Final Draft Lake Alternative Evaluation

for the

Bear Valley Water Sustainability Project

Prepared for:

Big Bear Area Regional Wastewater Agency

Big Bear City Community Services District

Big Bear Lake Department of Water and Power

Big Bear Municipal Water District

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WATER SYSTEMS CONSULTING, INC.

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1 EXECUTIVE SUMMARY

Natural precipitation provides the sole source of water supply for the Big Bear Valley (Valley), and is relied on for potable groundwater supplies, replenishing Big Bear Lake and Stanfield Marsh, and supporting the rare and diverse habitat and species in the Valley. Drought conditions and a long-term decline in precipitation trends have led the local water management agencies to investigate opportunities for supplemental water supplies, which are extremely limited due to its isolated location at the top of the watershed. Currently, wastewater generated within the Valley undergoes preliminary and secondary treatment and is discharged outside of the watershed to irrigate alfalfa fields in the Lucerne Valley, located approximately 20 miles north of the Valley.

The Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), and Big Bear Municipal Water District (BBMWD) (collectively, the Project Team) recognize that retaining recycled water in the watershed for beneficial use would significantly increase the sustainability of local water supplies. The Project Team has partnered to develop a project that will recover this lost water resource and keep the water in the Valley for beneficial reuse.

In 2016, the Bear Valley Water Sustainability Study evaluated four (4) alternatives for reuse, including distribution of tertiary treated recycled water for landscape irrigation and several groundwater recharge alternatives using advanced purified water. However, these alternatives address only the potable water supply component of the Valley's water needs and do not provide sufficient benefits to warrant the local investment so they have not been pursued.

The Project Team is currently evaluating an additional water reuse alternative that provides more widespread benefits to the Valley, known as the Lake Alternative. The Lake Alternative includes the following uses and benefits:

- High quality water will be discharged to the Stanfield Marsh Wildlife and Waterfowl Preserve, providing a consistent water source to sustain habitat and increase education opportunities for the community and visitors
- Water from the Marsh provides new inflow to Big Bear Lake to augment lake levels, enhance recreational opportunities and aquatic habitat and support water quality improvements
- High quality water will be discharged to Shay Pond to sustain habitat for the federally listed Unarmored Threespined Stickleback fish, which is currently sustained using potable water
- During extended dry periods, water from Big Bear Lake will be pumped to Sand Canyon to recharge the groundwater basin to strengthen the sustainability of the groundwater basin
- During wet periods, excess water could be stored locally as snow, providing flexibility to further enhance winter recreation, reduce spills from Big Bear Lake, augment spring runoff and increase groundwater recharge. Water could also be used to irrigate the local golf course in the summer, if desired.

- Additional inflow may enable BBMWD to modify their current Big Bear Lake management strategy to minimize spills and optimize releases to enable additional water to be captured downstream for recharge of the San Bernardino Basin, rather than discharged to the ocean.

Implementation of the Lake Alternative will require significant upgrades to BBARWA's wastewater treatment plant (WWTP) to produce high quality water that meets stringent discharge requirements for Big Bear Lake, particularly for nutrients (specifically phosphorus and total inorganic nitrogen) and total dissolved solids (TDS). To achieve the anticipated effluent limits, it is anticipated that BBARWA will need to implement a series of upgrades to existing unit processes and integrate new unit processes:

- Upgrade the extended aeration process through retrofit of the existing oxidation ditches to optimize biological nitrification-denitrification (NDN) and phosphorus removal.
- If needed, incorporate chemical precipitation of soluble phosphorus through addition of a metal salt within the activated sludge tankage, upstream of clarification.
- New NDN process to reduce inorganic nitrogen concentrations. This process may consist of a biologically active filter with sand or synthetic media, or biological reactors designed specifically for nitrogen and phosphorus removal.
- New low pressure filtration, such as microfiltration (MF) or ultrafiltration (UF), to reduce flocculated or colloidal solids upstream of the reverse osmosis (RO) process.
- New RO to reduce TDS concentration and nutrient concentrations.
- Disposal of brine stream generated from the RO process, such evaporation ponds, with or without brine minimization.

The preliminary design capacity of the treatment upgrades is 2.2 mgd, which corresponds with the 10-year average annual flow to the WWTP. It is assumed that any flows in excess of 2.2 mgd would be treated to a secondary level and discharged to Lucerne Valley, similar to the existing discharge method. Accounting for seasonal and annual flow variations and the volume disposed of as brine, the preliminary estimate of yield from the Lake Alternative is 1,950 AFY.

The Lake Alternative is a multi-component project that achieves the Project Team's goal of recovering a lost water supply to increase the sustainability of local water supplies to benefit the entire Valley. It is also the most cost-effective alternative that has been identified, in terms of unit cost of water recovered for various beneficial uses. The Project Team is continuing to collaborate with regulators and other stakeholders to refine these benefits, identify potential additional benefits and identify a path toward a cost effective and multi benefit for sustainable water in the Big Bear Valley.

2 INTRODUCTION

2.1 BACKGROUND

The Big Bear Valley (Valley) is located in the San Bernardino Mountains of San Bernardino County, California. The area includes approximately 135 square miles within a 12-mile long valley surrounded by mountain ridges and rugged slopes. Land surface elevations range from 6,000 to 9,900 ft and the area is entirely surrounded by the San Bernardino National Forest. Big Bear Lake (Lake) lies within the Valley and has a surface area of approximately 10 square miles and 23 miles of shoreline and is connected to the Stanfield Marsh Wildlife and Waterfowl Preserve. The Valley is home to approximately 23,000 full time residents. The area is primarily residential with some commercial uses, and experiences an influx of part-time population and vacationers enjoying the four season recreational facilities within the valley. In 2016, it is estimated that 8.3 million people visited the Valley. Due to the recreational nature of the Valley economies, occupancy within the valley fluctuates seasonally, typically peaking in July and at the lowest level during the winter. Based on the United States Census American Community Survey 2010-2014 data, all of the developed areas of the Valley are considered Disadvantaged or Severely Disadvantages Communities due to Median Household Incomes (MHI) less than 80% or 60%, respectively, of the statewide MHI, as defined in the California Public Resources Code Section 75005.

Natural precipitation provides the sole source of water supply for the Valley, and is relied on for potable groundwater supplies, replenishing the Lake, and supporting the rare and diverse habitat and species in the Valley. Drought conditions and a long-term decline in precipitation trends have led the local water management agencies to investigate opportunities for supplemental water supplies, which are extremely limited due to its isolated location at the top of the watershed. Currently, wastewater generated within the Valley undergoes preliminary and secondary treatment and is discharged outside of the watershed to irrigate alfalfa fields in the Lucerne Valley, located approximately 20 miles north of the Valley.

2.2 PROJECT TEAM

The Project Team is comprised of the Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), and Big Bear Municipal Water District (BBMWD). The Project Team recognizes that retaining recycled water in the watershed for beneficial use would significantly increase the sustainability of local water supplies to benefit the entire Valley and has partnered to jointly fund and prepare this report. The following sections provide a brief introduction to each agency.

2.2.1 BBARWA

BBARWA was formed in March 1974 to conduct a study to develop a plan for wastewater management within the greater Valley region. A subsequent 1975 Wastewater Facilities Plan was prepared which identified the need to provide centralized, environmentally friendly wastewater conveyance, treatment and disposal for the BBARWA service area.

The BBARWA service area includes the entire Valley (79,000 acres) and is served by three separate collection systems: City of Big Bear Lake, representing approximately 47% of the connections, and BBCCSD, representing approximately 48% of the connections, and County of San Bernardino Service Area 53B (CSA 53), representing approximately 5% of the connections. Each of these member agencies maintains and operates its own wastewater collection system, and delivers wastewater to BBARWA's interceptor system for transport to the BBARWA Regional Wastewater Treatment Plant (WWTP).

2.2.2 BBCCSD

BBCCSD was created in 1966 by a formation and consolidation election and initially provided solid waste collection, fire protection and street lighting services. In 1967, the former Big Bear Mutual Service Company voted to relinquish ownership and operation of their water system to BBCCSD. Currently BBBCSD's services include water, wastewater collection, fire protection & emergency medical services, solid waste collection, and street lighting services. BBCCSD's water service area includes Big Bear City and portions of San Bernardino County. BBCCSD's wastewater collection area includes Big Bear City and portions unincorporated communities such as Sugarloaf, Erwin Lake, Whispering Forest, and Moonridge.

2.2.3 BBLDWP

BBLDWP was formed in 1989 with the purchase of the retail water system from Southern California Water Company and currently provides water service to the City of Big Bear Lake, located along the south side of Big Bear Lake, as well as the unincorporated communities of Fawnskin, which lies to the north of the lake, and Sugarloaf, Erwin Lake and Lake William areas, which lie on the east side of the Valley.

The City of Big Bear Lake provides wastewater collection services within the city, while BBCCSD and CSA 53B provide wastewater collection services within BBLDWP's water service area that lies outside the city limits.

2.2.4 BBMWD

BBMWD, formed in 1964, is an independent special district that is responsible for the overall management of Big Bear Lake. The primary responsibilities of BBMWD are:

- Stabilization of the level of Big Bear Lake by managing the amount of water released to Bear Valley Mutual
- Watershed/water quality management
- Recreation management
- Wildlife habitat preservation and enhancement
- Bear Valley Dam and Reservoir maintenance

2.3 PRIOR STUDIES & PURPOSE

There is a long legacy of exploring water reuse opportunities in the Big Bear Valley for a variety of beneficial uses including wildlife habitat, landscape irrigation, surface water discharge, and groundwater recharge. Water reuse opportunities in the Valley were first investigated in 1964 and evaluations have continued intermittently since BBARWA was formed in 1974.

Most recently, in 2016, the Bear Valley Water Sustainability Study (2016 Study) evaluated four (4) alternatives for reuse, including distribution of tertiary treated recycled water for landscape irrigation and several groundwater recharge alternatives using advanced purified water. The 2016 Study concluded that groundwater recharge at two different recharge sites (Greenspot and Sand Canyon) was the highest ranked alternative due to a lower unit cost relative to the other alternatives and higher volume of water retained in the Valley.

Due to stringent water quality requirements and the challenge of disposing of the brine waste generated from the treatment process upgrades, full-scale groundwater recharge in the Valley is still a costly option. Although local potable groundwater water supplies are impacted by drought, conservation efforts in the past few years have maintained the total potable consumption below the safe yield of the groundwater basin. While the availability of high quality recharge water would benefit the water agencies by providing a supplemental drought proof source of supply when needed during future extended drought periods, continuous large volumes of recharge water are not needed to sustain local groundwater supplies at this time. A full-scale groundwater recharge project addresses only the potable water supply component of the Valley's water needs and does not provide sufficient benefits to warrant the high cost. For these reasons, full scale groundwater recharge in the Valley is not being pursued at this time.

The purpose of this report is to evaluate an additional water reuse alternative that more widespread benefits to the Valley; the subject alternative is presented in Section 2.5. This report repeats some relevant background information contained in the 2016 Study for context. Additional background information and detail on the prior alternatives evaluated can be found in the 2016 Study. Appendix C to the 2016 Study includes a timeline summarizing the evolution of wastewater management in the Valley from 1935 to 2003 as well as a partial list of documents related to water reuse in the Valley, as of April 2005.

2.4 PROJECT GOALS AND OBJECTIVES

The goal of the Project Team is to partner to recover a lost water resource, close the water loop, and keep the water in the Valley for beneficial reuse. This goal will be achieved through development of a multi-benefit water reuse project that:

1. Augments natural recharge for water supply sustainability
2. Protects the rare and diverse habitat and species in the Valley
3. Promotes a thriving community through enhanced recreation

2.5 THE LAKE ALTERNATIVE

The project alternative evaluated in this report is referred to as the Lake Alternative and includes upgrades to the WWTP to produce high quality water for the following uses and benefits:

- High quality water will be discharged to the Stanfield Marsh Wildlife and Waterfowl Preserve (Marsh), providing a consistent water source to sustain habitat and increase education opportunities for the community and visitors

- Water from the Marsh provides new inflow to the Lake to augment Lake levels, enhance recreational opportunities and aquatic habitat and support water quality improvements
- High quality water will be discharged to Shay Pond to sustain habitat for the federally listed Unarmored Threespined Stickleback (Stickleback) fish, which is currently sustained using potable groundwater
- During dry periods, Lake water will be pumped to Sand Canyon to recharge the groundwater basin to strengthen the sustainability of the groundwater basin during extended droughts
- During wet periods, excess water could be stored locally as snow using existing snow making infrastructure. This provides flexibility to further enhance winter recreation, reduce spills from the Lake, augment spring runoff and increase groundwater recharge. The existing snow making pump and pipeline can also be used to deliver irrigation water to the Bear Mountain Golf Course in the summer, if desired. The water demand for the Bear Mountain Golf Course is estimated to be 120 AFY (1).
- Additional inflow into the Lake may enable BBMWD to modify the current Lake management strategy to minimize spills and flood control releases and optimize releases to enable additional water to be captured for recharge of the San Bernardino Basin, rather than discharged to the ocean.

The Project Team is conducting ongoing outreach to a variety of potential stakeholders within the Valley and the greater Santa Ana River watershed to collaboratively refine these benefits and identify potential additional benefits that could be achieved through implementation and management of the Lake Alternative.

The Lake Alternative will require significant upgrades to the treatment process at the WWTP to meet stringent discharge requirements for the Lake, as discussed in subsequent sections of this report.

3 WATER SUPPLIES AND MANAGEMENT

This section provides a brief overview of current water supplies and water management practices in the Big Bear Valley to provide context for the development of recycled water supplies. Currently, the sole source of water supply in the Valley is groundwater from the Big Bear Valley Groundwater Management Zone (Basin). BBMWD manages Big Bear Lake but the water agencies do not have surface water rights and imported water is not available in the Valley due to lack of infrastructure to the isolated location. Additional information about potable water supplies can be found in the BBCCSD 2015 Urban Water Management Plan (UWMP) and BBLDWP 2015 UWMP.

3.1 BIG BEAR VALLEY GROUNDWATER MANAGEMENT ZONE

The Basin lies in the northeastern portion of the Santa Ana River Watershed and is currently not adjudicated. The Basin is roughly 14 miles long from east to west and 7 miles wide from north to south. Big Bear Lake and Baldwin Lake are located in the middle of the Basin. Surface drainage within the Basin flows to one of the two lakes, mostly Big Bear Lake. Big Bear Lake empties on the west into Bear Creek, which is a tributary to the Santa Ana River. Additional information on the management of surface water in Big Bear Lake is discussed in Section 3.3.

The Basin is primarily composed of unconsolidated alluvium and is divided into upper, middle and lower aquifers; where the upper and middle aquifers are the primary producers. Based on the drainage system, the Basin is divided into 16 hydrologic subunits with the main tributaries including Grout Creek, Van Dusen Canyon, Sawmill Canyon, Sand Canyon, Knickerbocker Creek, Metcalf Creek, and North Creek. The Basin and subunits are presented in Figure 3-1.

The Basin is naturally recharged from percolation of precipitation, runoff and underflow from fracture rock formations; with groundwater levels that generally correlate with annual fluctuations of precipitation. Storage capacity of the Basin is estimated by DWR at 42,000 AFY with the maximum perennial yield estimated at 4,800 AFY (7). In addition to the municipal water purveyors, there are numerous private wells throughout the Basin serving properties that are not connected to a public water system.

BBLDWP and BBCCSD manage and monitor the Basin. Through the Groundwater Monitoring and Management Plan, BBLDWP contributes to Basin management by conducting monthly monitoring of 18 non-pumping monitoring wells and approximately 40 production wells, bi-annual Technical Review Team meetings, and has established conservation levels based on groundwater levels and trends in key wells. BBCCSD also manages the groundwater level and water quality by conducting monthly monitoring in 11 non-pumping monitoring wells and 13 production wells, monthly monitoring of surface flow in Van Dusen Creek, Shay Creek and Green Canyon Creek, and has established action criteria for average groundwater levels across the BBCCSD service area that are tied to conservation stages and measures. Conservation efforts have helped to keep annual groundwater production less than the perennial yield of the Basin. The Basin is not currently identified by DWR to be in overdraft condition. (4) (8)

3.1.1 Sustainable Groundwater Management Act

In 2014, California passed the Sustainable Groundwater Management Act (SGMA), which established a framework for sustainable, local groundwater management. The California Department of Water Resources (DWR) is responsible for implementing the law and supporting local agencies to achieve sustainable groundwater management. DWR identified the Basin as a Medium Priority Basin and SGMA requires Medium Priority Basins that are not in critical overdraft to be managed under a Groundwater Sustainability Plan (GSP) by January 21, 2022. The GSP will be developed and implemented through formation of the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), which is a Joint Powers Authority (JPA) comprised of the four agencies on the Project Team.

In December 2017, the BVBGSA applied for a Sustainable Groundwater Planning Grant to fund the preparation of the GSP. The GSP is anticipated to be completed by 2020 and will leverage existing data sources and management actions that have been utilized by BBLDWP and BBCCSD in the past. The workshops held throughout the development of the GSP will provide a venue to engage relevant stakeholders in a dialogue to build on this foundation and develop similar management actions to meet sustainability goals for the Basin as a whole.

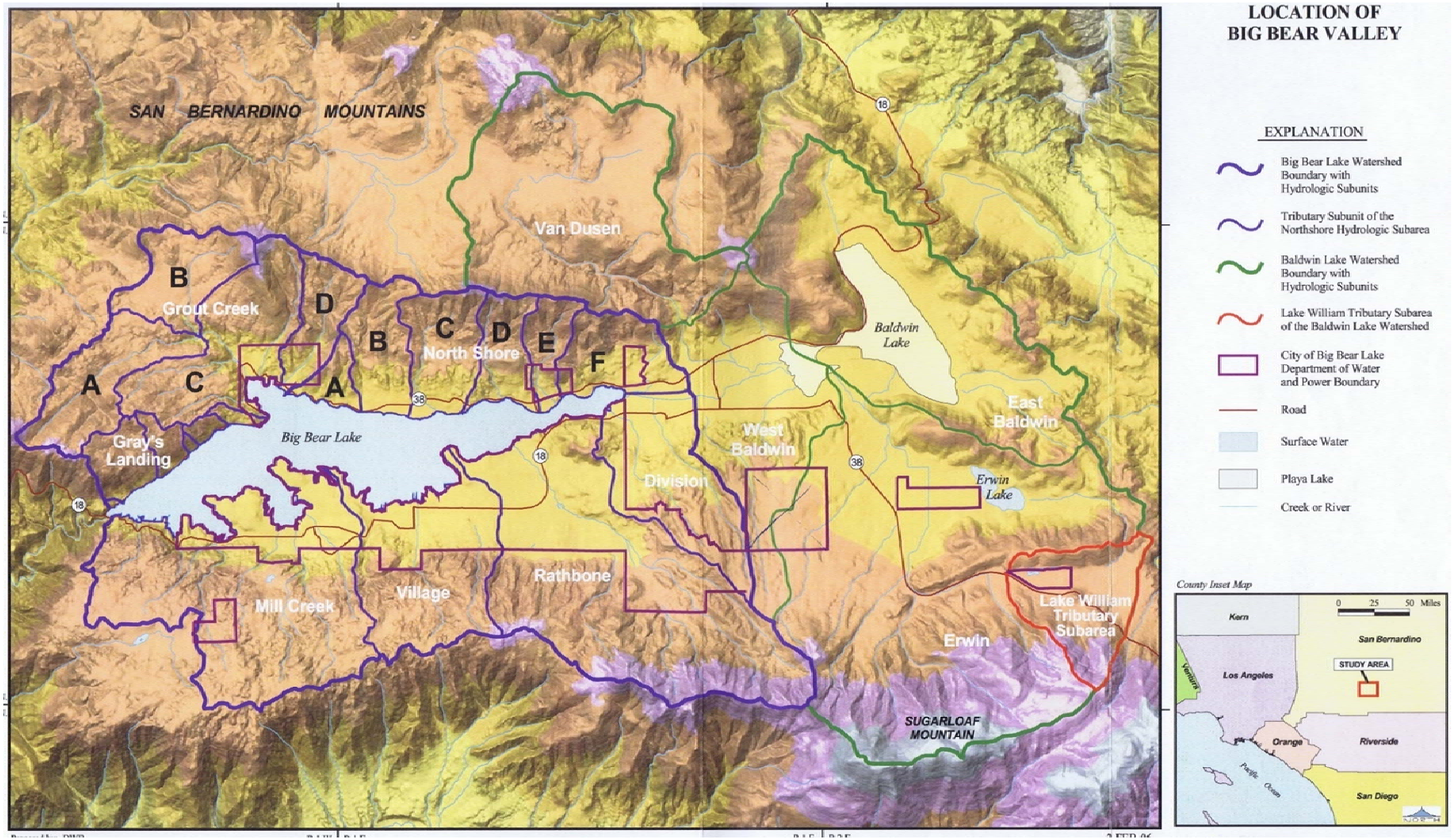


Figure 3-1. Big Bear Valley Groundwater Basin and Subunits (9)

3.2 WATER DEMAND

The BBLDWP service area is primarily residential with commercial accounts making up 5% and industrial making up less than 1% of the total accounts. BBCCSD serves only residential accounts. The projected water demands for BBLDWP and BBCCSD area are presented in Table 3-1. The historical and projected water demands for each water agency along with the total demands for the agencies are presented in Figure 3-2. These estimates do not include water used from private wells, which was estimated to be approximately 169 AFY in the BBLWDP 2006 Water Master Plan (7).

Table 3-1. Water Demand Projections for Bear Valley Water Agencies (AFY)

Water Agency	2015	2020	2025	2030	2035
BBLDWP[1]	2,095	2,169	2,246	2,326	2,408
BBCCSD[2]	940	1,163	1,220	1,281	1,344
Total	3,035	3,332	3,466	3,607	3,752

Note:
1. BBLDWP 2015 UWMP
2. BBCCSD 2015 UWMP

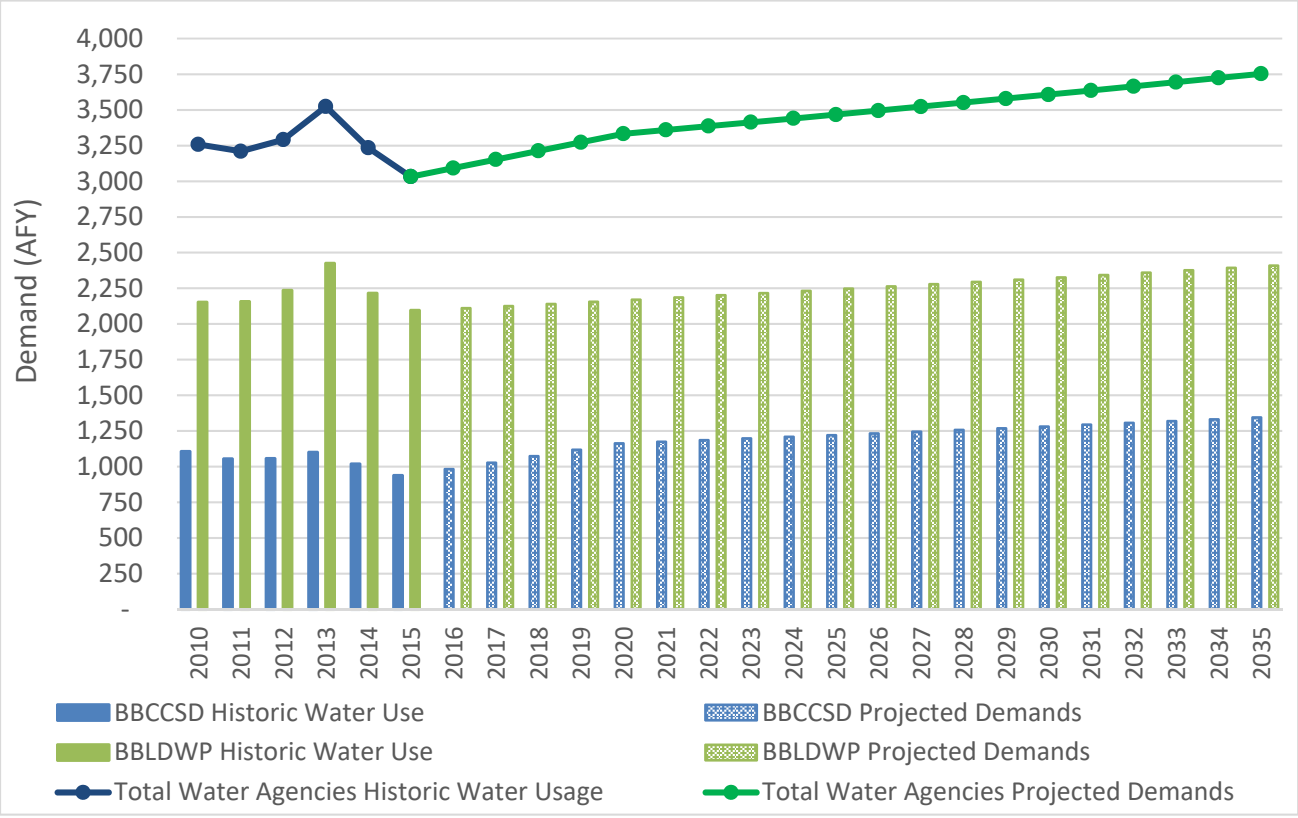


Figure 3-2. Historic and Projected Water Demands

3.3 BIG BEAR LAKE WATER MANAGEMENT

This section describes the key management practices and documents that govern the management of the water in Big Bear Lake. This information is also presented graphically in Figure 3-4.

3.3.1 The 1977 Judgement

The Big Bear Dam was originally constructed to provide water storage for Bear Valley Mutual Water Company (Mutual), which was formed in 1903 by the citrus growers of the Redlands/Highland area to ensure water supply for irrigation needs. The historic operation of the Big Bear Lake (Lake) as an irrigation reservoir resulted in drastic fluctuations in lake levels, which conflicted with the goals of BBMWD and the community of Big Bear Valley. A legal conflict over the water rights and management of the lake was ultimately settled out of court through the 1977 Judgement. Under the terms of this judgement, BBMWD purchased the lake bottom, Bear Valley Dam, and the right to utilize and manage the surface of Big Bear Lake from Bear Valley Mutual. Bear Valley Mutual retained a storage right and ownership of all water inflow into the Lake (1). Mutual has the right to request Lake releases as may be reasonably necessary to meet the requirements of Mutual's stockholders, not exceeding 65,000 AF in any ten (10) year period.

3.3.2 In-Lieu Water and Lake Release Policy

The 1977 Judgment allows BBMWD to maintain a higher water level in the lake by delivering water to Mutual from an alternate source of water. This alternate source of water, referred to as In-Lieu Water, comes mainly from the State Water Project through a contract executed in 1996 with San Bernardino Valley Municipal Water District (Valley District), a State Water Contractor. This In-Lieu Agreement provides that:

- BBMWD shall make Lake releases to meet the demands of Mutual when such releases are consistent with BBMWD's Lake Release Policy (described below)
- Whenever Lake releases under the Lake Release Policy are not sufficient to meet Mutual's demands, Valley District shall provide In-Lieu Water to Mutual to meet the remainder of their demands
- BBMWD shall pay Valley District a fixed annual fee, which is escalated annually based on BBMWD's assessed value. In 2017, BBMWD's In-Lieu payment to Valley District was approximately $1,400,000.

BBMWD's current Lake Release Policy was adopted in 2006 provides guidance on how Mutual demands will be met depending on the Lake level.

- When the Lake is in the top 4 feet, Mutual's demands will be met with Lake releases
- When the Lake is between 4 and 6 feet below full, Lake releases will be made in the months of November through April and In-Lieu Water will be obtained from May to October
- When the Lake is more than 6 feet below full, In-Lieu Water will be obtained

3.3.3 Snow Making Withdrawals

BBMWD currently has a contract with the Big Bear Mountain Resorts, allowing the withdrawal of an allocated amount of water from the Lake to use for snow making purposes. Currently, Big Bear Mountain Resort is authorized to withdraw a maximum of 11,000 acre-feet (AF) of water from the Lake over a 10-year rolling period, not exceeding 1,300 AF in any single year. It is calculated that half of the water withdrawn from the lake is returned as runoff (1).

3.3.4 Net Wastewater Exports

The 1977 Judgement required that, beginning in 1986, any net export of water to an area of the Upper Bear Creek Watershed that is not tributary to the Santa Ana Watershed would be transferred from BBMWD's Lake Account to Mutual's Lake Account, as discussed in Section 3.3.6. Because water reclamation was not implemented by 1986, a net wastewater export occurs annually and is calculated as the difference between the wastewater that leaves the Big Bear Lake watershed and the water that is imported into the Big Bear Lake Watershed from the Baldwin Lake Watershed. Groundwater that is produced within the Big Bear Lake Watershed and returned to the sewer after use is treated at the BBARWA WWTP (located in the Baldwin Lake Watershed), then discharged to Lucerne Valley; this water is exported from the Big Bear Lake Watershed. Groundwater that is produced in the Baldwin Lake Watershed by BBLDWP and BBCCSD and served to customers within the Big Bear Lake Watershed is imported into the Big Bear Lake Watershed. In 2016, the net wastewater exported from the Big Bear Lake Watershed was 848 AF.

3.3.5 Fish Protection Releases

In 1995, the State Water Resources Control Board (SWRCB) issued Order No. 95-4, which requires BBMWD and Mutual to release water from the Lake for fishery protection in Bear Creek. Sufficient water must be released from the Lake to maintain a seven-day average flow of 1.2 cubic feet per second (cfs) and minimum average daily flow of 1.0 cfs in Bear Creek no more than 500 feet downstream of its confluence with West Cub Creek, referred to as Station A. SWRCB Order No. 95-4 also requires sufficient releases to maintain a minimum flow of 0.3 cfs approximately 300 feet downstream of the toe of the dam, referred to as Station B. The dam releases required to maintain these minimum flows vary by month and by hydrologic year type (normal, above normal or below normal precipitation).

3.3.6 Watermaster Accounting

The 1977 Judgment requires the establishment of a Watermaster to maintain three basic accounts:

BBMWD's Lake Account. A detailed account to reflect actual operation of the Lake by BBMWD.

Mutual' s Lake Account. A corollary account that simulates the effect of Mutual's operation if Mutual had owned the Lake, the In-Lieu Program was not in place, and there was no net wastewater export from the Big Bear Lake Watershed.

Basin Make-up Account. An account of BBMWD's annual and cumulative obligation for Basin Make-up Water in the San Bernardino Groundwater Basin to offset any deficiencies in recharge as a result of BBMWD's Lake operation. In 2016, the Basin Make-up Account had an ending balance of 27,120 AF. This positive amount means that there has been an increase in groundwater recharge in the San Bernardino Basin as a result of the BBMWD operation of the Lake.

Figure 3-3 depicts the actual Lake levels under BBMWD's operation compared to the simulated Lake operation by Mutual as shown by the balance of Mutual's Lake Account. In 2016, BBMWD's operation of the Lake resulted in a Lake level 14.43 feet higher than it would have been under Mutual's operation.

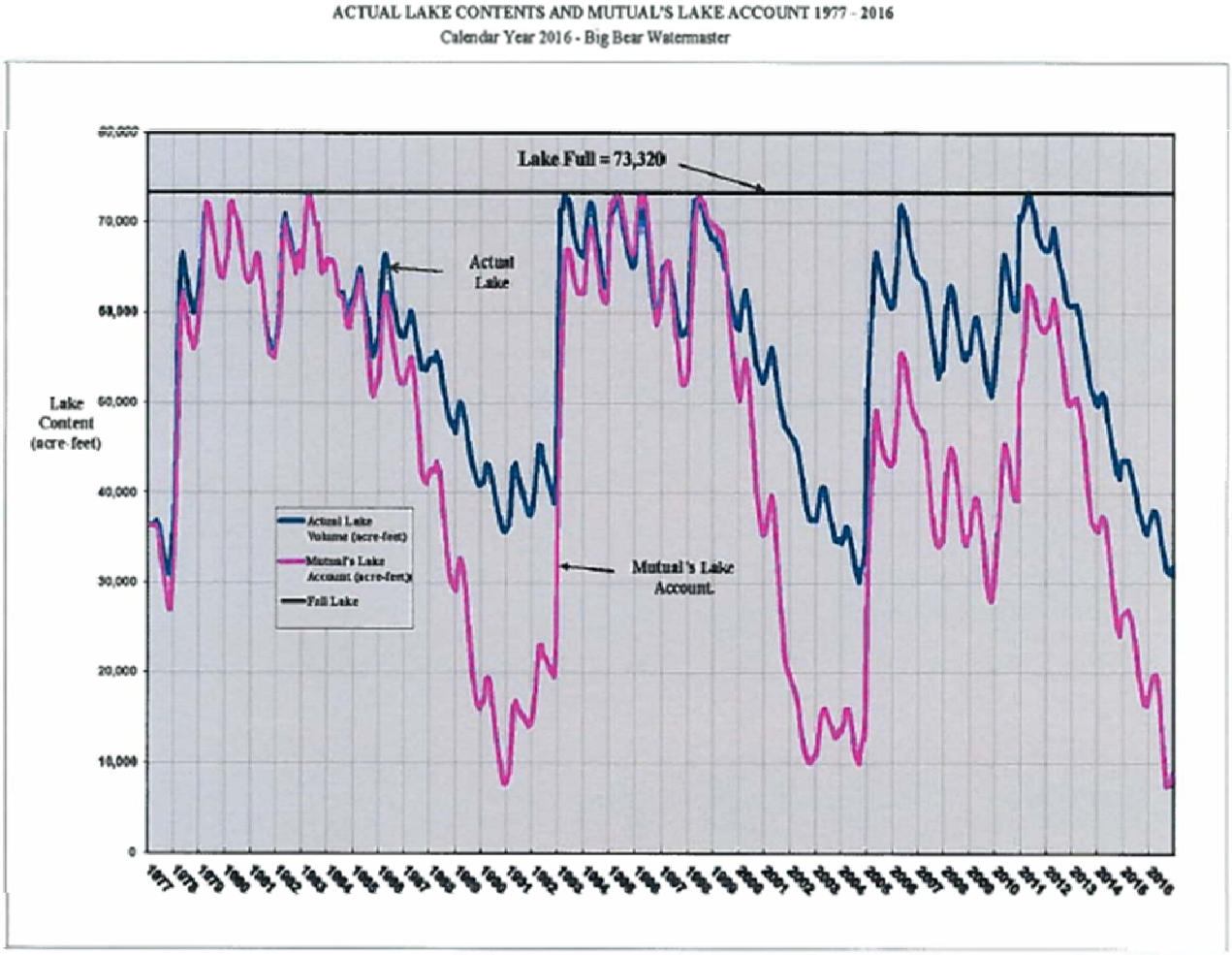


Figure 3-3. Actual Lake Levels and Mutual's Lake Account Comparison, 1977 - 2016 (5)

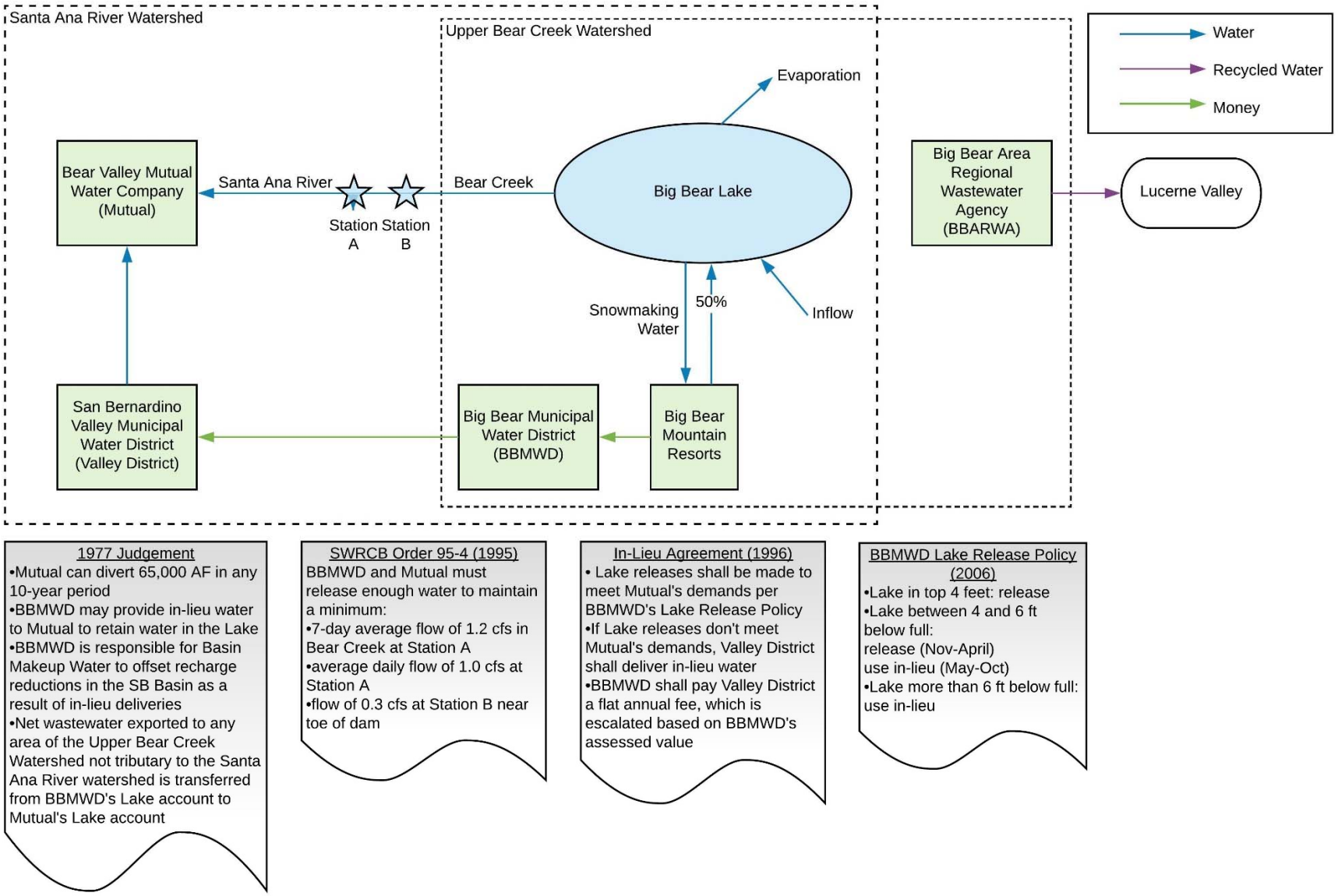


Figure 3-4. Big Bear Lake Management Framework

4 WASTEWATER CHARACTERISTICS AND FACILITIES

BBARWA owns and operates a 4.9 million gallon per day (MGD) capacity WWTP located just south of Baldwin Lake on the east side of the Valley. In 2016, the WWTP treated approximately 1.9 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake and CSA 53 in Fawnskin.

4.1 EXISTING AND PROJECTED WASTEWATER FLOWS

The influent flows to BBARWA's WWTP are comprised of three components:

- Flow from full-time residential homes
- Flows due to tourism, commercial activities and part-time residential homes
- Flows from Infiltration and Inflow (I/I) due to precipitation

These components create a seasonal variation in the wastewater flows treated at the plant. Based on full-time residency rates from BBCCSD and BBLDWP and the number of full-time dwelling units reported by Bear Valley Electric, BBARWA's 2010 Sewer Master Plan (2010 SMP) estimated that the full-time residential rate is 38% (2).

The tourism season is largely concentrated in the months of December through April due the local ski resorts; this period also corresponds with higher precipitation and increased flows due to I/I. The months of June and July also see a slight rise in tourism due to Lake recreation activities. Average daily flows and the seasonal variation during the 10-year period from 2007 to 2016 (which included a wet and dry cycle) are shown in Figure 4-1. The average daily flow for this 10-year period is approximately 2.2 MGD and the maximum month flow is 5.5 MGD.

The 2010 SMP estimated the future sewer flows based on future population and equivalent dwelling unit (EDU) projections utilizing the constant sewer load index of 172 gallons per day (gpd) for full time residential EDUs. The 2010 SMP assumes the full-time EDUs will increase at an annual rate of 0.8% over a 20-year period based on a long-term average. Assuming the full-time residence rate remains at 38% and that I/I will be consistent with the previous average, the 2010 SMP projects that the average annual sewer flows will increase to 2.7 MGD by 2030. However, the 2010 SMP flow projections did not account for reduced sewer loads due to recent water conservation so future flows will likely be significantly lower than projected.

If the Lake Alternative is implemented, it is recommended that the future flow projections be updated as part of the preliminary design phase to inform the design capacity for treatment upgrades based on realistic flows based on current water use trends.

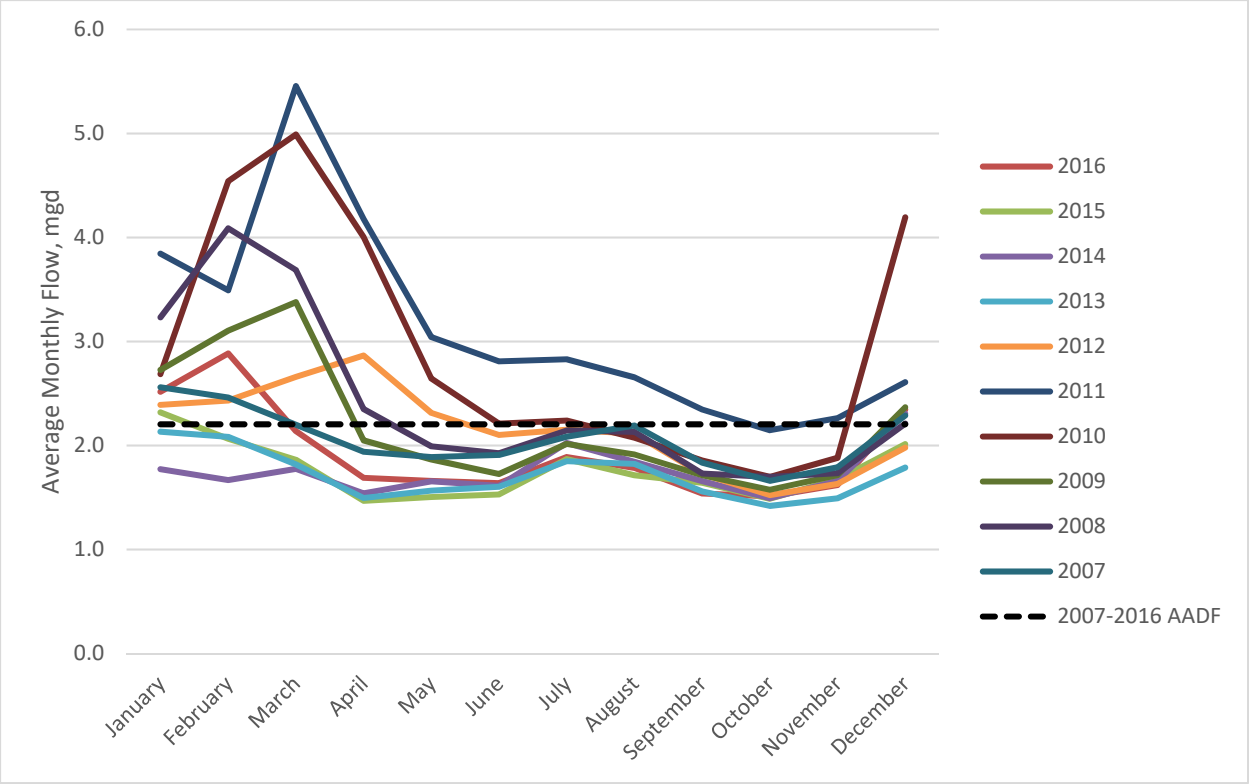


Figure 4-1. 10-Year Average Daily Flows by Month (2007-2016)

4.2 EXISTING FACILITIES AND DISCHARGE REQUIREMENTS

BBARWA's WWTP is located on a 93.5-acre lot. The WWTP process components occupy 11.2 acres and the remaining 82.3 acres include storage ponds and evaporation ponds. Influent flows are conveyed through three BBARWA operated sewer mains and lift stations to the plant. The WWTP currently provides preliminary and secondary treatment. Table 4-1 summarizes the WWTP's treatment processes and the process flow diagram is depicted in **Figure 4-2**.

BBARWA recently completed several upgrades to the sludge dewatering process. Heat exchangers were installed on the existing generator to capture waste heat; hot water from the heat exchangers is used to heat the floor of the lined drying bed. A 315 foot by 60 foot metal building was also constructed to cover the lined drying bed so that the dewatering process could operate year round.

BBARWA's WWTP generates its own electricity using three natural gas generators that can be run in parallel: two 250 KW Cummins generators and one Waukesha generator with a rating of 600 kilowatts for a total generating capacity of 1100 kilowatts. BBARWA only generates the energy needed to operate the WWTP and Administration Building and typical generation is in the range of 225,000 - 350,000 kilowatt-hours (kW-hr) per month. In 2015, total energy generation was 3,100,216 kW-hr. Natural gas consumption was 43,544 million British Thermal Units (MMBTU) or 435,440 therms. BBARWA also has a connection to the Bear Valley Electric utility system that is used to run its pumping stations and can serve as an emergency backup power supply for the WWTP.

Table 4-1. BBARWA's WWTP Treatment Process

Treatment Process[1]	Description
Preliminary Treatment	Consists of bar screens, grit removal and disposal of solids
Secondary Biological Treatment	Consists of oxidation ditches which use mechanical aeration to achieve organic material stabilization, nutrient removal and pathogen reduction. Solids production is minimized by the Cannibal® Solids Reduction System, through use of a side-stream interchange bioreactor with aeration controlled by the ORP level.
Secondary Sedimentation Treatment	Consists of clarifiers to settle solids. Waste activated sludge (WAS) is pumped to a dissolved air floatation (DAF) system
WAS Thickening	Consists of a DAF system that skims sludge for sludge dewatering. Filtrate is returned to oxidation ditches.
Sludge Dewatering[2]	Sludge is dewatered using a belt press and dried in a building with heated floors that utilize waste heat from a generator. The building allows sludge to be dried year-round. The dry solids are hauled to a composting facility in Redlands.

Notes:
1. Descriptions obtained from the 2005 BBARWA Recycled Water Master Plan unless otherwise noted.
2. Obtained from BBARWA's website - http://bbarwa.org

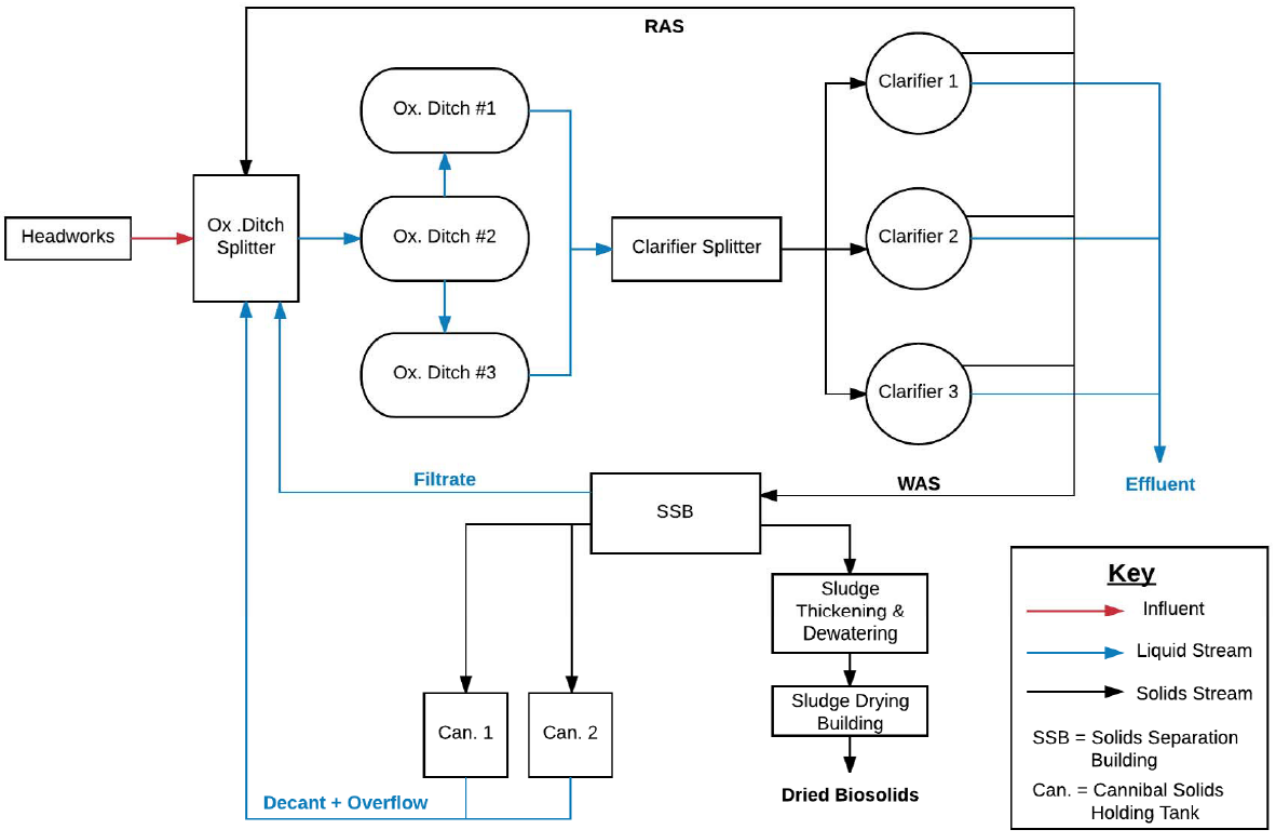


Figure 4-2. BBARWA WWTP Process Flow Diagram

4.2.1 Existing Discharge Requirements

The wastewater stream that is treated by the WWTP consists of sewage generated from urban land uses. There are no significant sources of major industrial waste or processing water treated by the facility (2). The WWTP discharge is currently regulated by the Santa Ana Regional Water Quality Control Board (RWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR) issued on June 24, 2005. There are three permitted discharge locations, summarized in Table 4-2. Discharge Point 001 for irrigation in Lucerne Valley, is located within the Colorado River Basin Region and is regulated by Colorado River Basin RWQCB WDR Order No. R7-2016-0026 (Colorado WDR), issued on June 30, 2016.

Treated secondary effluent is discharged to a 480-acre site in Lucerne Valley (LV Site) for irrigation of fodder and fiber crops that are used as feed for livestock. Use of recycled water for crop irrigation at the LV Site began in 1980 and 100% of the WWTP effluent is currently discharged to the LV Site. Figure 4-3 depicts the location of BBARWA's existing recycled water distribution facilities and the LV Site, approximately 20 miles north of the Valley. Discharge Points 002 and 003 are not currently used.

Table 4-2. WDR Order No. R8-2016-0044 Discharge Points

Discharge Point	Effluent Description	Receiving Water/Disposal Site	Recycling Reuse
001[1]	Secondary effluent w/o disinfection	Storage Ponds in Lucerne Valley	Irrigation in Lucerne Valley
002	Secondary effluent with disinfection	State surface water (Storage pond in Baldwin Lake) and Big Bear Valley Groundwater Management Zone	Construction and wildlife habitat
003	Tertiary effluent with disinfection	Big Bear Valley Groundwater Management Zone	Irrigation

Notes:
1. The Colorado River Basin Regional Water Quality Control Board (Region 7) regulated the use of the recycled water in the Lucerne Valley (WDR Order No. R7-2016-0026).

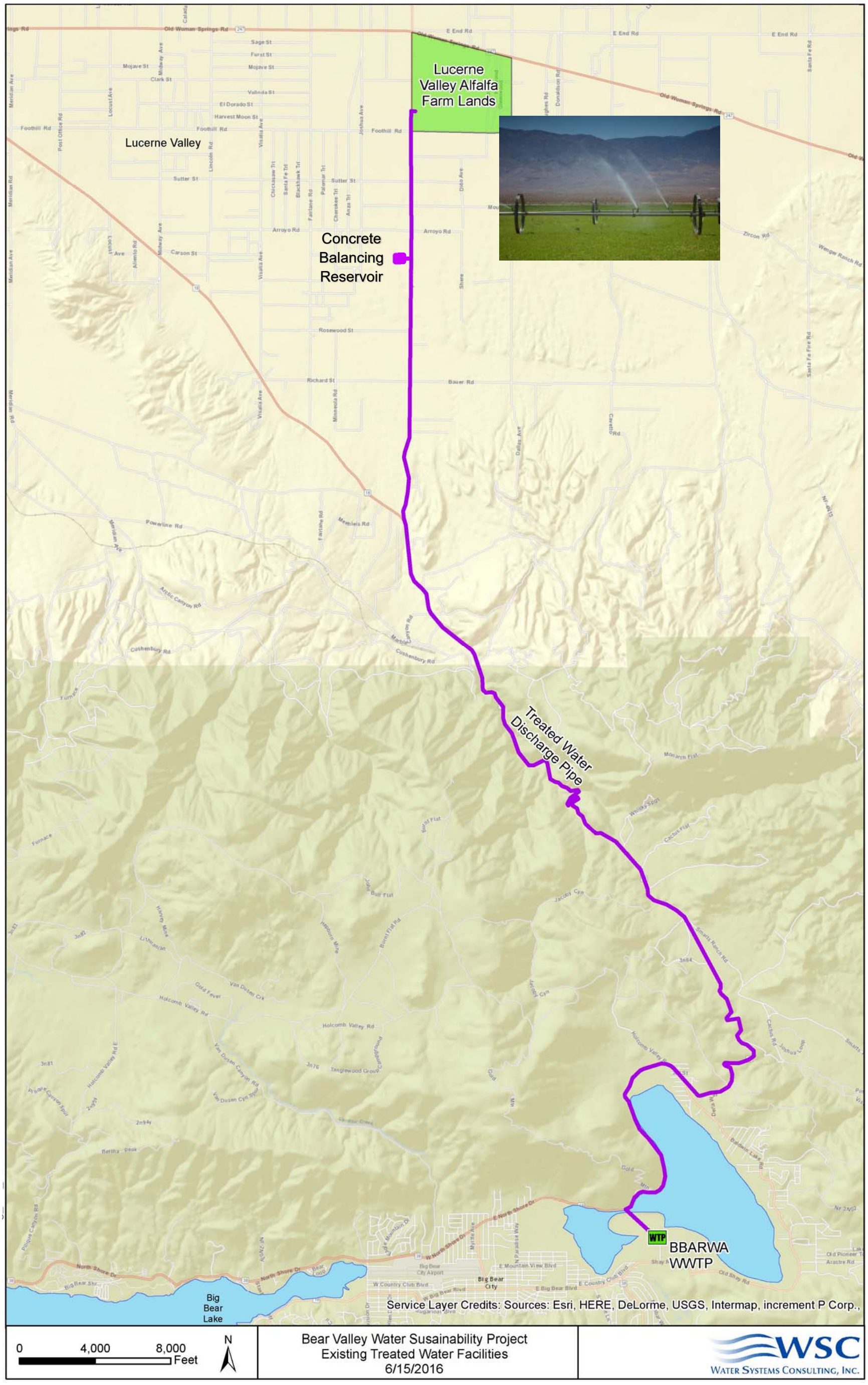


Figure 4-3. Existing Recycled Water Facilities

The effluent requirements for conventional pollutants for recycled water discharged to the LV Site contained within the Colorado WDR are presented in Table 4-3 and a summary of the actual effluent quality in 2015 is presented in Table 4-4.

The previous Colorado WDR that regulated this discharge (Board Order 01-156) included a Total Dissolved Solids (TDS) limit of a maximum of 400 mg/L above the domestic source water. The WWTP discharge was always well within compliance with this requirement. The recently updated WDR requires BBARWA to provide a technical report in the form of a study that analyzes the impacts to groundwater in the vicinity of the LV Site by the discharge and an evaluation of water quality trends. The results of the study will be used to establish an appropriate effluent limitation for TDS. BBARWA submitted this report to the Colorado River Basin RWQCB in December 2017 with a recommendation that the prior TDS limit remain unchanged. The Colorado River Region RWQCB has not yet provided feedback on the report or an indication of whether the TDS effluent limitation will be changed. At this time, a substantive change in the TDS limit is not anticipated and treatment upgrades are not anticipated to be required to remain in compliance with this WDR. A copy of BBARWA's two WDR permits are attached in Appendix A.

Table 4-3. Discharge Limits for LV Site

Parameter	Units	30-Day Mean	7-Day Mean	Maximum Daily
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	-
Total Suspended Solids (TSS)	mg/L	30	45	-
Chloride	mg/L	60	-	80
Sulfate	mg/L	60	-	80
Boron	mg/L	-	-	0.75
Total Nitrogen	mg/L	10	-	-
pH	pH units	Between 6.0 - 9.0 at all times		

Table 4-4. 2015 BBARWA WWTP Effluent Quality – Annual Average

Parameter	Value	Units
TDS	453	mg/L
BOD_5	6	mg/L
TSS	13	mg/L
Chloride	56	mg/L
Sulfate	43	mg/L
Phosphorus	2.3	mg/L
Total Inorganic Nitrogen (TIN)	4.6	mg/L
pH	7.12 – 8.09	pH units

5 RECYCLED WATER MARKET ANALYSIS UPDATE

A brief description of previous alternatives evaluated in the 2016 Study was discussed in Section 2.3. This section provides additional details on the recycled water uses envisioned for the Lake Alternative only.

In 2017, the Project Team collaborated to identify a new Lake Alternative that maximizes the use of existing infrastructure to reduce project costs while keeping most or all of the treated water in the Valley for a variety of beneficial uses. The following uses are anticipated to be included in the Lake Alternative and are discussed in more detail in subsequent sections.

- Continuous water supply to Stanfield Marsh Wildlife and Waterfowl Preserve
- Continuous water supply to Big Bear Lake
- Continuous water supply to Shay Pond Unarmored Threespined Stickleback habitat
- Periodic groundwater recharge in Sand Canyon during dry periods
- Periodic storage in the watershed as snow during wet winter periods
- Irrigation water for Big Bear Golf Course
- Potential water supply for downstream users when water exceeds needs in the Valley

5.1 STANFIELD MARSH AND BIG BEAR LAKE

Discharge to Stanfield Marsh was considered in the 2016 Study as a potential groundwater recharge location; however, it was not pursued because a prior study stated that the bottom of the Marsh contains a clay layer that would prevent sufficient percolation into the surrounding groundwater basin. Discharge to the Marsh is being re-evaluated as part of this study due to the benefits that a new consistent water source would provide to the wildlife in the Marsh, and because it provides a means to supplement inflow in the Lake as well.

The Stanfield Marsh Wildlife and Waterfowl Preserve began a transformation in 1982 when BBMWD, working with the California Department of Fish and Wildlife, dredged basins, laid culvert pipes to connect to the Lake, and planted the shoreline, followed by numerous other enhancements in subsequent years. The Marsh is now a scenic 145-acre nature park that includes a gazebo, walking paths, and two boardwalks that extend out into the Marsh so that visitors can observe the wildlife in, under and around the water. The Marsh is home to rare and diverse species of birds, fish, amphibians, and mammals. In the center of the Marsh, there is an island that was constructed to provide a safe haven for waterfowl, including a moat-like barrier to make it difficult for predators to reach it, even when water levels are low. Informational placards installed at the Marsh educate visitors on the diverse wildlife and BBMWD has plans to install several additional placards, such as those as shown in Figure 5-1, to increase educational opportunities and awareness of the value of the Marsh to the local ecosystem.

Figure 5-1. Informational Placards at the Marsh Provide Educational Opportunities for Visitors

Rainfall and snowmelt are the only sources of water for the Marsh so the water level varies from season to season and throughout longer hydrologic cycles. During wet periods, the Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, the boardwalks extend over dry soil, and the wildlife become scarce. This condition is shown in Figure 5-2, which was taken in September 2016 following the recent multi-year drought.

Figure 5-2. Aerial View of the Dry Marsh, September 2016

High quality recycled water would provide a new, drought proof source of inflow to stabilize the water levels and sustain habitat in the Marsh even during dry periods.

Water from the Marsh will also provide new inflow into the Lake to augment Lake levels. Preliminary model analysis performed by BBMWD indicates that new inflow into the Lake could increase Lake levels by as much as 7 feet in 10 years, depending on the volume of new inflow. As discussed in Section 3.3.2, in-lieu water is obtained to meet Mutual's Lake demands when Lake levels are below 4 and 6 feet from full, depending on the month. With the additional inflow, Lake levels will be in the top 4 feet more often, which will reduce in-lieu water needs.

Increased Lake levels will also enhance recreational opportunities by enabling BBMWD to reduce closures of boat ramps due to low water levels during dry periods. More wetted shoreline is anticipated to improve aquatic habitat and the additional inflow will provide BBMWD with additional flexibility in managing Lake releases, creating an opportunity to improve water quality in the Lake.

The California Code of Regulations Title 22 (Title 22) establishes acceptable uses of recycled water and provides that disinfected tertiary recycled water may be used as a source of supply for nonrestricted recreational impoundments, which are water bodies where no limitations are imposed on body-contact water recreational activities.

In 2000, BBARWA was issued a National Pollutant Discharge Elimination System (NPDES) permit (Santa Ana Region Board Order No. 00-12), which included the Marsh and a proposed new Stickleback habitat in Baldwin Lake as authorized discharge points, subject to construction of tertiary treatment and disinfection upgrades. The NPDES permit limited discharges to the Marsh to periods of lower water levels when the Marsh was not hydraulically connected to the Lake. The tertiary treatment upgrades were not completed and the discharge point was never used so the NPDES permit was not renewed when it expired in 2005. In 2005, the Santa Ana Regional Board issued Order No. R8-2005-0044, as discussed in Section 4.2.1, which does not allow discharge to the Marsh. A new NPDES permit would be required for the Lake Alternative to address discharges into the Marsh, the Lake, and the Shay Pond Stickleback habitat.

5.2 STICKLEBACK FISH HABITAT

5.2.1 History

The Unarmored Threespine Stickleback (*Gasterosteus aculeatus williamsoni*), also known as UTS (referred to as "Stickleback" in this study), is listed as both a Federal and State of California Endangered Species under the respective Endangered Species Acts (1). On the California list, the Stickleback is also given the title of Fully Protected Species (2). The Stickleback lives in California and have been on the Federal list since 1970 and on the State list since 1971 (2) (3). There has been a population of Stickleback in the Shay Creek area on the east side of the Valley, as shown in Figure 5-3, which includes Shay Pond, Sugarloaf Pond, Juniper Springs, Motorcycle Pond, Shay Creek, Wiebe Pond, and Baldwin Lake (10). By the summer of 1990, it was thought that the Stickleback remained in only Shay Pond; however, several years of above-average precipitation in the mid-1990s resulted in the establishment of a pool of water in Baldwin Lake (10). This study focusses primarily on Stickleback in Shay Pond.

There is a long history of study and group effort regarding the Stickleback in the Shay Creek area. The main stakeholders include the United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), the San Bernardino National Forest (SBNF), BBCCSD, BBLDWP, and BBARWA. Additionally, the Shay Creek Working Group, which includes representatives from the USFWS, CDFW, SBNF, BBCCSD, DWP, and BBARWA, was formed during the process of preparing the USFWS' 2002 Biological Opinion (BO) for the area (4).

The Shay Creek Working Group has been meeting since 1999 to address and resolve issues related to the Stickleback in the Shay Creek area, including re-initiation of Section 7 consultation resulting in a 2007 Draft revised BO (1). The 2007 Draft BO has not been finalized so the 2002 BO is still in effect. The primary issue that requires resolution is the impact on the Stickleback habitat from three Special Use Permits issued by the SBNF to BBCCSD (for groundwater extraction and spring diversion), BBLDWP (for groundwater extraction), and BBARWA (for wastewater effluent outfall line) (1). Studies and discussions indicate that the actions these permits allow may be adversely impacting the Stickleback in Shay Creek (4).

In 2009, the USFWS conducted a 5-Year Review Summary and Evaluation of the Stickleback, which stated that the Stickleback spend all of their life in freshwater and the ideal habitat for Stickleback is a small, clean pond in the stream with a constant flow of water through it. The Stickleback tend to gather in areas of slower-moving or standing water (10 p. 12).

One of the Conservation Measures for the Stickleback in the Description of the Proposed Action in the 2002 BO is "Shay Pond Land Acquisition", which includes acquisition of the land on which Shay Pond lies, as well as some additional area immediately around the pond to adequately maintain and manage the aquatic habitat(4 p. 4). This has been completed with involvement from BBCCSD, DWP, and BBARWA (5).

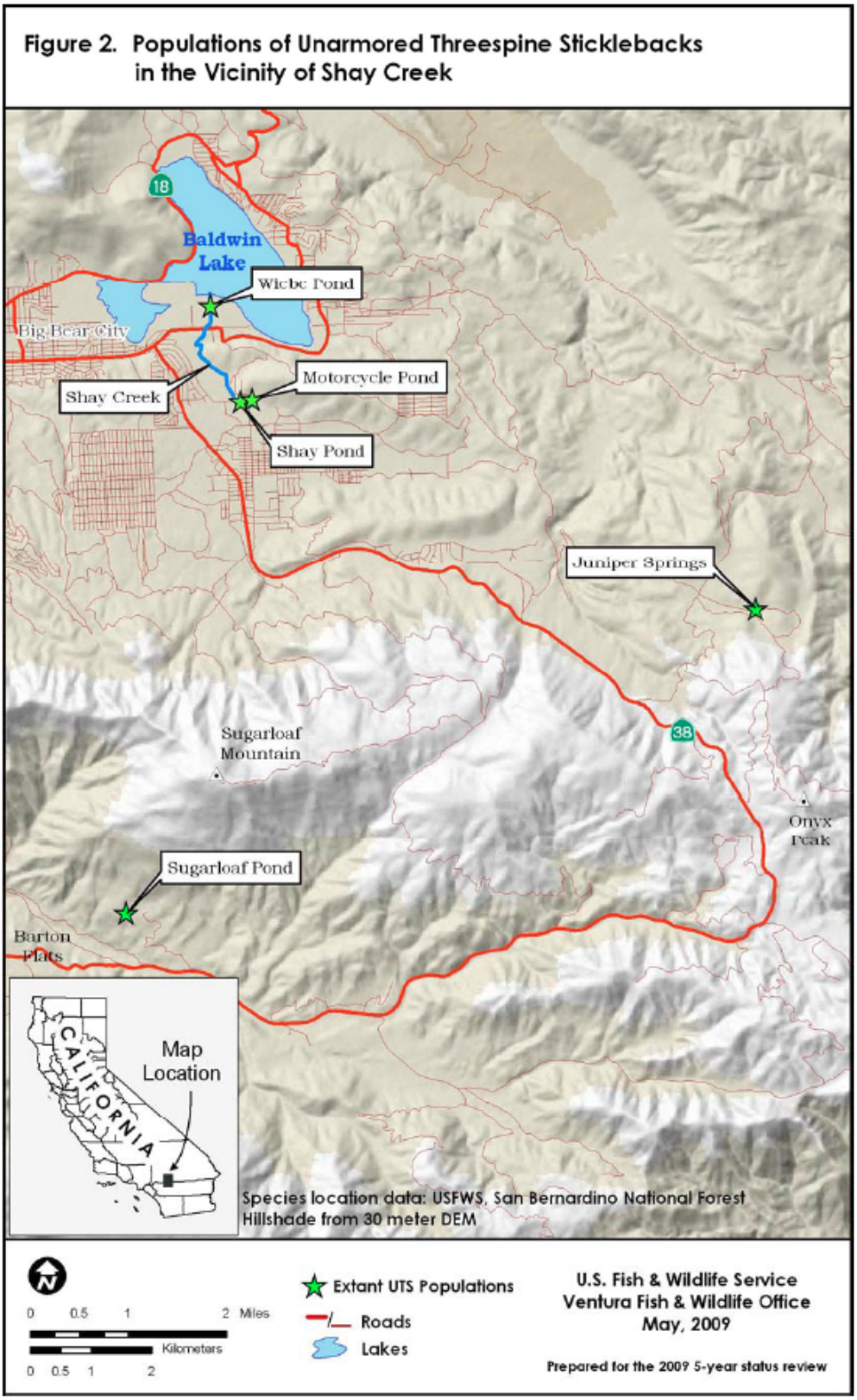


Figure 5-3. Populations of Stickleback in the Shay Creek Area (3 p. 11)

Per the 5-Year Review, there are habitat threats that are specific to the Shay Creek area, including wetland vegetation growth and encroachment, pollution or eutrophication from contamination from horse manure, and loss of flow in the creek due to property development in the area (3 p. 20). To mitigate wetland vegetation growth and encroachment, Shay Pond was dredged by BBCCSD in 2011 (5), and again most recently in 2017. Figure 5-4 and Figure 5-5 show the pond before and after the 2011 dredging, respectively.

Figure 5-4. Shay Pond Before Dredging (5)

Figure 5-5. Shay Pond After Dredging (5)

5.2.2 Shay Pond Water Supply

The requirements of the 2002 BO state that BBCCSD will continue to provide water to Shay Pond to maintain a minimum 20-gallon-per-minute outflow from Shay Pond. To meet this outflow requirement, BBCCSD discharges 50 gpm of potable water into the pond. This equates to 80 AFY, which is significant for BBCCSD because it represents approximately 9% of BBCCSD's customer water demand. The objective is to maintain a minimum pond water level that will support suitable habitat conditions for the fish. BBCCSD currently meets this requirement by discharging potable water into Shay Pond, but the 2002 BO also states that, should a suitable alternative supply of water be found to be appropriate for the stickleback in the future, BBCCSD may use an 'in-lieu' water supply, which could include the use of tertiary-treated water. Prior to use as an in-lieu supply, tertiary-treated water must be studied to confirm suitability to support long-term Stickleback survival, see Section 4.1.3.1 for details. The Lake Alternative would provide an in-lieu water supply for Shay Pond to meet the requirements of the 2002 BO, which would enable BBCCSD to recover this potable supply to serve their customers.

5.2.3 Next Steps for Implementation

Implementation of the Lake Alternative will require further investigation into the suitability of the proposed recycled water quality for discharge into Shay Pond. The concept of providing recycled water to Shay Pond has been evaluated by BBARWA previously. In the Mitigation Monitoring and Reporting Program (MMRP) of the *Final Program Environmental Impact Report for the Big Bear Area Regional Wastewater Agency's Recycled Water Master Plan* (Final EIR), Biological Resources Mitigation Measure 4.5-8 states that: "BBARWA shall initiate a long-term study of Stickleback survival in recycled water if this component of the [Recycled Water Master Plan] program is implemented. The following steps will be implemented: (1) obtain submittals outlining a proposed study program to answer the question of whether the Stickleback can survive and breed over several generations without any measurable damage to individuals or the population; (2) consult with the [USFWS] and [CDFW] to obtain concurrence and approval to implement the study program; (3) fund the study implementation and compile a report of results and recommendations; and (4) submit the report and recommendation to the [USFWS] and [CDFW] with the objective of obtaining an incidental take permit to use recycled water to supplement the habitat in Shay Creek and replace potable water currently being used for this purpose," (6 p. 12). Specific issues that are anticipated to be addressed through these studies include contaminants of emerging concern (CECs), endocrine disrupting compounds (EDCs), and temperature.

Another parallel path could include seeking outside partnerships to develop and implement this beneficial use alternative. For instance, in the late 1990s, the National Heritage Foundation (NHF) sought a partnership with BBARWA to upgrade the WWTP to tertiary treatment to provide water for creation of a new Stickleback habitat in Baldwin Lake. The NHF obtained grant funding to support the construction of treatment upgrades and the pipeline to the new habitat, although this work was not ultimately completed. Additionally, The Nature Conservancy (TNC) played a role in developing a plan in the Santa Clara River watershed addressing important Stickleback habitat (3). The Project Team could coordinate with the NHF, TNC, and/or other similar organizations focused on habitat restoration to evaluate partnership opportunities to further study and enhance the Stickleback habitat.

A new NPDES permit would be required for the proposed discharge into Shay Pond.

5.3 GROUNDWATER RECHARGE AT SAND CANYON

Groundwater recharge at Sand Canyon was evaluated by Thomas Harder & Co. (Harder) to assess the feasibility of recharging the groundwater aquifer at Sand Canyon using surface water from Big Bear Lake and estimate the annual recharge capacity. Harder found that the recharge potential at Sand Canyon is approximately 380 AFY over a 6-month period, based on a recharge area of approximately 4.2 acres and a recharge rate of 2.1 ft/day. The primary limit to recharge rates in the Sand Canyon area appears to be available subsurface storage space to accommodate the groundwater mound. The target maximum groundwater level relative to the land surface was 20 ft below ground surface because previous studies in the Big Bear area have shown that this depth is protective of liquefaction. The full technical memorandum presenting Harder's analysis is attached as Appendix A.

The Sand Canyon recharge concept involves extracting water from the Lake (a blend of surface water and recycled water) and discharging it into Sand Canyon, which serves as a flood control channel. The recharge operation would only occur during dry periods when needed to supplement groundwater supply and would be operated intermittently as needed to avoid interference with flood flows. Prior studies evaluating potential recharge operations in Sand Canyon considered constructing a series of small berms along the streambed to create a percolation area or modifying stream channel to create a meandering stream with small natural ponds to slow the water down and enhance percolation. An additional concept that could be considered is the use of inflatable rubber dams in the channel which could be inflated to create percolation ponds during the recharge operation only and deflated at all other times so as not to impact the natural function of the channel. All of these concepts would need to be coordinated with the flood control agency to ensure that the capacity of the flood control channel remains sufficient to meet the primary purpose of providing flood protection. If these improvements resulted in a decrease in surface flow entering the Lake, the impact to surface water rights under the 1977 Judgment would need to be evaluated.

When water is needed for recharge in Sand Canyon during dry periods, it is assumed that the existing lake pump station owned by Big Bear Mountain Resort (Ski Resort) could be used to transfer water through an existing pipeline into the existing storage pond located at Bear Mountain Ski Resort. These facilities are used primarily for snow making in the winter and are expected to be available for the proposed recharge operation, which would only occur in April – October when the resorts are not making snow. The Project Team has conducted preliminary discussions with the Resort about the Lake Alternative and potential joint use of their snowmaking facilities. The Resort is interested in the Lake Alternative because low Lake levels significantly complicate their snow making operation so they would benefit from an increase in Lake levels. The Project Team will continue discussions with the Resort and work to develop a mutually agreeable arrangement for joint use of the snowmaking facilities. This study assumes joint use of the snowmaking facilities will be viable and that a new pump station would be constructed near the Resort pond to convey water through a new pipeline to discharge into Sand Canyon, as shown in Figure 7-3. If a joint use arrangement for the snowmaking facilities cannot be negotiated, constructing new pumping and conveyance facilities to reach Sand Canyon would substantially increase the project cost.

5.4 SNOW STORAGE

During wet periods, excess water could be stored as snow at the Resorts using their existing snowmaking infrastructure. This would reduce spills from the Lake, keep more of the water in the Valley and enhance winter recreation by providing additional snowmaking water to the Resorts beyond their current allotment from the Lake. When the snow melts in the spring, runoff would be augmented, which is expected to increase natural groundwater recharge and may improve fish spawning habitat in streams tributary to the Lake. A hydrologic analysis would be required to assess the potential benefits of this component, but this is a flexible strategy to enable to Project Team to further expand the benefits of the Lake Alternative.

Title 22 provides that disinfected tertiary recycled water may be used for artificial snowmaking for commercial outdoor use.

5.5 GOLF COURSE IRRIGATION

As another potential option to keep additional water in the Valley, the existing snowmaking facilities could also be used to deliver irrigation water to the Bear Mountain Golf Course (also owned by the Ski Resort) in the summer, if desired. The water demand for the Bear Mountain Golf Course is estimated to be 120 AFY (1). This option would allow the Resort to rest their groundwater irrigation wells and reduce pumping from the Basin.

Title 22 provides that disinfected tertiary recycled water may be used for irrigation of unrestricted access golf courses, subject to the restriction that irrigation shall not take place within 50 feet of an unshielded domestic water supply well and that recycled water impoundment may not occur within 100 feet of a domestic water supply well. Additionally, some adjustments to irrigation practices may be needed to comply with the use site requirements in Title 22. This option would need to be coordinated with the Resort.

5.6 DOWNSTREAM RECHARGE

Additional inflows into the Lake will provide BBMWD with more flexibility in managing Lake releases, while still maintaining higher Lake levels than are possible without the Lake Alternative. In particular, during wet periods, additional flood control releases are anticipated that will flow down the Santa Ana River to the Seven Oaks Dam, which is upstream of the San Bernardino Groundwater Basin area. BBMWD intends to coordinate with Valley District in an effort to optimize the volume of releases from the Lake that can be captured for recharge of the San Bernardino Basin, rather than flow past to the ocean. A Seven Oaks Dam capture project is underway that will enable Valley District to vastly increase their capacity to recharge water released from the Seven Oaks Dam. To further assess the potential benefits to recharge in the San Bernardino Basin, a hydrology study is needed to estimate the volume and timing of additional flows under a range of hydrologic conditions. That information can then be input into Valley District's model to assess their ability to capture these flows for recharge.

6 TREATMENT UPGRADE REQUIREMENTS

A key consideration in the development of any recycled water project is the required quality and treatment level of the recycled water as established by various permitting agencies and State Regulations. The key drivers for treatment upgrades for the Lake Alternative are described in this section.

6.1 BASIN PLAN WATER QUALITY OBJECTIVES

In order to recharge the Basin or discharge recycled water to the Lake, the recycled water must meet the water quality objectives set by the Santa Ana River Basin Water Quality Control Plan (Basin Plan). The Basin Plan establishes beneficial uses and water quality objectives (WQO) for the ground and surface waters of the region and includes an implementation plan describing the actions by the RWQCB and others that are necessary to achieve and protect the water quality standards. The Basin Plan provides a general narrative regarding the WQO for each water body type and specific numeric objectives for total dissolved solids (TDS), hardness, sodium, chloride, total inorganic nitrogen (TIN), total phosphorus (TP), sulfate, and chemical oxygen demand (COD). Additional information about the Basin plan is provided in Appendix B of the 2016 Study. The WQO for the Big Bear Valley are summarized in **Table 6-1**. As shown, the WQOs for Big Bear Lake are the most stringent of the proposed discharge points and will therefore govern the treatment upgrades required for the Lake Alternative.

Table 6-1. Basin Plan Water Quality Objectives

Water Body	TDS	Hardness	Sodium	Chloride	TIN	Sulfate	COD
Inland Surface Streams							
Rathbone Creek (downstream of Sand Canyon)	300	-	-	-	-	-	-
Shay Creek (Narrative Objectives)	-	-	-	-	-	-	-
Lakes and Reservoirs							
Big Bear Lake	175	125	20	10	0.15	10	-
Wetlands (Inland)							
Stanfield Marsh (Narrative Objectives)	-	-	-	-	-	-	-
Groundwater Management Zones							
Big Bear Valley	300	225	20	10	5	20	-

6.1.1 Big Bear Lake Nutrient Limits

In addition to the numeric and narrative WQOs, Big Bear Lake is subject to a Total Maximum Daily Load (TMDL) numeric target of 35 µg/L-P for total phosphorus during dry hydrologic conditions, per Resolution No. R8-2006-0023. By 2020, the total phosphorus numeric target must be achieved at all times. A causal target was established for phosphorus because it was determined to be the limiting nutrient in the lake; however, nitrogen may be the limiting nutrient under certain conditions and as a result, a nitrogen TMDL may be established in the future. Data collected in accordance with the Big Bear Lake Watershed-wide Nutrient Monitoring Plan is currently used to assess compliance with the lake's water quality objectives, and can also assist in determining nutrient TMDL waste-load allocations (WLAs) and numeric targets for nitrogen in the future. Response targets for macrophyte coverage, percentage of nuisance aquatic-vascular plant species and chlorophyll a concentration have also been implemented under the nutrient TMDL to further assess water quality improvements in the lake.

The nutrient limits for an NPDES permit to Big Bear Lake are expected to align with the Basin Plan WQOs and the TMDL numeric targets to protect the beneficial uses of the lake. The anticipated effluent nutrient limits of 35 µg/L-P for total phosphorus and 0.15 mg/L-N for total inorganic nitrogen would require multiple process steps and consistent treatment through seasonality. For a cold climate like Big Bear's, compliance with stringent nutrient limits through the winter season would be the greatest challenge due to decreased biological nutrient removal when wastewater temperatures drop below 10-degrees Celsius. Some California wastewater facilities that operate in cold climates have separate summer and winter nutrient limits in consideration of this seasonal affect – the winter limits being less stringent – although it is unknown at this point if BBARWA's future discharge permit would be considered for seasonal limits. The treatment required to meet the expected phosphorus and nitrogen limits includes enhanced nutrient removal processes and technologies, as further described in Section 7.1 of the report.

Note that the RWQCB may consider permitting increased nutrient limits for the discharge if an approved nutrient offset program is implemented as well. A nutrient offset program would reduce nutrient loads elsewhere in the watershed by an amount at least equal to the amount discharged in excess of the WQO. Coordination with the RWQCB staff is needed to explore potential opportunities for a nutrient offset program in the Valley.

6.2 SURFACE WATER DISCHARGE

Based on initial discussions with the SWRCB Division of Drinking Water (DDW), this project would not likely be considered a Surface Water Augmentation project because the Lake is not used directly as a drinking water source and the environmental buffer between the discharge point and downstream uses is extremely large. Additional coordination with DDW is needed to verify the permitting strategy and technical analysis may be required to support DDW's determination.

6.3 GROUNDWATER RECHARGE REQUIREMENTS

Several key regulatory requirements for groundwater recharge are described in the following subsections.

6.3.1 Recycled Water Concentration

The groundwater replenishment regulations in Title 22 require that the initial concentration of filtered and disinfected tertiary recycled water (Recycled Water Concentration or RWC) not exceed 20% of the total recharge water, which requires 80% of the total recharge water to come from other high-quality water sources for blending. Blend water can be a combination of imported SWP water, captured surface water, or natural underflow. If sufficient dilution water is not available from these sources, advanced purified recycled water using reverse osmosis (RO) and advanced oxidation can serve as a dilution source. As discussed previously, SWP water is not available in the Valley. The Groundwater Recharge Regulations assess a project's compliance with the RWC requirement using a 120-month running monthly average.

The Lake Alternative proposes to discharge treated water to the Marsh, which will flow through to the Lake and blend with surface water captured in the Lake, which is expected to be a qualified dilution water source. Based on annual Lake inflows from 1977 to 2016 (5), the lowest 10-year rolling average of Lake inflows over this period was 10,389 AF, which occurred in 2016. Based on effluent flows from 2007-2016, the anticipated 10-year average recycled water flow into the Lake is approximately 1,950 AF, which would equate to approximately 16% RWC in the Lake on a 10-year rolling average.

In addition, natural underflow beneath the Sand Canyon recharge area is expected to qualify as a dilution source. A preliminary estimate of underflow volume was developed by Thomas Harder & Co. in the Sand Canyon Recharge Evaluation Technical Memorandum, dated November 29, 2017 and attached as Appendix A. Depending on the interpretation of the data by the SWRCB Department of Drinking Water (DDW), the underflow dilution credit is estimated to range from 58 AFY to 247 AFY, which would further reduce the RWC of 16% from the blended Lake water. Based on this preliminary assessment of available diluent water, groundwater recharge at Sand Canyon with blended water from the Lake is expected to meet the initial RWC requirement of 20%.

Because the Lake WQO are much more stringent than the Basin WQO, it is anticipated that the blended water from the Lake will meet the WQOs for groundwater recharge in the Basin.

At the planning level, there is some uncertainty in the treatment requirements because the qualifying dilution water has not been fully quantified. If needed, project proponents have an opportunity to perform additional analysis to demonstrate to the RWQCB and DDW that tertiary treatment and dilution water will meet the Title 22 and Basin Plan requirements. The RWQCB and DDW will make the final decisions on the required treatment levels after review and evaluation of technical information presented by the project proponent during the permitting process.

6.3.2 Minimum Travel Time

The Groundwater Recharge Regulations require a minimum "response retention time" or minimum groundwater travel time of two months between the point of surface application or injection, and the point of extraction. Harder's preliminary analysis shows that the recharge water will reach the nearest production well (Sheephorn Well) in a little more than approximately 13 months. For preliminary recharge siting purposes, the Groundwater Recharge Regulations allow a "credit" of 0.25 for travel time calculations using an analytical model, as was done for this analysis. Thus, the credited retention time is interpreted to be 3.25 months (13 x 0.25). This credited retention time is less than the minimum retention time of 2 months, indicating that the simulated recharge operation is feasible based on the data assumptions in the analysis.

6.3.3 Pathogen Control

Pathogen controls include specific provisions for log reduction of microorganisms and treatment process requirements. The treatment process used to treat recharge water for a GRRP must provide treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction from raw sewage to usable groundwater. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction. If the treatment process itself does not achieve the required pathogen control credits, additional credit can be gained through underground retention time prior to extraction. The pathogen control credit requirement and underground retention time should be considered as part of the treatment process selection during preliminary design.

7 LAKE ALTERNATIVE ANALYSIS

The following subsections provide additional information about the Lake Alternative, including treatment upgrades, yield, brine disposal alternatives, treated water distribution, and a summary of capital and operating costs.

7.1 TREATMENT UPGRADES

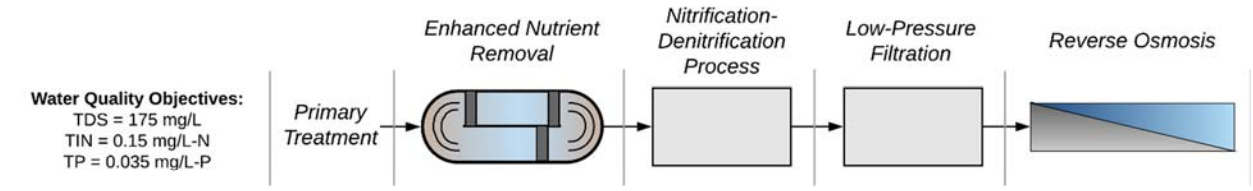
For the Lake Alternative, BBARWA's existing wastewater facility will be upgraded to meet the water quality objectives identified for Big Bear Lake in the Santa Ana Basin Plan (Table 6-1). Inorganic nitrogen and phosphorus must be removed through multiple in-series processes because a single process cannot reliably reduce effluent TIN and TP concentrations to the levels required for Big Bear Lake's WQOs. To achieve these strict effluent limits, it is anticipated that BBARWA will need to implement a series of upgrades to existing unit processes and integrate new unit processes, specifically:

- Upgrade the extended aeration process through retrofit of the existing oxidation ditches to optimize biological nitrification-denitrification (NDN) and phosphorus removal. Phosphorus removal occurs in anaerobic conditions and denitrification occurs in anoxic conditions, both of which could be incorporated into the existing infrastructure with modifications to aeration patterns or with dedicated tanks. If needed, chemical precipitation of soluble phosphorus can be performed through addition of a metal salt within the activated sludge tankage, upstream of clarification.
- Nutrient-laden liquid sidestreams, which are produced during solids handling processes, may require management or treatment due to the potential negative impacts of returning high nutrient loads to other unit processes. The need for sidestream treatment will be determined during subsequent phases of the project when a plant-wide mass balance and/or process model can be developed to identify sidestream characteristics.
- Retrofit or operational modifications to secondary clarifiers for settling of phosphorus precipitates. It is important to note that chemical precipitation of phosphorus within the existing clarifiers requires an evaluation of effects on sludge production and handling. Removal of phosphorus through chemical precipitation is expected to increase solids production and impact operation of the current solids handling process.
- Addition of an NDN process to reduce inorganic nitrogen concentrations. This process may consist of a biologically active filter with sand or synthetic media, or biological reactors designed specifically for nitrogen and phosphorus removal. The denitrification process will likely require an external carbon source to facilitate the reduction of nitrate.
- Low pressure filtration, such as microfiltration (MF) or ultrafiltration (UF), to reduce flocculated or colloidal solids upstream of the reverse osmosis (RO) process.

- RO to reduce TDS concentration and nutrient concentrations. The assumed operational recovery for the RO system is 90% of the design flow. While it may be challenging for conventional RO systems to achieve this recovery rate, emerging RO technologies that are configured for brine recirculation, multiple pass, or in-series operation to achieve high recoveries (such as closed-circuit reverse osmosis), have been demonstrated to achieve high recovery rates with reduced energy consumption at comparable capital costs to conventional RO (15). Such technologies would need to be piloted with BBARWA's specific water quality characteristics to verify expected performance for this application.

  The low-pressure filtration and RO unit processes are expected to provide the physical filtration for reduction of the 1 to 2 mg/L of TIN and TP coming from upstream processes. RO is the only unit process capable of removing TDS, making it a critical unit process for compliance with WQOs. It is assumed that 100% of the design flow will need to receive RO treatment to meet the WQOs. RO offers the advantage of removing organics, inorganics and nutrients to a sufficient level for meeting nutrient WQOs; however, the RO process also presents the challenge of managing brine stream disposal in an inland location, as further discussed in Section 7.3.

A representative process flow diagram (PFD) for this alternative is shown in Figure 7-1. Potential water quality performance for TIN, TP and TDS constituents are estimated for each unit process; however, it is important to note that the performance of each of these unit processes is highly site specific based on the water quality composition being treated. A pilot test of each unit process is recommended to refine performance estimates and establish design criteria.



		Primary Treatment	Enhanced Nutrient Removal	Nitrification-Denitrification Process	Low-Pressure Filtration	Reverse Osmosis
Potential Water Quality Performance	TIN (mg/L-N)	--	5	1	1	0.1
	TP (mg/L-P)	8	2	2	0.1	0.02
	TDS (mg/L)	430	430	430	430	50*

Figure 7-1. Representative Treatment Process Flow Diagram for the Lake Alternative

7.1.1 Effluent Temperature

It should be noted that Lake water temperatures and WWTP effluent temperatures vary seasonally. While they are relatively similar in the summer months, the WWTP effluent temperature is considerably higher than the Lake temperature in the winter, as shown in Figure 7-2. It is expected that the discharge permit for this alternative would include limits for effluent temperature, and/or the allowable temperature change in the Lake caused by the discharge to avoid adverse thermal impacts to aquatic habitat. As a result, the treatment upgrades may need to include a provision for effluent cooling during winter.

Temperature reduction of the effluent may be achieved through a variety of methods or a combination of methods (16). Potential methods that may be applicable to BBARWA's WWTP include:

- Selecting a disinfection process with lower relative heat addition than other alternatives (i.e. chlorine contactor or UV) and by covering the disinfection facility to reduce solar energy addition
- Use of a multiple port diffuser system at the discharge location to facilitate more rapid mixing with the receiving water
- Discharge into a constructed wetland with long detention times through shaded, deep narrow channels
- Discharge into shallow reservoir to act as a cooling pond to achieve evaporative and radiative heat loss prior to surface water discharge. Depending on the configuration of the treatment process, the existing secondary effluent storage ponds may be able to provide some cooling benefit
- Spray cooling, which uses evaporative cooling to remove heat from treated wastewater by spraying it into the air from a lined pond when the ambient temperature is significantly lower than the effluent temperature. Spray cooling could potentially be implemented in the secondary effluent storage ponds and would require the installation of a pump, manifold and nozzles.
- Cooling towers or chillers could be considered, although they are expensive to install and operate so this equipment is not desirable

The need for effluent cooling should be assessed during the preliminary engineering phase once discharge temperature criteria are more well defined. The costs for the Lake Alternative presented in Table 7-5 do not include the cost of effluent cooling, if required.

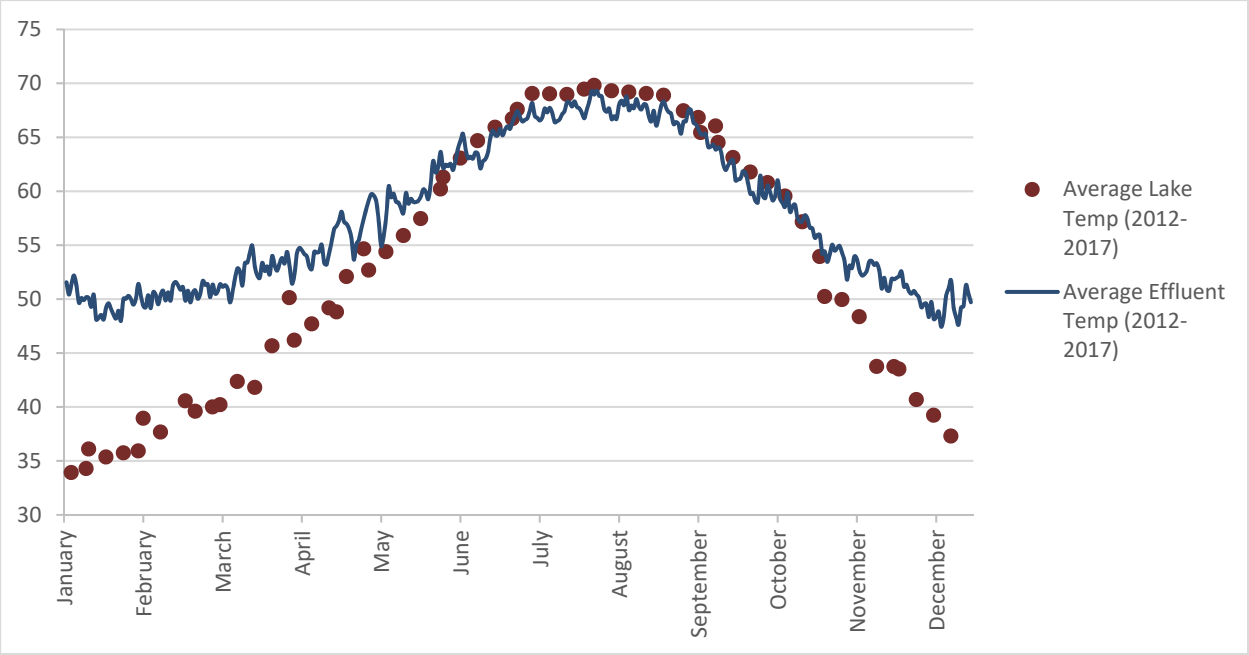


Figure 7-2. Comparison of Average Lake and BBARWA Effluent Temperatures (2012-2017)

7.2 DESIGN CAPACITY AND ANNUAL YIELD

The design capacity of the treatment upgrades is assumed to be 2.2 mgd, which corresponds with the 10-year average annual flow. Based on a preliminary sizing analysis, increased treatment capacity results in only a marginal increase in yield and does not provide an appreciable increase in economic or environmental benefit. It is assumed that any flows in excess of 2.2 mgd would be treated to a secondary level and discharged to Lucerne Valley, similar to the existing discharge method.

However, due to daily and seasonal variations in flow, the actual yield will be less than 2.2 mgd. It is assumed that the secondary effluent storage volume will offset some daily variations in flow, but the capacity is not sufficient to offset seasonal variations, particularly in dry years when summer flows have been as low as 1.6 mgd. A preliminary analysis based on monthly flows for the 10-year period from 2007-2016 indicates that the average secondary effluent available will be approximately 1.93 mgd, or 2,160 AF. Based on a 90% recovery rate, the average recycled water production would be 1.74 mgd, or approximately 1,950 AFY.

Note that recycled water production may increase in the future as average dry weather flows increase due to growth; however, continued conservation may offset some increases. Additionally, reduced design capacities could be evaluated to determine the optimal cost to yield ratio. It is recommended that the design capacity and RW production estimates be refined during the preliminary and final design phases based on more detailed flow data and actual MF and RO recovery rates.

7.3 BRINE DISPOSAL - SOLAR EVAPORATION PONDS

A key challenge with implementation of RO treatment, particularly in inland communities, is effective management of the brine concentrate. The most common brine concentrate disposal options include deep well injection (where permitted), surface water discharge (including the ocean), discharge to a wastewater treatment plant (such as via the Inland Empire Brine Line), land disposal, and solar evaporation or Zero Liquid Discharge (ZLD) with disposal of solids to a landfill. Deep well injection, surface water discharge, and land application are not feasible due to regulatory and geologic constraints (14). Discharge to the Inland Empire Brine Line is assumed to be infeasible because the nearest discharge point is over 20 miles away in straight line distance and the capacity is fully subscribed. ZLD, a combined evaporation and crystallization process that produces a dry waste, has relatively high capital and O&M costs and operational complexity compared to other disposal alternatives, and is typically only considered for disposal of municipal brine when no other disposal option is available (17). Therefore, ZLD is not evaluated in this study.

The focus of this section is a preliminary evaluation of several solar evaporation pond alternatives. Evaporation ponds rely on solar energy to evaporate water from the brine concentrate stream, leaving behind precipitated salts, which ultimately are disposed of in a landfill. Evaporation ponds for brine concentrate disposal are most appropriate for smaller volume flows and for regions having a relatively warm, dry climate with high evaporation rates, level terrain, and low land costs. Evaporation ponds are relatively easy to construct, are low maintenance and have no mechanical equipment except for pumps to convey brine to the ponds. However, pond size requirements can be quite high depending on the brine flow and evaporation rates and the regulatory requirement for impervious liners of clay or synthetic membranes substantially increases the cost of construction. Monitoring wells will be required to verify that seepage from the ponds is not contaminating underlying groundwater.

A comparative analysis of evaporation ponds located in either the Big Bear Valley on the WWTP site or in the Lucerne Valley on BBARWA's 480-acre site is presented in this section.

7.3.1 Brine Volume & Reduction

As discussed in Section 7.2, the actual treated flow may be lower than the design capacity of 2.2 mgd; however, the full capacity of 2.2 mgd is used for this brine disposal analysis to ensure sufficient disposal capacity if higher recovery rates area achieved or flows increase in the future due to growth.

As discussed in Section 7.1, the estimated recovery of the RO process is 90%, so 10% of the treated flow, or 220,000 gallons per day (gpd), will be brine concentrate. If recovery of additional water is desired or if it is necessary to reduce the size of the evaporation pond, an additional treatment process can be added to further concentrate the brine volume. Potential brine concentration processes include electrodialysis reversal (EDR), Vibratory Shear Enhanced Process (VSEP) and Enhanced Membrane Systems (EMS), which were previously evaluated for BBARWA (14). Although these processes recover additional water for beneficial use, they are relatively high in capital and O&M cost and increase operational complexity.

For the purposes of this analysis, a brine concentrator is assumed to have a 90% recovery rate, so 10% of the original brine concentrate, or 22,000 gpd, will be discharged to an evaporation pond. Brine concentrator recovery rates greater than 90% may be achievable and would further reduce the brine volume discharged to the evaporation pond. The water recovered from a brine concentrator is expected to be relatively low in TDS (less than 500 mg/l), so it expected that the product water could be blended with the RO permeate and still meet the TDS WQO for the proposed uses.

7.3.2 Evaporation Rates and Pond Size

Due to a higher evaporation rate and lower precipitation, ponds located in Lucerne Valley could be smaller than ponds located in Big Bear Valley. The estimated evaporation rate in Lucerne Valley is 63 inches per year (14) and average annual precipitation is 8.4 inches per year (15). The estimated evaporation rate in the Big Bear Valley is 45 inches/year (14) and the average annual precipitation at the BBCCSD station is 14.4 inches per year (5). Although the average annual evaporation rate calculated for the Lake in the Big Bear Watermaster Annual Reports is higher at 51.2 inches per year (previous 12-year average), the lower value of 45 inches per year is used in this comparative analysis to be consistent with the evaporation data available for the Lucerne Valley region.

Evaporation efficiency of brine is significantly lower than fresh water; while complex site-specific variables impact the actual evaporation rate, an evaporation ratio of 0.70 is considered a reasonable allowance in absence of site specific data (16). Subtracting the annual precipitation from the annual evaporation and adjusting for brine evaporation efficiency yields a net evaporation rate of 38.2 inches per year in Lucerne Valley and 21.4 inches per year in Big Bear Valley.

The required evaporative area of an evaporation pond is based on the flow rate of brine and the evaporation rate but the actual pond area constructed should be at least 20% larger to allow for operational contingency and space for dikes and service roads (16). Total evaporation pond areas for the two location and brine volume options were calculated using an evaporation pond regression model (17) and are presented in Table 7-1.

Table 7-1. Evaporation Pond Areas

	Evaporation Pond Total Area, acres	
Brine Flow Rate	**Big Bear Valley**	**Lucerne Valley**
RO Concentrate (220,000 gpd)	138	78
Reduced Brine (22,000 gpd)	13.8	7.7

As shown, the evaporation pond areas are greatly reduced when the brine is concentrated; however, brine concentrators add a significant capital and O&M cost that may offset the cost savings and benefits of the reduced pond size. The BBARWA WWTP site is 80 acres and the adjacent land is primarily in the flood plain and/or National Forest System Land so a 138-acre evaporation pond near the WWTP site in Big Bear Valley is not likely feasible.

7.3.3 Brine Storage and Conveyance

7.3.3.1 Big Bear Valley

If the evaporation ponds are located at the BBARWA WWTP site, the brine is assumed to be conveyed directly from the treatment process to the evaporation ponds so brine storage and brine pumps would not be required. A new pipeline from the RO process to the evaporation ponds would be needed. An allowance of 2,000 feet is included in this analysis, assuming that the evaporation ponds are located within the current WWTP site.

7.3.3.2 Lucerne Valley

If evaporation ponds are located in the Lucerne Valley, BBARWA desires to use the existing effluent pipeline for brine conveyance as it is not financially feasible to construct a second pipeline to Lucerne Valley. Because this pipeline will also need to be used to convey peak flows to the Lucerne Valley site, the operational strategy to maintain dual use of this pipeline will be an important consideration to ensure that BBARWA is able to remain in compliance with discharge permit requirements at all times.

The key constraint on the use of the pipeline is anticipated to occur during winter periods with sustained higher flows. During these periods, the availability of the pipeline to convey brine to Lucerne Valley will be limited and brine discharges will need to occur in a series of relatively short windows during which the effluent storage provides a buffer to discharge brine. The maximum month effluent flow from the WWTP in the 10-year period from 2007-2016 occurred in March 2011 and was 169 million gallons (MG), or an average monthly flow of 5.6 mgd. The maximum daily flow in March 2011 was 7.6 mgd, but the maximum day flow in the 10-year period was 9.6 mgd on December 22, 2010, which is equal to the maximum capacity of the effluent pump station. The WWTP has 10 MG of emergency storage that provides sufficient capacity to manage peak hour flows (18) so 9.6 mgd is the maximum expected effluent flow, limited by the capacity of the auxiliary effluent pump station.

The design capacity of the proposed tertiary treatment upgrades is 2.2 mgd, so the secondary effluent discharged to Lucerne Valley will be reduced by that amount during high flow periods. The WWTP has 2 secondary effluent storage ponds with a combined storage of 5 MG. Table 7-2 shows the duration of time that the effluent pumps can be turned off during peak flow periods and the duration of time they will need to run to empty the storage ponds once they are filled. At a minimum, 13 hours of brine storage volume must be provided at the WWTP to allow for the secondary effluent pumps to empty the ponds. During a peak day event, the secondary effluent storage will refill in only 15 hours so additional brine storage is recommended to provide operational flexibility so that operators do not have to transition from effluent to brine discharge during a peak day while also managing peak hour flows using the emergency storage pond. For this analysis, 3 days of brine storage is assumed, but this could be increased if additional operational flexibility is needed. The brine pump station is sized to empty the brine storage tank in 35 hours so that it can be emptied within the effluent storage window of the 1-Year max month flow condition in Table 7-2. The resulting brine storage and pumping capacities are shown in Table 7-3.

Table 7-2. Secondary Effluent Storage and Pumping Durations in Peak Flow Periods

Wet Weather Flow Condition	Total Flow, mgd	Secondary Effluent Flow, mgd[1]	Hours of Secondary Effluent Storage[2]	Minimum Time to Empty Secondary Effluent Storage[3]
10-Year Maximum Month Flow (2007-2016)[4]	3.3	1.1	109 hours	13 hours
1-Year Maximum Month Flow (2011)	5.6	3.4	35 hours	13 hours
Peak Daily Wet Weather Flow	9.6	7.6	15 hours	13 hours

Notes:
1. Total Flow minus 2.2 mgd which is diverted to the tertiary treatment system
2. Time to fill 5MG secondary effluent storage when effluent pumps are off, assuming that it is emptied by a prior pumping cycle. This is the available window for brine discharge.
3. Assumes auxiliary pumps are operated at maximum capacity of 9.6 mgd until the ponds are emptied
4. Average of maximum month flows for the 10 year period 2007-2016

Table 7-3. Brine Storage and Pumping Capacity for Lucerne Valley Evaporation Ponds

Brine Flow Rate	Brine Storage Volume, gallons	Brine Pumping Capacity, gpm
RO Concentrate (220,000 gpd)	660,000	470
Reduced Brine (22,000 gpd)	66,000	50

Under this operational scenario, the discharge pipeline to Lucerne Valley would be used for brine discharge for up to 35 hours, then would be available for secondary effluent discharge for up to 3 days while to brine storage tank is refilled. Each time the pipeline use switches from brine to secondary effluent, the brine remaining in the pipeline would need to be flushed into the evaporation pond before the effluent could be applied to the fields. This mode of operation would limit the amount of time the pipeline is filled with brine and may help reduce corrosion potential; however, further evaluation is needed during the preliminary design phase to assess the suitability of the existing cement lined ductile iron pipe to convey brine. A condition assessment and corrosion testing of the pipeline material is recommended to determine whether the existing pipeline would be degraded by this operation. If the pipeline needs to be lined to protect it from corrosion, this would significantly increase the capital cost. A flushing and monitoring protocol would need to be established to ensure that the discharge to the fields remains in compliance with BBARWA's WDR permit which regulates this discharge. The existing WDR permit would need to be modified to include the proposed evaporation pond, subject to approval by the Colorado River RWQCB.

The existing discharge pipeline fills a concrete lined balancing reservoir located approximately 1.25 miles south of BBARWA's LV Site then flows by gravity to the LV site to irrigate the fields. Because the concrete balancing reservoir was not likely constructed with an impervious liner and it would be difficult to flush frequently, it is assumed that brine flows will not enter the balancing reservoir, but be conveyed to the LV site through a new dedicated brine pipeline from the balancing reservoir site, approximately 10,000 feet long. Automatic control valves could be installed at the balancing reservoir site to enable BBARWA to conduct the pipeline flushing remotely before switching to effluent discharge. Note that BBARWA's 2010 Sewer Master Plan indicates that there are 2 parallel pipelines from the balancing reservoir to the LV Site so the configuration and operation of these pipelines should be investigated to evaluate whether one could be repurposed to convey brine to the LV site and eliminate the need to construct a new pipeline.

7.3.4 Brine Disposal Comparative Costs

Comparative capital and O&M costs for each scenario are presented in Table 7-4.

Table 7-4. Brine Concentration and Evaporation Comparative Costs

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cost Component[1]	Big Bear Valley RO Concentrate 138 Acre Pond[2]	Big Bear Valley Reduced Brine 13.8 Acre Pond	Lucerne Valley RO Concentrate 78 Acre Pond	Lucerne Valley Reduced Brine 7.7 Acre Pond
Capital Costs				
Evaporation Pond	$13,394,000	$1,339,000	$7,507,000	$750,000
Brine Concentrator	-	$8,522,000	-	$8,522,000
Brine Storage	-	-	$1,432,000	$143,000
Brine Pump Station	-	-	$584,000	$93,000
Brine Pipeline	$290,000	$219,000	$1,837,000	$1,452,000
Total Capital Cost	**$ 13,684,000**	**$ 10,080,000**	**$ 11,360,000**	**$ 10,960,000**
O&M Cost				
Evaporation Pond	$67,000	$7,000	$38,000	$4,000
Brine Concentrator	-	$539,000	-	$539,000
Brine Storage	-	-	$14,000	$1,000
Brine Pump Station	-	-	$52,000	$5,000
Brine Pipeline	$3,000	$2,000	$18,000	$15,000
Total O&M Cost	**$ 70,000**	**$ 548,000**	**$ 122,000**	**$ 564,000**

Notes:

1. Capital costs include 25% markup for construction contingency and 30% markup for implementation. See Appendix B for a summary of capital cost methodology and assumptions.
2. Sufficient space on the existing WWTP site is not available and adjacent lands are primarily in the flood plain and/or National Forest System Lands so this alternative is likely not feasible, or the capital cost will be much higher due to the need for land acquisition.

7.3.5 Representative Evaporation Pond Alternative

As shown in Table 7-4, the capital cost of Alternative 1 is significantly higher than that of Alternatives 2, 3 and 4 and is likely not feasible due to the size of the land required. The remaining alternatives are relatively comparable in capital cost, but the O&M cost of Alternative 3 is substantially lower because it does not include a brine concentrator. Although Alternatives 2 and 4 recover more water for beneficial use due to the additional recovery through the brine concentrator, the unit cost of Alternative 3 is still lower due to the substantially lower O&M costs. Therefore, Alternative 3, which includes disposal of the full RO brine concentrate stream to evaporation ponds at the LV site, is used as the representative brine disposal alternative in this study. If an RO system at the WWTP can achieve greater than 90% recovery, the size of the evaporation ponds can be reduced, which will result in lower costs for all evaporation pond alternatives.

7.4 TREATED WATER STORAGE & DISTRIBUTION

The treated water is planned to be discharged continuously to Shay Pond and Stanfield Marsh; therefore, treated water storage at the WWTP is not included.

A single effluent pump station is assumed to pump purified water to both Shay Pond and Stanfield Marsh; the variation in elevation of the two discharge points is approximately 15 feet. The pump station capacity will match the capacity of the tertiary treatment system, which is 2.2 mgd, or approximately 1,530 gpm. A new effluent pump station is included in the cost estimate in this study, but if the existing effluent auxiliary pumps could be used as the primary secondary effluent pump station, the existing secondary effluent pump station may be able to be repurposed to avoid the need for a new effluent pump station. If this modification is feasible, the cost of effluent pump station improvements could potentially be reduced, but additional evaluation of the existing pump stations and the WWTP operation would be needed to determine if this is a viable option.

There is an existing 6-inch C-900 PVC pipeline that begins at the intersection of Shay Road and Palomino Drive and terminates near Shay pond that can be used to convey purified water to Shay Pond, with an extension of approximately 710 feet to reach Shay Pond. This pipeline was constructed in 1986 for future use, but has never been put into service.

A new 12-inch pipe will need to be installed from the WWTP to the proposed discharge point in Stanfield Marsh, as shown in Figure 7-3. BBARWA identified an existing pipeline that is believed to extend from near the Marsh to the WWTP, however, BBARWA located a valve on this line and found that the number of turns was consistent with a 6-inch pipeline, which is too small to accommodate the proposed flows. Additionally, the year of construction and condition of the pipeline are unknown.

When water is needed for recharge in Sand Canyon, it is assumed that the Resort's existing snowmaking facilities will be used to transfer water into the existing storage pond located at Bear Mountain Ski Resort and a new pump station would be constructed near the pond to convey water through a new pipeline to discharge into Sand Canyon, as shown in Figure 7-3. The pump station and pipeline are sized to convey 380 AF of recharge water over a 6-month period, which equates to approximately 470 gpm. If a joint use arrangement for the Resort's snowmaking facilities cannot be negotiated, constructing new pumping and conveyance facilities to reach Sand Canyon would substantially increase the project cost.

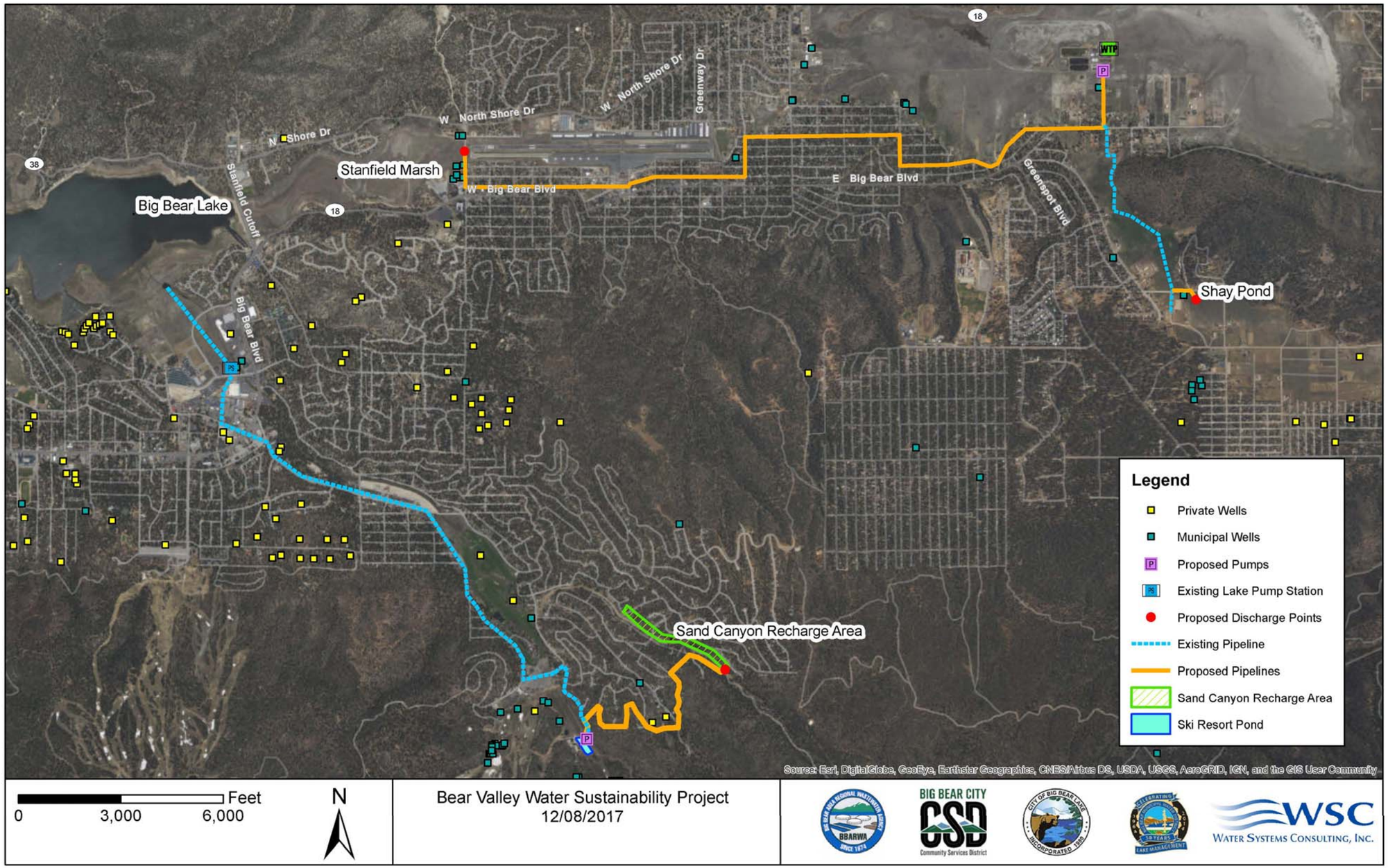


Figure 7-3: Proposed Infrastructure for Bear Valley Lake Alternative

7.5 UNIT COST

The unit cost for the Bear Valley Lake Alternative is shown in Table 7-5. Itemized cost estimates are included in Appendix C.

Table 7-5: Unit Cost for Bear Valley Lake Alternative

Total Capital Cost	Annual O&M	Annual Yield (AF)[1]	30-year Net Present Value (NPV)	Unit Cost ($/AF)[2]
$43,715,000	$2,397,000	1,950	$116,549,000	$1,920

Notes:
1. Based on 10-year average flows. See discussion of yield in Section 7.2, actual yield will vary annually.
2. Unit costs for various alternatives are calculated by dividing the 30-year NPV by the total yield in the 30-year period. See Appendix B for more detail.

7.6 BENEFITS

Implementation of the Lake Alternative provides numerous benefits as described in Section 5, including:

- A consistent high-quality water source to the Marsh to sustain habitat and increase education opportunities for the community and visitors through wildlife observation
- A new source of inflow to the Lake to augment Lake levels, enhance recreational opportunities and aquatic habitat and support water quality improvements. Preliminary models indicate that the implementation of the Lake Alternative will increase Lake levels by nearly 7 feet in 10 years.
- A new and consistent high-quality water source to Shay Pond to sustain habitat for the Unarmored Threespined Stickleback fish, so that the current potable water source can be redirected to serve the community
- A drought proof source of recharge water during dry periods, which will allow blended Lake water to be pumped to Sand Canyon to recharge the groundwater basin to strengthen the sustainability of the groundwater basin during extended droughts
- Flexibility during wet periods to store excess water locally as snow using existing snow making infrastructure. This provides an opportunity to further enhance winter recreation, reduce spills from the Lake, augment spring runoff and increase groundwater recharge. The existing snow making pump and pipeline can also be used to deliver irrigation water to the Bear Mountain Golf Course in the summer, if desired.
- Additional inflow into the Lake may enable BBMWD to modify the current Lake management strategy to minimize spills and flood control releases and optimize releases to ensure that the water can be captured for recharge of the San Bernardino Basin rather than discharged to the ocean.

7.7 ALTERNATIVES COMPARISON

Table 7-6 compares the Lake Alternative to Alternatives 1 through 4 evaluated in the 2016 Study. Capital and O&M Cost estimates from the 2016 Study were escalated to October 2017 and financing assumptions were revised to align with the estimates in this report to provide an even comparison. Note that the unit costs are based on funding 100% the project with loans at a rate of 5% and are expected to be conservative. The project is pursuing multiple grant programs as well as low interest loans which could reduce both the capital payment and interest rate, resulting in a lower unit cost than presented here.

As shown, the Lake Alternative retains more water in the Valley at a lower unit cost than other alternatives, and provides several additional benefits, as discussed in Section 7.6.

Table 7-6. Alternative Comparison

Alternative	Alternative 1 Irrigation (Segment 1.1 Only)	Alternative 2 Greenspot	Alternative 3 Sand Canyon (Low Range)	Alternative 4 Greenspot & Sand Canyon	Lake Alternative
Total Capital Cost	$3,510,000	$47,984,000	$25,057,000	$75,102,000	**$43,715,000**
Annual O&M Cost	$68,000	$1,614,000	$1,232,000	$2,860,000	**$2,397,000**
Recycled Water Yield (AFY)	54	1,000	520	1,750	**1,950**
Unit Cost ($/AF)	$3,950	$3,510	$4,180	$3,310	**$2,110**
Net Present Value	$6,406,000	$105,351,000	$65,226,000	$173,711,000	**$123,309,000**

8 NEXT STEPS

The Lake Alternative is a multi-component project that achieves the Project Team's goal of recovering a lost water supply to increase the sustainability of local water supplies to benefit the entire Valley. As shown in Table 7-6, it is also the most cost-effective alternative that has been identified, in terms of unit cost of water recovered for various beneficial uses.

To move the Lake Alternative into implementation, the following next steps toward several key milestones will need to be pursued in parallel.

8.1 FUNDING APPLICATIONS

Outside funding from various sources will be critical to moving this project forward. Additional outreach to funding agencies and development of a funding and financing strategy is recommended to prioritize funding program pursuits. Potential funding programs that have been identified for the Lake Alternative include:

- $15 million in federal grant funding previously authorized in the Water Resources Development Act of 2007 for water reclamation and distribution by BBARWA. The Project Team is currently pursuing an extension of this authorization, which is set to expire. If the authorization is extended, the project will remain eligible for funding, subject to allocation by the federal government
- California Department of Water Resources Integrated Regional Water Management Implementation Grants, implemented through the Santa Ana Watershed Project Authority
- US Bureau of Reclamation (USBR) WaterSMART Title XVI Water Reclamation and Reuse Program
- United States Department of Agriculture (USDA) Water and Wastewater Disposal Loan and Grant Program
- SWRCB Water Recycling Funding Program Grant and Loan Program
- SWRCB Clean Water State Revolving Fund Loan Program
- US Bureau of Reclamation WaterSMART Water & Energy Efficiency Grant Program (Note: Cannot apply for both USBR Title XVI and WaterSMART programs)
- iBank

8.2 ENVIRONMENTAL IMPACT REPORT

To comply with the California Environmental Quality Act (CEQA), it is anticipated the Project Team will prepare an Initial Study (IS) followed by an Environmental Impact Report (EIR) for the recommended project. In anticipation of applying for federal funding sources, the Project Team may also prepare an Environmental Assessment (EA) and an Environmental Impact Statement (EIS) to comply with the National Environmental Policy Act (NEPA).

Some funding programs require a completed EIR/EIS before a funding application can be considered complete so the schedule.

8.3 PERMIT APPLICATIONS

Ongoing coordination with the permitting agencies will be needed to refine permitting strategies and identify supporting technical studies that will be required. Some specific coordination requirements are expected to include:

- Coordinate with the RWQCB to explore the feasibility of developing a nutrient offset program in exchange for increased nutrient discharge limits for the Marsh/Lake (See Section 6.1.1)
- Continue coordination with DDW to verify the permitting strategy for the Marsh/Lake discharge and the Sand Canyon Recharge Component. Identify technical analysis required to support a determination that the project will not be regulated as Surface Water Discharge (See Section 6.2). Identify technical analysis required to justify recycled water dilution credit from surface water and underflow (See Section 6.3).
- Initiate a long-term study of Stickleback survival in recycled water (See Section 5.2.3)

To obtain an NPDES permit, BBARWA will need to submit a Report of Waste Discharge (ROWD) to the Santa Ana RWQCB, along with an Engineering Report describing the treatment upgrades, effluent characteristics, and proposed uses. The Engineering Report must also be submitted to DDW for review in parallel and DDW will issues findings and conditions for the Sand Canyon recharge component of the project to be incorporated into the discharge permit issued by the RWQCB. The ROWD should be submitted as soon as the Engineering Report is available but no later than six months before the project becomes online, as it typically takes six months for the Regional Board and EPA to review and issue a new permit.

8.4 PRELIMINARY ENGINEERING

A preliminary engineering report is needed to support the development of funding applications, the EIR and the permit applications and can be prepared in parallel with these activities to expedite the implementation schedule. As noted in prior sections of this report, key issues that will need to be evaluated during the preliminary engineering phase include:

- Update WWTP flow projections based on current water use trends to inform appropriate sizing of treatment and disposal facilities (See Section 4.1)
- Update estimates of Lake water level impacts based on anticipated project yield, which may consider the effects of evaporation in the Marsh (See Section 5.1)
- Quantify potential Lake water quality improvements resulting from the implementation of the Lake Alternative (See Section 5.1)
- Refine the estimated recharge potential in Sand Canyon through performance of a pilot infiltration test (See Section 5.3)
- Coordinate with flood control agency to identify technical studies and management practices needed to enable effective joint use of Sand Canyon for flood control and recharge (See Section 5.3)
- Perform a hydrology study to estimate the volume and timing of additional Lake releases under a range of hydrologic conditions so this information can be used in Valley District's model to assess their ability to capture these flows for recharge. (See Section 5.6)

- For Sand Canyon recharge, verify the pathogen control credit that can be achieved by the selected treatment process and identify whether additional underground retention time is needed to achieve the required total credit. (See Section 6.3.3)
- Perform a treatment process alternatives analysis and conduct a pilot study using potential equipment to refine design criteria and validate treatment performance estimates, including nutrient removal capability and RO recovery rates (See Section 7.1)
- Evaluate whether effluent temperature reduction will be required in cooler months (See Section 7.1.1)
- Refine design capacity and RW production estimates based on more detailed flow data, updated future flow projections, and actual MF and RO recovery rates (See Section 7.2)
- Perform a condition assessment and corrosion testing of the exisitng discharge pipeline to Lucerne Valley to determine whether the existing pipeline could accommodate brine conveyance without resulting in significant corrosion. Evaluate whether one of the parallel lines from the concrete balancing main to the LS site could be repurposed for brine conveyance. (See Section 7.3.3)
- Evaluate whether the existing secondary effluent pump station could be repurposed for the new tertiary effluent discharge (See Section 7.4)
- Initiate a water quality sampling program for nutrients, metals, COD, etc. throughout the existing treatment process to support modeling and design of the potential process upgrades needed at the WWTP.

8.5 PUBLIC OUTREACH

A public information program for the Lake Alternative is recommended to engage the community in the development of the project and educate them about the features and benefits. A public information program could take many forms and it is recommended that the Project Team engage in a proactive public outreach program in coordination with other existing or planned outreach programs.

A demonstration project can also be a key feature of a public outreach program because it provides an opportunity to engage and educate the community and improve confidence in the ability of the treatment processes to provide high quality water.

8.6 STAKEHOLDER COORDINATION AND GOVERNANCE

The Project Team should continue the ongoing stakeholder outreach activities they are currently engaged in, including:

- Coordination with each other regarding funding, cost sharing, and ongoing operation and management for the various project components
- Outreach to the Ski Resort to negotiate joint use of their snowmaking facilities for Sand Canyon Recharge and potentially additional snow storage, as well as use of Lake water for irrigation of the Bear Mountain Golf Course
- Collaboration with Valley District to further assess benefits to recharge in the San Bernardino Basin and the potential for a partnership

In addition, an effort should be made to identify potential additional stakeholders that should be engaged early in the project, such as organizations focused on habitat restoration to identify partnership opportunities to further study and enhance the Stickleback habitat

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APPENDIX A. SAND CANYON RECHARGE EVALUATION

Technical Memorandum

To: Ms. Laine Carlson
Water Systems Consulting, Inc.

From: Thomas Harder, P.G., C.HG.
Thomas Harder & Co.

Date: 29-Nov-17

Re: Sand Canyon Recharge Evaluation

This Technical Memorandum (TM) presents an evaluation of groundwater recharge potential within Sand Canyon near the City of Big Bear Lake, California (see Figure 1). The evaluation is being conducted as part of a larger study to assess the feasibility of delivering surface water from Big Bear Lake to Sand Canyon using a combination of existing and new pumps and pipeline infrastructure. The water from Big Bear Lake would include treated water stored in the lake from a Big Bear Area Regional Wastewater Agency (BBARWA) treatment plant. Given the source of water, it will be necessary to consider California Division of Drinking Water (DDW) regulations for indirect potable reuse in evaluating the location of recharge within Sand Canyon.

The specific purpose of this evaluation was to consider the following:

1. Given the surface configuration of the Sand Canyon channel and the hydrogeology of the area, how much water can be recharged in Sand Canyon?
2. Where in Sand Canyon would the recharge facilities need to be located in order to meet DDW regulations for subsurface residence time of recharge water prior to extraction?
3. As there is a diluent requirement for recharge of recycled water in surface basins and given that regulations allow for consideration of subsurface underflow as a diluent source, how much natural underflow can be applied to the diluent requirement in Sand Canyon?

Sources of Data

A number of hydrogeological studies have already been conducted in Sand Canyon. These include:

- Geoscience, 1990. Geohydrologic Characteristics and Artificial Recharge Potential of the Sand Canyon Area. Dated December 1990.
- Geoscience, 2002. Results of Drilling, Construction, Testing and Pump Design for the Sheephorn Well. Dated February 1, 2002.

Analysis Methodology

Geoscience (1990) had previously conducted a travel time analysis for the Sand Canyon area using a numerical groundwater flow model. The downgradient extent of recharge ponds was identified as the point where Teton Road crosses the channel (see Figure 2). Based on this analysis, the travel time to the proposed downgradient extraction wells (proposed to be near TH-5) was more than six months. However, the analysis was based on a range of assumed hydraulic conductivity of 13 ft/day to 40 ft/day. Further, the range of effective porosity was 0.15 to 0.2. These values are relatively high and estimated based on the lithology of sediments encountered during drilling of test boreholes in the area. Subsequent pumping tests from the City of Big Bear Lake Department of Water's (the City's) Sheephorn Well (see Figure 2) indicate that the hydraulic conductivity of the aquifer is less than 1 ft/day. Further, other pumping tests in the area have shown that the effective porosity (which is equivalent to the specific yield in an unconfined aquifer) is on the order of 0.04.

In order to reevaluate the potential travel time and mounding from recharge basins upstream of Teton Road using updated aquifer properties, TH&Co developed a two-dimensional analytical flow model of the Sand Canyon area (see Figure 3 for model area). The analysis was conducted for steady state conditions using the model code WinFlow[1]. All travel time analyses were conducted using the particle tracking feature which allows for the estimation of groundwater travel time between two points from advective groundwater flow. The analysis incorporated the following assumptions:

- The area of the Sand Canyon channel identified for recharge is shown on Figure 3 and is equivalent to approximately 4.2 acres.
- The volume of water applied to the Sand Canyon recharge area was based on an assumed recharge rate of 0.5 ft/day, applied to the recharge basins over a 6-month period. Thus, the total volume of managed recharge for the simulation was 384 acre-ft.

[1] WinFlow Version 3, Environmental Simulations Inc., 2003.

- The analysis was conducted with the Sheephorn Well pumping at a rate of 125 gallons per minute (gpm) for 7 hours per day and the Sand Canyon Well pumping at a rate of 115 gpm for 9 hours per day.
- The initial groundwater levels were conditioned to a groundwater level contour map published by Geoscience (1990)[2] (see Figure 3). This contour map was generated based on data collected during a relatively dry hydrologic period.
- The hydraulic conductivity of the aquifer beneath the basins is assumed to be 1 ft/day.
- The porosity of the aquifer sediments is assumed to be 0.04.
- The sediments in the vadose zone and aquifer are homogeneous.

Findings

Recharge Potential

The primary limit to recharge rates in the Sand Canyon area appears to be available subsurface storage space to accommodate the groundwater mound. The target maximum groundwater level relative to the land surface was 20 ft below ground surface. Previous studies in the Big Bear area have shown that this depth is protective of liquefaction. This groundwater level was achieved at a recharge rate of 2.1 acre-ft/day in the recharge area, with the shallowest groundwater levels occurring beneath the furthest downgradient recharge basins. At a recharge rate of 2.1 acre-ft/day, the maximum predicted recharge for this study was approximately 380 acre-ft/yr, based on a six-month recharge period.

Recharge Water Subsurface Travel Time to the Nearest Downgradient Well

The particle tracking analysis shows that the recharge water will reach the nearest production well (Sheephorn Well) in a little more than approximately 13 months (see Figure 4). Assuming the Sand Canyon recharge project would fall under the definition of a Groundwater Replenishment Reuse Project (GRRP), per DDW regulations, the required subsurface retention time for the recharge water is 2 months. For preliminary recharge siting purposes, a "credit" of 0.25 is applied for travel time calculations using an analytical model, as was done for this analysis. Thus, the credited retention time is interpreted to be 9.75 months (39 x 0.25). This credited retention time is less than the retention time simulated for this analysis (13 months), indicating that the sites simulated are feasible based on the data assumptions in the analysis.

The limiting factors for recharge capacity, as identified by this analysis, were infiltration rate and groundwater mounding in proximity to the land surface. Further data collection will be necessary to determine the total recharge potential of the Sand Canyon area of interest. The most

[2] Geoscience, 1990. Geohydrologic Characteristics and Artificial Recharge Potential of the Sand Canyon Area.

representative infiltration rates can be obtained through a pilot infiltration test. The test would consist of a controlled release of water into a portion of the channel where the water can be dammed up and temporarily ponded. The water level stage in the ponded area can be measured using a staff gage. Once the depth of the ponded area was sufficient (1 to 2 ft deep), the discharge into the channel would be discontinued and the rate of infiltration measured using the staff gage. Optimally, a succession of multiple wetting and drying cycles would be conducted to obtain an average infiltration rate. If possible, the test should also be conducted at multiple locations along the channel, to determine differences in infiltration rate with location.

Native Subsurface Underflow to the Recharge Area

As the aquifer beneath the Sand Canyon area is conceptualized as being unconfined, native subsurface underflow contribution to the portion of the aquifer beneath the recharge area was estimated based on the Dupuit Equation[3], which is expressed as:

$$Q = 0.5K\left(\frac{(h_1 - h_2)^2}{L}\right)$$

Where:

Q	=	Subsurface flow, (acre-ft)
K	=	Hydraulic Conductivity, (ft/day)
h_1	=	Initial Hydraulic head, (ft amsl)
h_2	=	Ending Hydraulic head, (ft amsl)
L	=	Flow Length (ft)

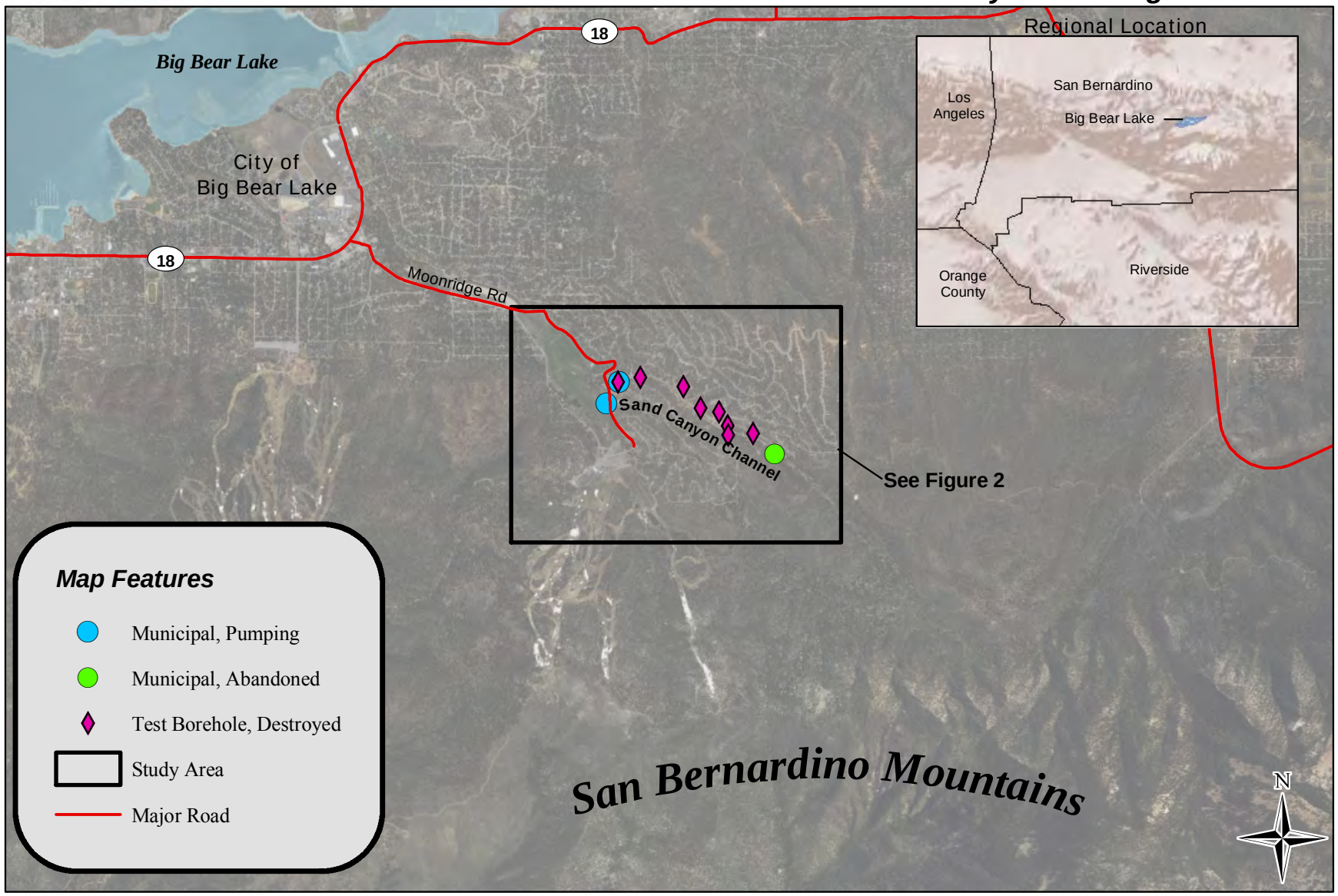
The change in hydraulic head was determined based on the contour map published in Geoscience (1990). The hydraulic conductivity was assumed to be 1 ft/day based on a pumping test conducted in the Sheephorn Well. A summary of the underflow analysis is provided in Table 1. The volume of underflow that may be applied toward the diluent requirement will likely depend on DDW review and interpretation of the data. A range of potential diluent credit was developed such that the low end of the range represents the underflow directly beneath the Sand Canyon channel and the high end of the range represents the entire flow net that ultimately contributes

[3] Fetter, 1994. Applied Hydrogeology, 3rd Edition. MacMillan College Publishing Co.

underflow to the Sand Canyon area, as shown on Figure 1. The range is approximately 58 acre-ft/yr to 247 acre-ft/yr (see Table 1).

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 0.25 0.5 1 Mile

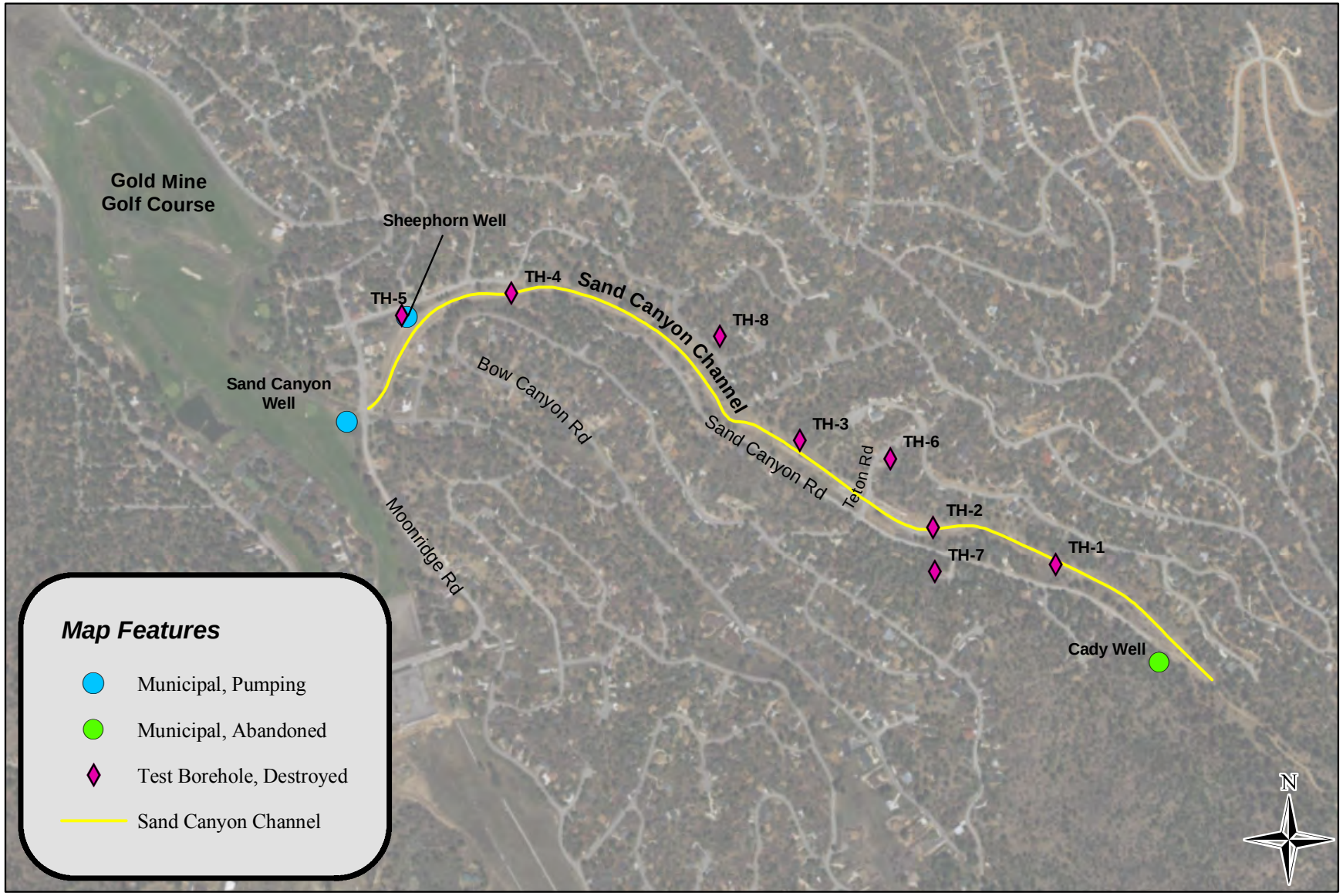
NAD 83 UTM Zone 11

Area Map

Figure 1

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000
Feet

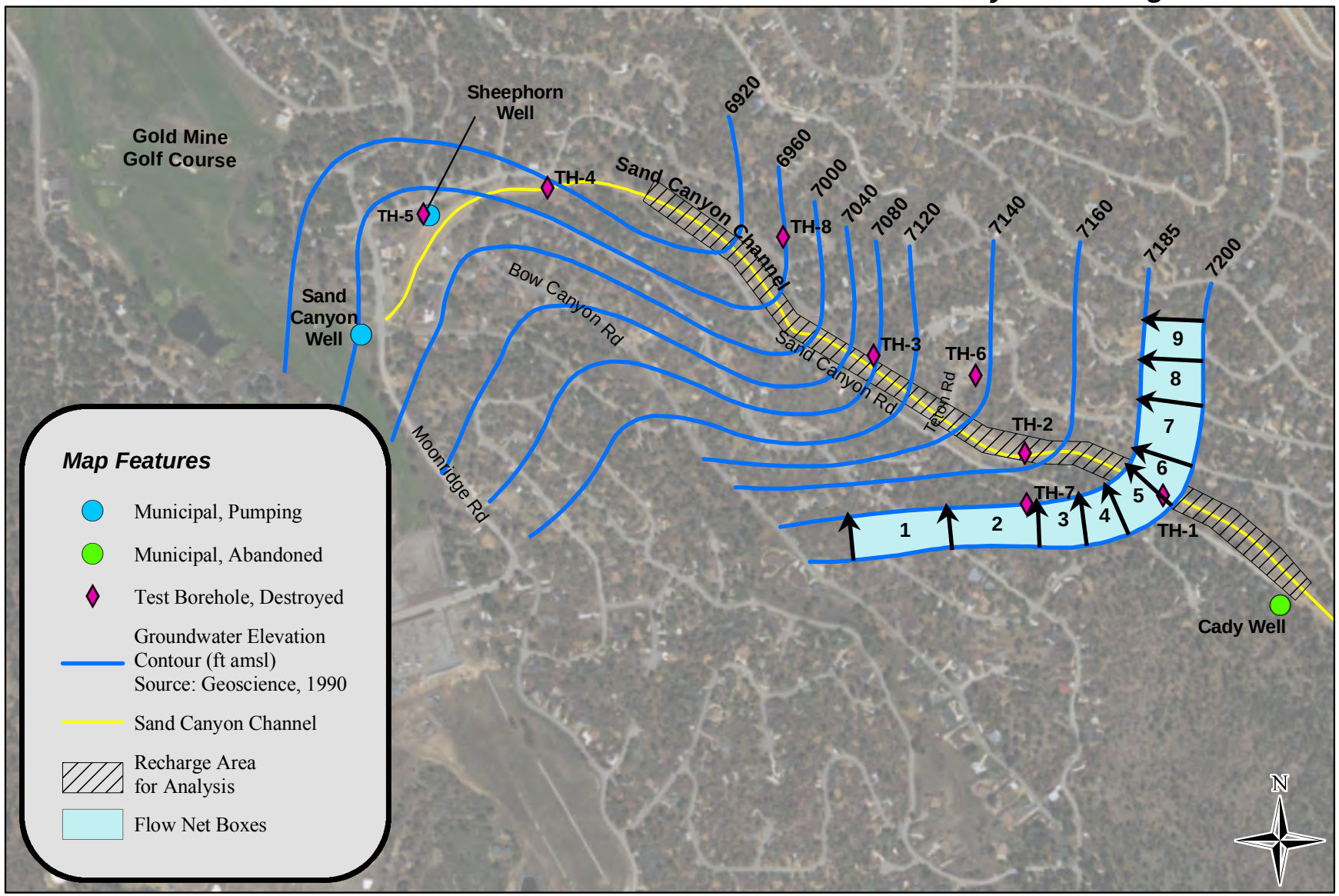
NAD 83 UTM Zone 11

Site Location

Figure 2

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000 Feet

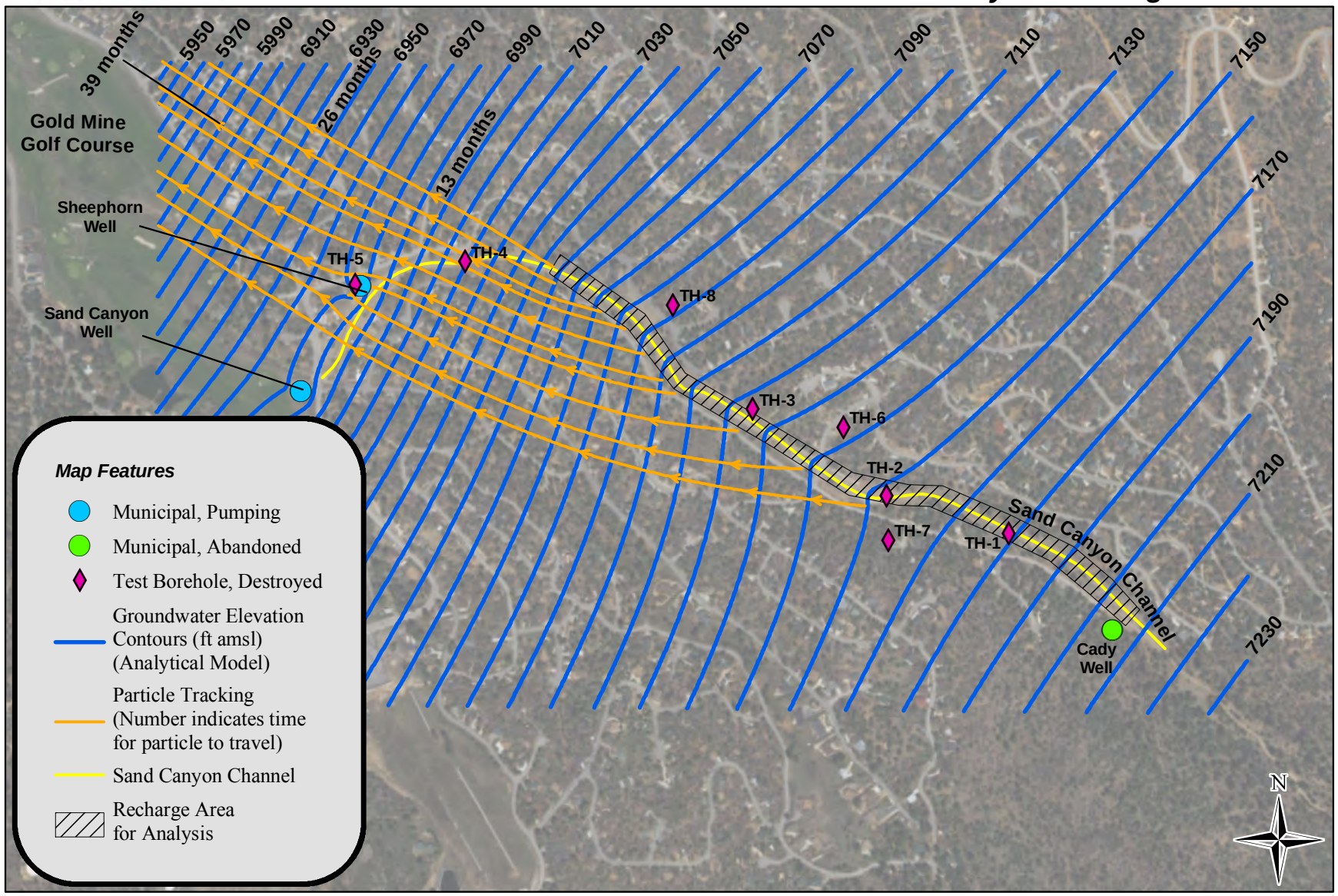
NAD 83 UTM Zone 11

Sand Canyon Underflow Analysis

Figure 3

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000 Feet

NAD 83 UTM Zone 11

Recharge Travel Time Analysis

Figure 4

Sand Canyon Underflow Analysis

Cell Name	Hydraulic Conductivity [K] (ft/day)	Flow Cell Width (ft)	Initial Hydraulic Head [h_1] (ft)	Ending Hydraulic Head [h_2] (ft)	Length of Flow Cell [L] (ft)	Flow Rate [Q] (ft^3/day)	Flow Rate [Q] (acre-ft/yr)
1	1	490	145	130	213	4,745	40
2	1	439	145	130	205	4,417	37
3	1	296	145	130	223	2,738	23
4	1	307	145	130	177	3,577	30
5	1	305	145	130	200	3,145	26
6	1	296	145	130	161	3,792	32
7	1	281	145	130	275	2,108	18
8	1	254	145	130	210	2,495	21
9	1	235	145	130	197	2,460	21
					Total Flow	**29,476**	**247**

Range in potential diluent credit = 58 - 247 acre-ft/yr

Notes:

Initial and ending hydraulic heads relative to assumed aquifer bottom.

Yellow highlighted values represent underflow directly beneath the Sand Canyon channel.

APPENDIX B. FINANCIAL ASSUMPTIONS

Planning Level Cost Estimates

The cost opinions (estimates) included in this Study are prepared in conformance with industry practice and, as planning level cost opinions, will be ranked as a Class 4 Conceptual Opinion of Probable Construction Cost as developed by the Association for the Advancement of Cost Engineering (AACE) Cost Estimate Classification System (19). The AACE classification system is intended to classify the expected accuracy of planning level cost opinions, and is not a reflection on the effort or accuracy of the actual cost opinions prepared for the study. According to AACE, a Class 4 Estimate is intended to provide a planning level conceptual effort with an accuracy that will range from -30% to +50% and includes an appropriate contingency for planning and feasibility studies. The conceptual nature of the design concepts and associated costs presented in this Study are based upon limited design information available at this stage of the projects. These cost estimates have been developed using a combination of data from RS Means CostWorks®, recent bids, vendor supplied data, experience with similar projects, current and foreseeable regulatory requirements and an understanding of the necessary project components. As specific projects progress, the design and associated costs could vary significantly from the project components identified in this Study. Cost opinions are planning level and may not fully account for site-specific conditions that will affect the actual costs, such as soils conditions and utility conflicts.

For projects components where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 3 of 2017, adjusted for San Bernardino, California, is used. Material prices were adjusted in some cases to provide estimates that align closer with actual local bid results. For projects where RS Means CostWorks® data is not available, cost opinions are generally derived from bid prices from similar projects, vendor quotes, material prices, and labor estimates, with adjustments for inflation, size, complexity and location.

Cost opinions are in 2017 dollars (ENR 20 City Average Construction Cost Index of: 10,817 for October 2017).

Markups and Contingencies

For the development of the planning level cost estimates, several markups and contingencies are applied to the estimated construction costs to obtain the total estimated project costs. The markups are intended to account for costs of engineering, design, administration, and legal efforts associated with implementing the project (collectively, Implementation Markup). Contingency accounts for additional construction costs that could not be anticipated at the time of this analysis. A summary of the markups and contingencies applied are presented in the table below.

	Markups and Contingencies
	Construction Subtotal
+	20% of Construction Subtotal for Contingency
+	40% of Construction Subtotal for Implementation
=	**Total Capital Cost**

Unit Cost and Net Present Value

To comply with federal funding program requirements, the net present values (NPV) are calculated for each alternative and treatment option. The NPVs account for capital costs (one-time costs associated with each alternative) and operation and maintenance (O&M) costs (i.e. electrical and maintenance) over a 30-year period. O&M costs are subdivided into Conveyance Pumping Energy costs and Non-Energy costs to enable these costs to be escalated at different rates in the future, recognizing that energy costs are anticipated to rise faster than non-energy costs.

The assumptions used to calculate the costs for each alternative are summarized in the table below.

Assumption	Current Value	Annual Escalation Rate	Description
Loan Terms	100% loan for 30-year loan term with a 5% capital financing rate		Loan term based on CWSRF loan term. Capital financing rate of 5% is expected to be conservative as the project may be eligible for low interest loans.
Discount Rate			A Discount Rate of 3% is used for the NPV
O&M – Conveyance Pumping Energy	$ 0.14/ KW-hr	3.0 %	Energy escalation based on US Energy Information Administration (USEIA) previous 5-year average electricity rate data for California Commercial rates.
O&M – Non Energy	Varies by facility type, based on capacity or capital cost	2.4%	Non-energy escalation based on California CCI previous 5-year average

APPENDIX C. DETAILED COST ESTIMATE

Alternative Information						
Treatment						
Secondary Effluent Available for Treatment	2.20	MGD	2509	AFY		
Recycled Water Produced	1.98	MGD	2220	AFY		
Capital Cost						
	Capacity/Size		Length			
Pipeline to Lake	12	in	19940	LF	$	4,276,000
Pipeline to Stickleback Pond	4	in	710	LF	$	67,000
Pipeline from Snow Making Pond to Sand Canyon	8	in	7210	LF	$	855,000
Recycled Water Storage	0.00	MG			$	-
Effluent Pump Station @ WWTP	1528	gpm			$	988,000
Pump Station @ Snow Making Pond	471	gpm			$	377,000
Enhanced Biological Nutrient Removal	2.20	MGD			$	1,918,000
Nitrification-Denitrification Process	2.20	MGD			$	2,758,000
MF/UF and RO	2.20	MGD			$	9,364,000
UV Disinfection	1.98	MGD			$	1,480,000
Brine Concentrator	0	gpd			$	-
Evaporation Ponds	77	acres			$	4,843,000
Brine Storage	0.66	MG			$	924,000
Brine Pump Station	470	gpm			$	377,000
Brine Pipeline	8	in	10000	LF	$	1,185,000
Monitoring Well for GWR	2	EA			$	215,000
Construction Subtotal					**$**	**29,627,000**
Construction Contingency	20%				$	5,925,000
Implementation Costs	40%				$	11,851,000
Total Capital Cost					**$**	**47,403,000**
O&M Cost Estimates						
	Capacity/Size		Length			
Pipeline			37860	LF	$	102,000
Storage	0.66	MG			$	15,000
Pump Station	2469	gpm				
Maintenance					$	139,000
Power					$	51,000
Enhanced Biological Nutrient Removal	2.20	MGD			$	150,000
Nitrification-Denitrification Process	2.20	MGD			$	211,000
UF/RO/UV	2.20	MGD			$	1,598,000
Evaporation Ponds	77.46	acres			$	38,000
Compliance Activities for Discharge Permits					$	126,000
Total Annual O&M Cost					**$**	**2,430,000**

BIG BEAR LAKE ANALYSIS: REPLENISH BIG BEAR
FINAL REPORT

Michael A. Anderson, Ph.D.
Riverside, CA

January 21, 2021

Acknowledgement of Credit

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EXECUTIVE SUMMARY

Big Bear Lake is an important natural resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland Southern California region. As with all other natural and man-made lakes in Southern California, the lake is subject to dramatic variability in water surface elevation; surface elevations reached as low as -48.5 feet (ft) relative to dam crest (72.33 ft maximum depth) in November 1961, corresponding to a volume of less than 1,000 acre-feet (af) and a lake surface area on the order of 200-300 acres during the extended drought in the late 1950's and early 1960's. Big Bear Municipal Water District (BBMWD) was subsequently formed in 1964 to manage and help stabilize the water level in Big Bear Lake. The region's natural hydrology includes severe protracted droughts and is influenced by the Pacific Decadal Oscillation (PDO) and El Nino-La Nina climate systems, which makes lake level stabilization a tremendous challenge. This wide variability in lake level, in turn, can have significant impacts on beneficial uses of the lake. Monitoring data collected primarily by the Big Bear City Community Services District (BBCCSD), BBMWD, and the Big Bear Lake Nutrient Total Maximum Daily Load (TMDL) group over the past decade underscore both the variability in regional hydrology and lake levels, and the consequences of extended periods of low runoff on water quality conditions. To minimize the impacts of frequent droughts, Replenish Big Bear was developed to recover and use a water resource currently discharged outside of the watershed.

This study assessed the overall conditions, ecological health and water quality in Big Bear Lake, and evaluated the potential influence on lake health of Replenish Big Bear. Three treatment alternative strategies (Treatment Alternatives), composed of advanced nutrient removal and reverse osmosis (RO) technologies, were evaluated:

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO (in addition to TIN & TP Removal)
(iii) Alternative 3: 100% RO (in addition to TIN & TP Removal)

This study included an analysis of available water quality data, development of a 2-D hydrodynamic-water quality model (CE-QUAL-W2), and application of the model to evaluate lake conditions with Replenish Big Bear that focused on the period from 2009-2019. This period was selected based upon a number of factors, including the wide range of hydrologic and water quality conditions in the lake, and availability of extensive lake monitoring and meteorological data, as well as some watershed monitoring data. Model simulations from 2020-2050 were also conducted to assess possible future conditions in Big Bear Lake under different hydrologic scenarios and Replenish Big Bear discharge alternatives. The routing of Replenish Big Bear water through Stanfield Marsh was also explored in greater detail to provide better understanding of the possible role of the marsh in nutrient attenuation.

Analysis of Water Quality Data

To augment the water quality information provided in the TMDL annual reports, additional conventional statistical and advanced machine learning analyses were conducted. Analyses focused on chlorophyll-a as the key response variable. The ratio of total nitrogen (total N) to total phosphorus (total P), often used to identify nutrient limitation, confirm P-limitation principally in place regulating algal production. Correlations developed between total P, total N, total inorganic N (TIN) and chlorophyll-a for each of the 4 TMDL sampling stations (n=150 for each station) indicate relatively weak correlations with nutrient concentrations (e.g., R^2-values of 0.08, 0.19, 0.21 and 0.31 between chlorophyll-a and total P for TMDL stations #1, 2, 6 and 9, respectively). R^2 values quantify the variance in dependent variable (chlorophyll-a) captured with the independent variable (e.g. total P), so it is clear that phytoplankton levels are a more complex function of conditions in the lake. Slightly higher R^2 values were in fact noted with total N (R^2=0.22-0.53), while chlorophyll-a was uncorrelated with TIN. Concentration of chlorophyll-a was also relatively weakly correlated with TDS and lake level; multiple linear regression (MLR) using all these variables yielded R^2-values of 0.31-0.55 depending upon TMDL sampling station.

Since significant portions of variance in observed chlorophyll-a concentrations remained uncaptured using MLR, machine learning was also evaluated. Machine learning, which is starting to be used in water quality applications, is often able to more effectively elucidate trends in complex datasets. Random forest and gradient-boosted regressor algorithms applied to TMDL station #1 data using day of year, lake level, TDS concentration and windspeed were able to capture most (0.92-0.96) of the observed variance in chlorophyll-a for the 10-yr 2009-2018 training set, notably without considering concentrations of total N or total P. For comparison, MLR using this same set of independent variables captured 0.43 of variance in observed chlorophyll-a concentrations. The gradient-boosted regressor model also demonstrated strong forecasting power, capturing 0.73 of variance in predicted chlorophyll-a concentrations of the 2019 data set (compared with 0.36 for the equivalent MLR model). Statistical analyses highlighted that multiple factors regulate chlorophyll-a concentrations in complex ways; machine learning was able to identify relationships and develop regressor models that reproduced and forecasted concentrations of chlorophyll-a with considerable accuracy.

Water column profile data were also used to quantify rates of internal nutrient recycling and areal hypolimnetic oxygen demand (AHOD). Internal nutrient recycling rates have been measured on a limited number of dates since 2002 using the laboratory core-flux method, while AHOD has not previously been measured at the lake. The *in situ* hypolimnetic mass balance approach using measured water column concentrations of ammonium as N (NH_4-N) and orthophosphate as P (PO_4-P) yielded recycling rates for 2010-2011 and 2015-2017 that were similar to previously measured values confirming the importance of nutrient recycling in lake biogeochemistry and nutrient budgets, and establishing the reliability of alum treatments in suppressing PO_4-P release. The analysis also yielded *in situ* estimates of early summer AHOD rates at TMDL station #1 of approximately 0.5 g/m^2/d.

Development of 2-D Hydrodynamic-Water Quality Model

A 2-D (longitudinal-vertical) hydrodynamic -water quality model for Big Bear Lake was developed using CE-QUAL-W2. The model quantifies heat and water budgets, 2-D hydrodynamics, and predicts concentrations of nutrients, dissolved oxygen (DO), chlorophyll-a and other parameters. The 2-D (longitudinal-vertical) representation assumes the primary gradients in water column properties and water quality are in the vertical and longitudinal directions, and well-mixed in the lateral direction; model branches were added for embayments that allow a quasi-3-D representation of the lake. The model requires extensive bathymetric, hydrologic, meteorological, water quality, and other data. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006). Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Big Bear Water Master reports. Hourly meteorological conditions were taken from Big Bear Airport and California Irrigation Management Information System (CIMIS) Station #199 located at the golf course. Data included solar shortwave radiation, air temperature, dewpoint temperature, windspeed, wind direction and cloud cover. Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and DO, and laboratory analyses of water samples collected at the lake for 2009-2019. The model was first developed and calibrated for lake level, water column temperature profiles and TDS, where generally very good agreement was achieved (mean absolute errors of 3.6 cm, 0.79-0.89 °C, and 11.9 mg/L, respectively).

Following this, model calibration to water quality data was conducted. The model included external nutrient loading from the watershed, atmospheric deposition, internal nutrient recycling, and nutrient uptake and release associated with macrophyte and epiphyton growth, senescence and death. Two algal groups were simulated, included one representing cyanobacteria capable of N_2-fixation. The 1st-order dynamic sediment model was combined with the 0th-order SOD model to simulate nutrient recycling and DO uptake in the surficial bottom sediments. Relative root mean square error was 17.7% for total P, 18.0% for total N, 29.5% for TIN, and 24.0 % for chlorophyll-a. Mean absolute errors for DO ranged from 1.02 – 1.40 mg/L for the 4 TMDL sampling stations.

Application of Model to Evaluate Conditions with Replenish Big Bear

The model was then used to predict conditions in Big Bear Lake from 2009-2019 that would reasonably be expected with water from Replenish Big Bear delivered to the lake. Supplementation of natural flows with 1,920 af/yr of Replenish Big Bear water adds about 0.2 meter (m) annually to the lake relative to levels observed in 2009-2019 (baseline), and which accrues over time such that the lake was predicted to be 1.7 m higher in late 2018 compared to the level present at that time. Supplementation also increased predicted lake volumes and surface areas, with lake area about 300 acres (16%) larger in late 2018 compared with actual area (approximately 2,200 acres vs 1,900 acres, respectively). TDS levels in the lake were strongly influenced by level of treatment and TDS concentrations in the Replenish Big Bear water; Alternative 1 water with TIN and total P removal was projected to have a TDS of 450 mg/L, while addition of RO to further treat 70% and 100% of the water (Alternatives 2 and 3) was assumed

to reduce effluent TDS to 150 and 50 mg/L, respectively. Addition of 1,920 af/yr of Alternative 1 water significantly increased TDS levels in the lake, increasing average predicted TDS from 251 mg/L for the baseline (natural) condition for 2009-2019 to 300 mg/L, while Alternatives 2 and 3 were predicted to yield lower average TDS concentrations of 244 and 226 mg/L, respectively. Exceedance of the TDS water quality objective of 175 mg/L was predicted to occur 97.6% of the time for both the baseline condition and for Alternative 2, while exceedance frequency increased to 100% for Alternative 1 and was reduced to 93.3% for Alternative 3.

Nutrient concentrations in the Replenish Big Bear water also varied markedly with treatment, with total N and total P concentrations in Alternative 1 effluent being about 6-9 times higher than median watershed concentrations, while effluent concentrations in Alternative 2 were projected to be 1.8-2.3 times larger and Alternative 3 being about 0.4-0.8 times that of median watershed values. The increased nutrient loading from Alternative 1 had a strongly detrimental effect on water quality, increasing average concentrations over 2009-2019 baseline of total N by about 50%, total P by 70%, and chlorophyll-a by 300%. In comparison, further treatment of effluent with RO yielded average concentrations comparable to (Alternative 2) or slightly improved (Alternative 3) relative to the baseline (natural no-project) condition.

Predicted Long-Term Future Conditions with Replenish Big Bear

Simulations for 2009-2019 were extended to 2050 to evaluate possible long-term conditions in the lake under natural hydrologic variability with and without supplemental water from Replenish Big Bear. Since detailed meteorological and hydrological conditions for the future are not known *a priori*, existing meteorological and flow data for 2009-2019 were used as the basis for forecasts. 2009-2019 included extreme ranges in rainfall, runoff and air temperatures; assuming this range is broadly representative of likely future meteorological and hydrologic conditions, Monte Carlo techniques were used to randomly select 100 different 30 year annual records from this set of data. From these 100 different hydrologic scenarios, the 5th-, 50th- and 95th-percentile 30 year average annual flow records and corresponding meteorological conditions were used as temporal boundary conditions for predictions of future conditions in the lake. The 5th-percentile corresponds to an average inflow rate of 8,646 af/yr and represents extended drought, while the 50th-percentile (median) corresponds to intervals of high runoff and drought (average annual inflow of 10,595 af/yr) comparable to 2009-2019, and the 95th-percentile represents a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr). (Note that since precipitation and runoff are log-normally distributed, the above arithmetic mean values understate the range in runoff within the simulation intervals; that is, a single high runoff year can significantly skew upward average values during a period of protracted drought.)

Supplementation with Replenish Big Bear was also predicted to increase average long-term (2009-2050) conditions in the lake that varied under the 3 hydrologic scenarios. Under the 50th-percentile hydrologic scenario, Replenish Big Bear was predicted to increase average lake level by 1.5 m, lake volume by nearly 13,000 af, and lake area by 260 acres relative to the predicted long-term baseline (no-project) condition. Water quality varied with level of treatment, with Alternative 1 nearly doubling predicted long-term average concentrations of TDS, total P and

total N and quadrupling average predicted chlorophyll-a levels. Long-term simulations indicate slight increases in average TDS, total P and total N and modest increase in chlorophyll-a for Alternative 2, and generally slight reductions or no significant change in concentrations with Alternative 3. Supplementation was predicted to have more substantial effects under the 5th-percentile runoff scenario, with increased average lake level of 3.4 m, increased volume of 16,104 af, and an additional average 638 surface acres (about 40% increase) relative to baseline. As with the median runoff scenario, supplementation with Alternative 1 effluent substantially degraded water quality, while further treatment (Alternatives 2 and 3) was predicted to result in comparable or slightly improved water quality in the lake. Effects of Replenish Big Bear were more muted at the 95th-percentile runoff scenario, when supplementation is less important, owing to the lower overall contributions of water and TDS and nutrients relative to the watershed.

Routing of Supplemental Water Through Stanfield Marsh

Simulations with Replenish Big Bear involved routing of effluent through Stanfield Marsh, where some nutrient uptake could be expected. Simulations indicate net removal of total P through the Marsh with Alternative 1 and Alternative 2 effluent, while simulations predicted that the Marsh would be a modest source of total P to Alternative 3 water with very low influent concentrations. Interestingly, the Marsh was predicted to be a source of total N across all levels of treatment, due to sediment decay, and some N_2-fixation and subsequent decay in response high PO_4-P concentrations and high TN:TP ratios in the effluent. Further work is needed, however, to better understand the role of the Marsh as a net sink and/or source for nutrients.

Summary

Lake conditions and water quality in Big Bear Lake varied significantly over 2009-2019, with wide variations in lake level, volume and surface area, as well as concentrations of TDS, nutrients and chlorophyll-a. Statistical, machine learning and hypolimnetic mass balance analyses provided valuable new information about water quality in Big Bear Lake, while CE-QUAL-W2 was able to reproduce observed trends in lake conditions. Supplementation of natural runoff with Replenish Big Bear water significantly increased lake levels, volumes and surface areas, especially during periods of drought, with resulting recreational, aesthetic, community and related benefits. The level of treatment had dramatic effects on water quality, however. Nutrient removal (Alternative 1) was not sufficient to protect water quality, although nutrient removal with further treatment (Alternatives 2 and 3) was predicted to yield water quality comparable to or slightly improved relative to baseline conditions.

I. INTRODUCTION AND STUDY OBJECTIVES

The Replenish Big Bear Team, a collaborative regional water resources program being implemented by Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD) and the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), engaged Professor Emeritus Michael A. Anderson (Dr. Anderson), who has in-depth knowledge of the Big Bear Lake (Lake), to evaluate the Lake water quality conditions and assess the potential impacts of the Replenish Big Bear project. This study was prepared in response to the Santa Ana Regional Water Quality Control Board (Santa Ana Water Board) staff's need to have a better understanding of the Lake's health to consider approving a discharge above current Basin Plan water quality objectives (WQOs) or the Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions.

This study assesses the overall conditions, ecological health, and water quality in Lake, and evaluates the potential influence on lake health of three treatment alternative strategies (Treatment Alternatives) to supplement the natural water supply to the lake. These Treatment Alternatives are composed of advanced nutrient removal and reverse osmosis (RO) technologies:

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO(70% RO + 30% TIN & TP Removal)
(iii) Alternative 3: 100% RO

A. Project Background

Replenish Big Bear was developed in an effort to help protect Big Bear Valley (Valley) and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. Replenish Big Bear is comprised of three independent projects, which will be implemented separately in the following progression, as practicable:

- Effluent discharge to Stanfield Marsh (and subsequently to the Lake) and Shay Pond;
- Use of Lake water for landscape irrigation of the local golf course; and
- Use of Lake water for groundwater recharge in Sand Canyon.

The first project, and primary regulatory driver, includes treatment upgrades at the BBARWA wastewater treatment plant (WWTP) to produce highly treated effluent for discharge to Shay Pond and Stanfield Marsh, which flows into the lake. This study evaluates the water quality in the lake and assesses impacts of discharge through Stanfield Marsh. For redundancy purposes, BBARWA is also seeking to maintain its current discharge location in Lucerne Valley, where undisinfected secondary effluent is currently conveyed to irrigate crops used for livestock feed. These new discharge points will allow BBARWA to minimize discharge of treated effluent outside of the watershed, which will increase Lake levels to better support beneficial uses including recreation and habitat, particularly in times of drought. Additionally, discharge to Shay Pond will replace potable water currently discharged to maintain the water flow through the pond. Figure

1 shows the project components for this first project, which is referred to as the effluent discharge project.

The other two projects will utilize lake water for (i) landscape irrigation at the local golf course to achieve in lieu recharge of the groundwater basin and (ii) direct groundwater recharge in Sand Canyon. These projects are not planned for any time soon.

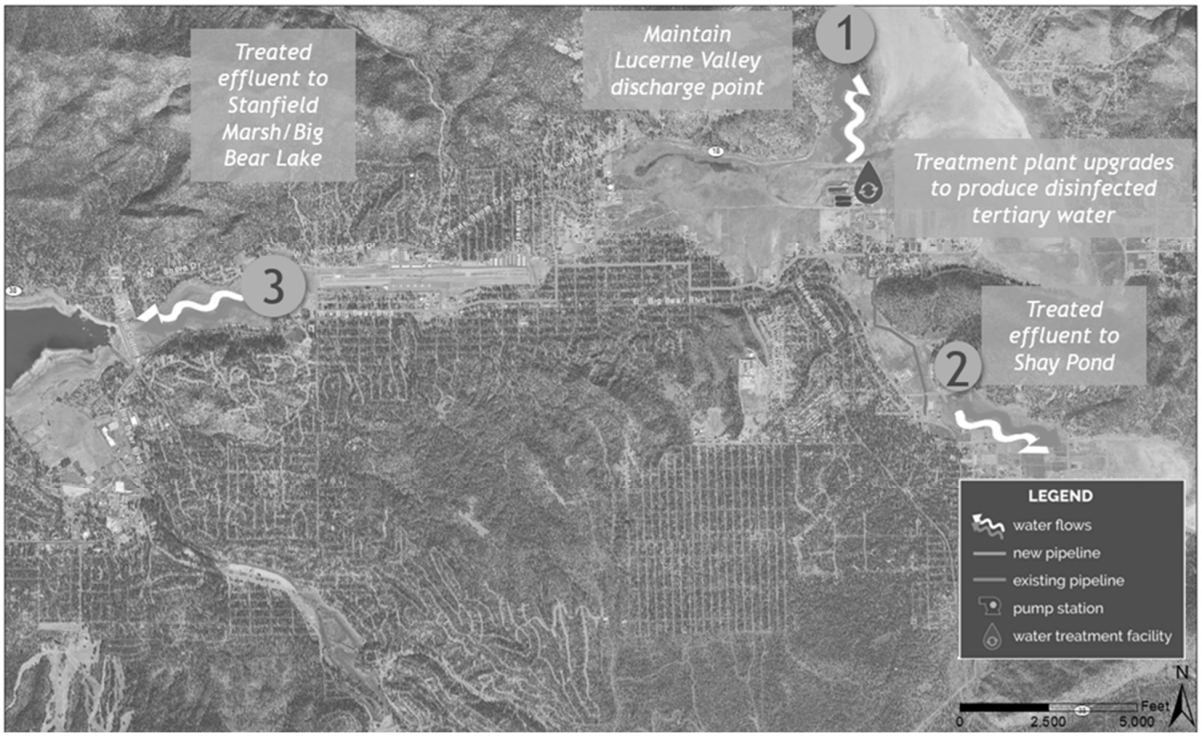

Figure 1. Effluent discharge project components and overview of discharge locations

B. Lake Background

Big Bear Lake is an important resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland southern California region. Together, Stanfield Marsh and the Lake have a surface area of nearly 3,000 acres, a storage capacity of 73,320 af, and an average depth of 32 feet (ft). Stanfield Marsh and the Lake are both waters of the State of California (State) and United States (U.S.), which have several designated beneficial uses. For reference, Table 1 shows the designated beneficial uses of the Lake and Stanfield Marsh per the 1995 Water Quality Control Plan for the Santa Ana Basin Plan (Basin Plan), as amended in 2008, 2011, 2016, and 2019. In addition, the Nutrient TMDL was adopted to address concerns with phosphorus and nitrogen impacts on the lake. Table 2 presents the Lake regulatory limits set to protect the Lake benefits.

Table 1. Beneficial uses of Big Bear Lake and Stanfield Marsh		
Beneficial Uses	**Big Bear Lake**	**Stanfield Marsh**
AGR - Agricultural Supply	✓	
COLD - Cold Freshwater Habitat	✓	✓
GWR - Groundwater Recharge	✓	
MUN - Municipal and Domestic Supply	✓	✓
RARE - Rare, Threatened, or Endangered Species	✓	✓
REC1 - Water Contact Recreation	✓	✓
REC2 - Non-Contact Water Recreation	✓	✓
SPWN - Spawning, Reproduction, and/or Early Development	✓	
WARM - Warm Freshwater Habitat	✓	
WILD - Wildlife Habitat	✓	✓

Table 2. Lake Regulatory Limits for Constituents of Interest		
Constituent	**Basin Plan WQO (mg/L)**	**Nutrient TMDL (mg/L)**
Total Dissolved Solids (TDS)	**175**	
Hardness	125	
Sodium	20	
Chloride	10	
Total Inorganic Nitrogen (TIN) (mg/L-N)	**0.15**	
Sulfate	10	
Total Phosphorus (TP) (mg/L-P)	**0.15**	**0.035**
Total Nitrogen (TN) (mg/L-N)		1
Chlorophyll-a (µg/L)		14
Note: **Bolded** constituents were identified as priority in previous regulatory meetings and are specifically evaluated in this study.		

The Lake is located about 6,743 ft (2,055 m) above mean sea level (MSL) in the San Bernardino Mountains in San Bernardino County. The Lake was formed following construction of the Bear Valley Dam in 1883-1884 to serve as an irrigation supply for the citrus industry in the downstream Redlands-San Bernardino communities. Since that time, the Lake has served as a vital engine for economic growth in the Valley, and the region has developed into a year-round destination with extensive recreational and commercial activities, primary and secondary residences, vacation properties and hospitality, and other services.

As with all other natural and man-made lakes in Southern California, the Lake is subject to dramatic variability in water surface elevation; surface elevations reached as low as -48.5 ft relative to dam crest (72.33 ft maximum depth) in November 1961, corresponding to a volume of less than 1,000 af and a lake surface area on the order of 200-300 acres during the extended drought in the late 1950's and early 1960's. BBMWD was subsequently formed in 1964 to manage and help stabilize the water level in the Lake. The region's natural hydrology includes severe protracted droughts and is influenced by the Pacific Decadal Oscillation (PDO) and El Nino-La Nina climate systems (Kirby, 2010), which makes lake level stabilization a tremendous challenge.

This wide variability in Lake level, in turn, can have dramatic impacts on recreational, economic, and aesthetic values of the Lake, as well as ecological conditions and Lake water quality.

Monitoring data collected over the past decade underscore both the variability in regional hydrology and Lake levels, and the consequences of extended periods of low runoff for water quality conditions in the Lake.

C. Objectives

This study (i) analyzed available historical data on Lake conditions to improve quantitative understanding of water quality in the Lake and the interactions and relationships of key causal and response parameters through statistical and advanced machine learning approaches; (ii) developed and calibrated a 2-D hydrodynamic-water quality model using available historical data to develop an improved process-level understanding of water quality; (iii) assessed conditions in the Lake under natural variable hydrology and climate change through the application of the 2-D hydrodynamic water quality model; and (iv) evaluated, through model simulations, Lake conditions with different treatment alternatives for the proposed Replenish Big Bear project. Phosphorus, nitrogen and total dissolved solids (TDS) are the primary constituents of interest with respect to impacts to the Lake and its beneficial uses.

II. ANALYSIS OF AVAILABLE WATER QUALITY DATA

As illustrated in the Baseline Assessment Tech Memo (WSC, 2020), the Lake is subject to widely varying lake volumes and wide ranges in nutrient, TDS, and chlorophyll-a concentrations. Extension of the analysis provided in the Baseline Assessment Tech Memo (WSC, 2020) was conducted to include additional calculations, regressions, and machine learning to better understand the factors, relationships, and interactions governing water quality. Field and laboratory data for TMDL stations #1 (Dam), #2 (Gilner Point), #6 (Mid-lake) and #9 (Stanfield) over the 2009-2019 time period formed the basis for the analyses. These monitoring stations are shown in Figure 2.

Linear regressions and other statistical analyses are commonly used to identify factors affecting water quality in lakes. Machine learning is now starting to be used for water quality assessments (Chou et al., 2018; Ahmed et al., 2019), including short-term forecasting of algal blooms (Park et al., 2015), owing its ability to often elucidate relationships within complex datasets. Supervised machine learning requires a robust dataset on which to train and validate models. BBMWD has developed and maintained a high quality Lake monitoring program, and has an excellent dataset that was used to train and test different supervised machine learning models. This dataset provides an empirical, data-based approach to identifying and understanding relationships between causal and response variables and predicting water quality in the Lake.

Data were also used where possible to quantify rates of important processes operating within the Lake. For example, increases in total P and total inorganic nitrogen (TIN) concentrations are routinely recorded in late summer/early fall that are thought to be associated with lake mixing (WSC, 2020). Hypolimnetic and/or water column mass balance calculations often allow calculation of internal nutrient recycling rates from bottom sediments (Cooke et al., 2005). Such calculations also provide comparisons with previous laboratory core-flux measurements (Anderson and Dyal, 2003), and allow evaluation of effects of runoff, lake level, and other factors on internal nutrient loading, which is recognized as an important source of nutrients to the Lake (contributing, for example, an estimated 52% of total nitrogen and total P loading under a dry scenario) (Santa Ana Water Board, 2005).

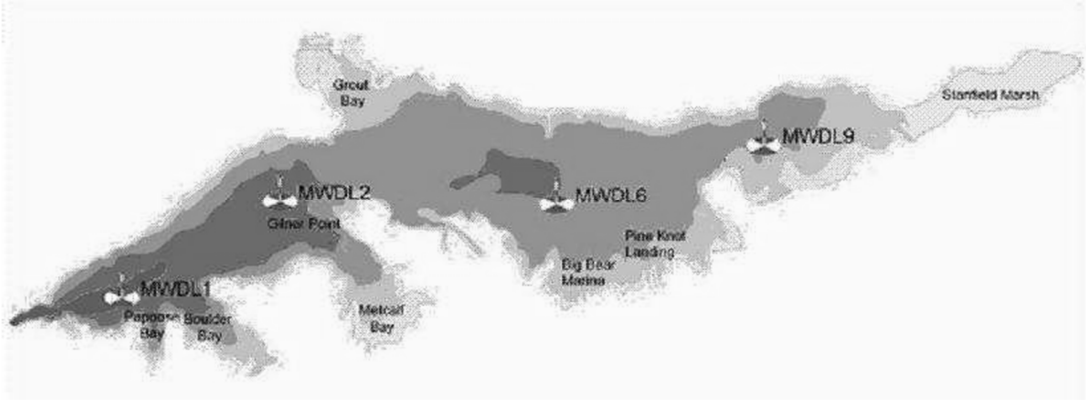

Figure 2. Big Bear Lake TMDL sampling station.

A. Factors Regulating Algal Productivity in Big Bear Lake

1. Statistical Analysis

The TMDL annual water quality reports provide water quality reports, time-series data, and summary statistics, so this section focuses on select statistical analyses of TMDL water quality data. The Lake is generally considered to be P-limited; the ratio of TN to TP concentrations (TN:TP ratio) is reflective of the elemental composition of phytoplankton, with P-limitation generally recognized at TN:TP ratios >20, and N-limitation at TN:TP ratio <5 (Thomann and Mueller, 1998). Photic zone TN and TP concentrations for the 2009-2019 time period were used to calculate TN:TP ratios at the four stations to confirm that P-limitation typically exists in the Lake. Median TN:TP ratios were 27-28 at the Dam, Gilner Point, and Mid-lake stations, but somewhat lower (21.1) at the Stanfield station (Table 3). The TN:TP ratios exhibited considerable variability, so values have been plotted as cumulative distribution functions (Figure 3). Based on these data, the Lake can be considered to be P-limited about 70% of the time and co-limited about 30% of the time. By this measure, N-limitation was present only 1-2% of the time, thus supporting efforts to constrain external loading and internal recycling of P in the Lake.

Table 3. Summary statistics for total nutrients and chlorophyll-a concentrations at the four TMDL sampling stations for 2009-2019 (photic zone).

Parameter	Value	Dam	Gilner Point	Mid-Lake	Stanfield
Total P	Median	0.036	0.040	0.040	0.051
	25-75%	0.024 – 0.050	0.024 – 0.060	0.026 – 0.068	0.033 – 0.088
	Min-Max	0.005 – 0.150	0.005 – 0.210	0.005 – 0.200	0.008 – 0.400
Total N	Median	1.12	1.10	1.16	1.22
	25-75%	0.92 – 1.26	0.93 – 1.27	0.94 – 1.33	0.96 – 1.53
	Min-Max	0.028 – 2.14	0.19 – 3.25	0.17 – 2.43	0.28 – 2.89
Chlorophyll-a	Median	9.4	10.9	11.7	15.1
	25-75%	6.1 – 14.6	6.7 – 16.0	7.5 – 16.5	8.8 – 27.0
	Min-Max	0.9 – 51	0.5 – 205	2.0 – 106	1.8 – 150
TN:TP	Median	28.2	27.3	27.2	21.2
	25-75%	19.1 – 40.4	18.9 – 38.2	17.4 – 39.0	14.8 – 30.8
	Min-Max	7.3 – 162	3.4 – 244	4.0 – 284	3.5 – 147

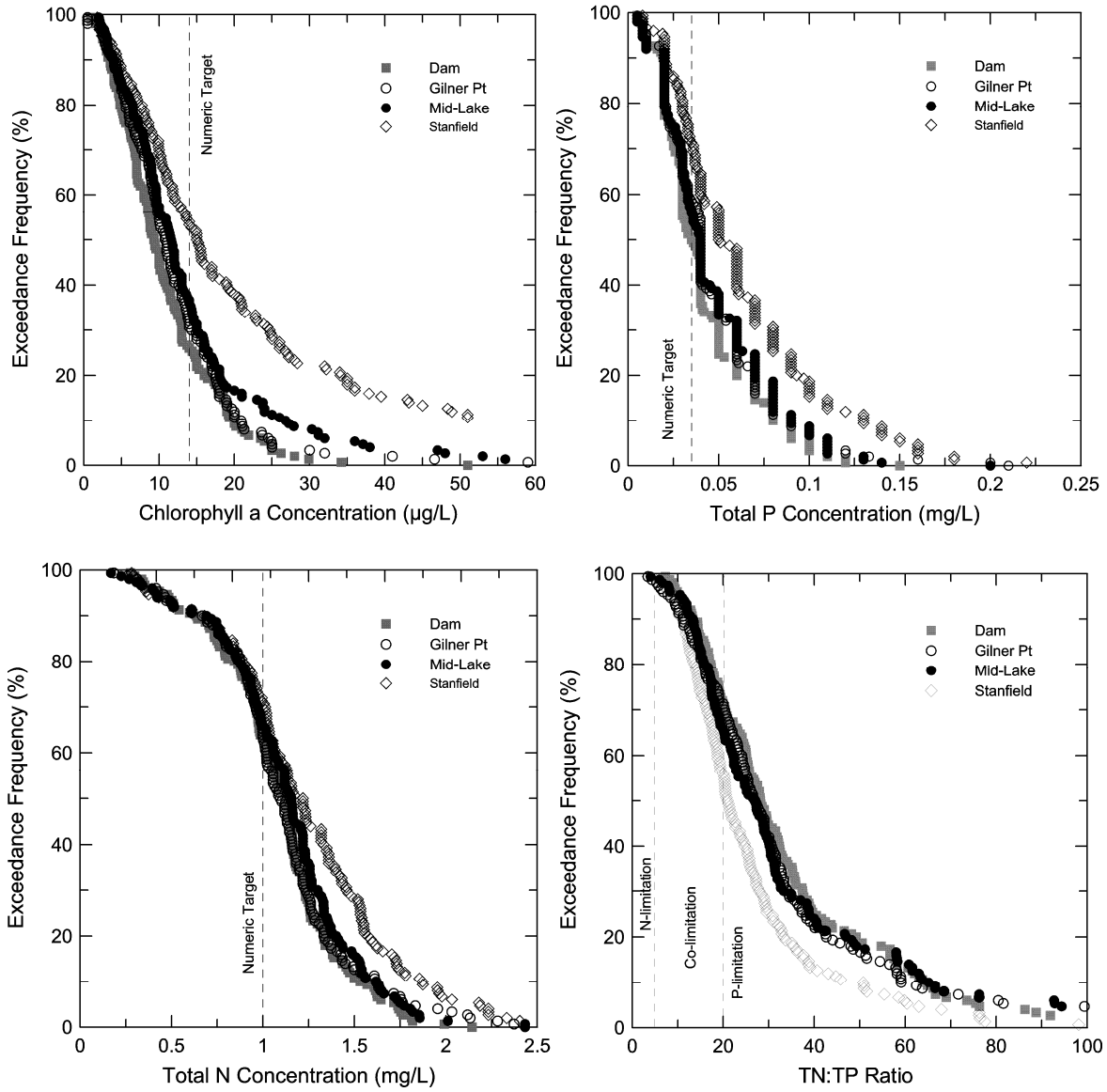

Figure 3. Cumulative distribution functions for a) chlorophyll-a, b) total P, c) total N and d) TN:TP ratios for the 4 TMDL sampling stations.

Correlations between chlorophyll-a concentrations and selected water column properties indicate that no single property captures a substantial amount of the variance in observed chlorophyll-a concentration for all four sampling stations, although the Stanfield station was somewhat more responsive to nutrient concentrations than the other stations (Table 4). Interestingly, TP concentration captured a smaller fraction of observed chlorophyll-a variance than TN (0.08-0.31 vs 0.22-0.53, respectively). Depth below full pool appears to be a useful attribute that integrates across a number of lake conditions and captured, on average, slightly more of the variance (larger R^2) in chlorophyll-a concentrations across all sites (R^2 = 0.22) compared with TP (R^2=0.21) (Table 4). Multiple linear regression using all of these parameters yielded limited improvements in R^2 values compared with single values, indicating that a substantial amount of variance in chlorophyll-a concentration is unaccounted for using basic water quality (and lake level) information (Table 4). Results are very similar when considering only summer months (Jun-Sep) (data not shown). In general, there was no strong correlation between chlorophyll-a and the parameters evaluated.

Table 4. R^2-values for correlations between selected water column properties and chlorophyll-a concentrations (Zrel full represents depth below full pool) (n=150).

Station	**TN**	**TP**	**TIN**	**TDS**	**$Z_{rel\ full}$**	**All**
Dam	0.22	0.08	0.05	0.17	0.29	0.31
Gilner Pt	0.31	0.19	0.00	0.25	0.32	0.43
Mid-Lake	0.34	0.21	0.00	0.19	0.25	0.40
Stanfield	0.53	0.31	0.04	0.18	0.22	0.55

Plots for Gilner Point highlight the variability in chlorophyll-a concentrations as a function of TP, TN, and TDS concentrations and depth below full pool ($Z_{ref\ full}$) across the wide ranging conditions present in the Lake over the 2009-2019 period (Figure 4).

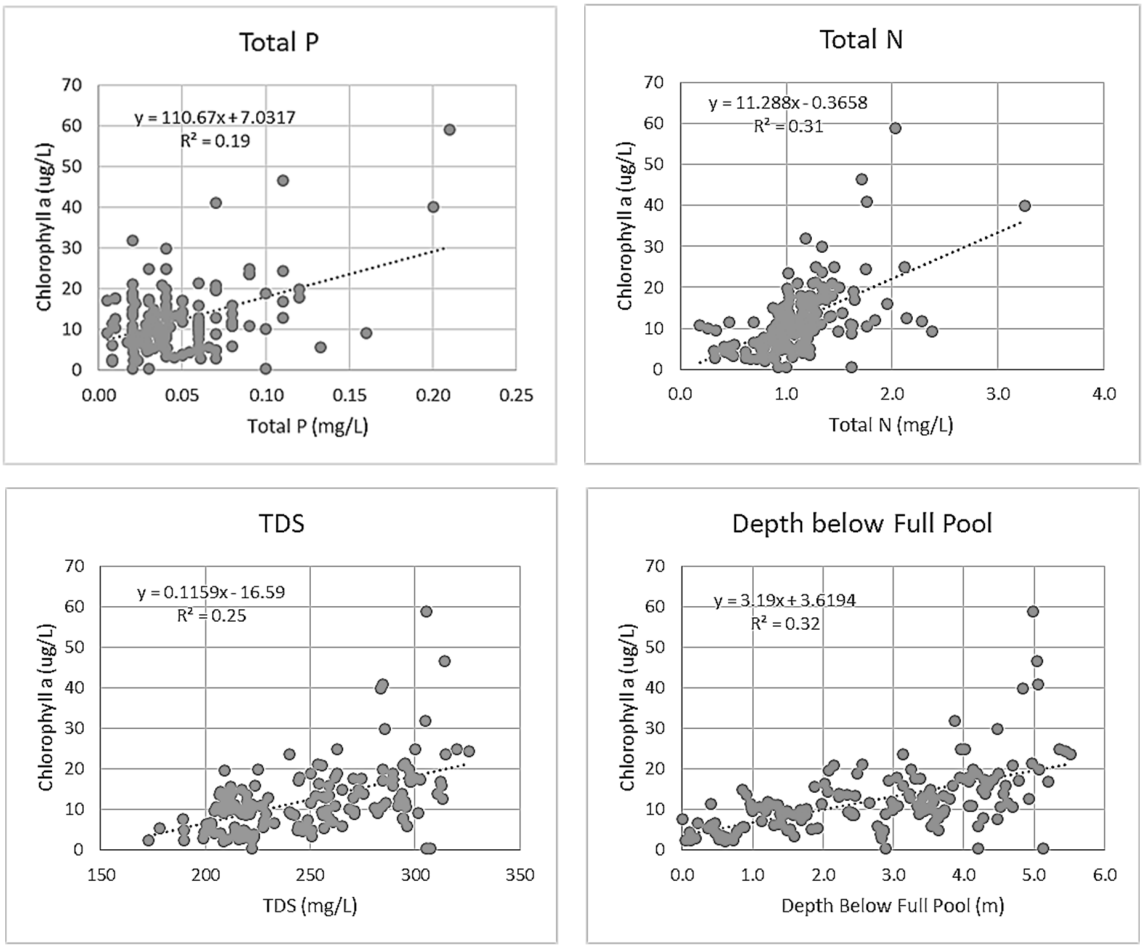

Figure 4. Plots and regression lines between chlorophyll-a and a) total P, b) total N, c) TDS and d) depth below full pool (TMDL station #2, Gilner Point).

2. Machine Learning

Linear regression equations reflected general trends indicating increases in chlorophyll-a in response to increased concentrations of nutrients, TDS, and decreasing lake level, but only captured a relatively small proportion of the variability in measured chlorophyll-a concentrations. Machine learning is often able to more effectively elucidate trends in complex datasets. Random forest and gradient boosted regression trees, k-nearest neighbor, and neural net models were developed using Python 3.7 scikit-learn (e.g., Mueller and Guido, 2017). The machine learning algorithms were trained on the 10-yr record from 2009-2018 (inclusive) and then used to predict water quality for 2019 for comparison with observed conditions.

Chlorophyll-a was the target variable in the machine learning analysis since it represents the key response variable for water quality in the Lake. Independent variables ("features") evaluated included total and dissolved N and P concentrations, water temperature, day of year, lake level

(depth below full pool), TDS concentration, and wind speed (U_w). Model goodness-of-fit was determined based on mean absolute error (MAE) and variance captured. Interestingly, nutrient concentrations and water temperature contained less value in predicting chlorophyll-a concentrations than day of year, lake level, TDS, and average wind speed. The relationships between these features and chlorophyll-a concentration at TMDL Station #1 (dam) in the training data are graphically represented in Figure 5.

The lowest set of panels in the following matrix diagram are scatter plots of chlorophyll-a (Chl) as a function of day of the year (Day), lake level below full pool (Level), TDS, and average windspeed (Uw). Visually one notes that chlorophyll-a exhibits trends of increased concentrations with increasing depth below full pool and increased TDS, although extremely large variability in chlorophyll-a concentrations exists at any given value of lake level or TDS. The final panel on the lower right side of the figure represents a frequency histogram, illustrating that most chlorophyll-a values were around 5-10 µg/L (*i.e.*, below the TMDL target of 14 µg/L), with very few observations at this station >25 µg/L (Figure 5).

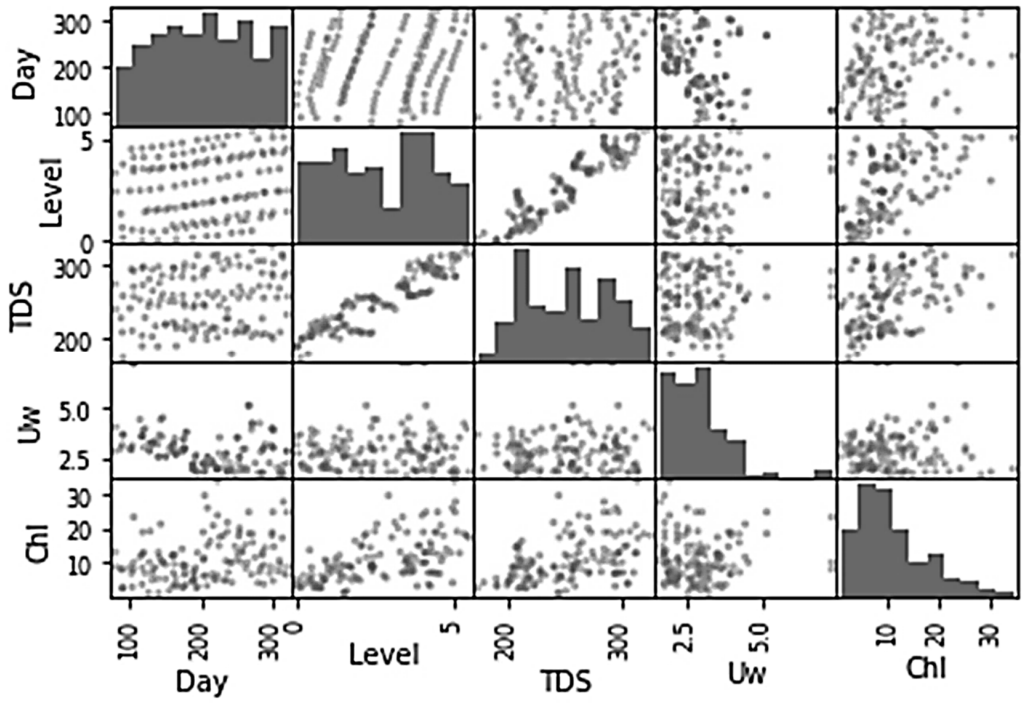

Figure 5. Matrix diagram showing scatter plots between selected parameters at TMDL station #1 (dam).

Application of the random forest regressor (RFR) and gradient-boosted regressor (GBR) using Day-Level-TDS-Windspeed as features yielded models that much more accurately reproduced observed chlorophyll-a concentrations and captured more than 90% of the variance (Figure 6, Table 5). Multiple linear regression using an expanded parameter set yielded a model that was

only better than the multi-layer perceptron (MLP) model, which actually generated excess variance.

Table 5. Mean absolute error between predicted and observed chlorophyll-a concentration and variance captured by machine learning and multiple linear regression models (2009-2018 training set).

Model (TMDL station #1)	**MAE (µg/L)**	**Variance Captured**
K-Nearest Neighbor (KNR)	3.4	0.52
Random Forest Regressor (RFR)	1.4	0.92
Gradient-Boosted Regressor (GBR)	1.0	0.96
Multi-Layer Perceptron (MLP)	14.8	-3.2
Multiple Linear Regression	3.3	0.43

The RFR and GBR models captured >90% of the variance in observed chlorophyll-a concentrations without incorporation of nutrient data (using only Day-Level-TDS-Uw), and mean absolute error (MAE) values were only about 30-40% that of the multiple linear regression model (Table 6).

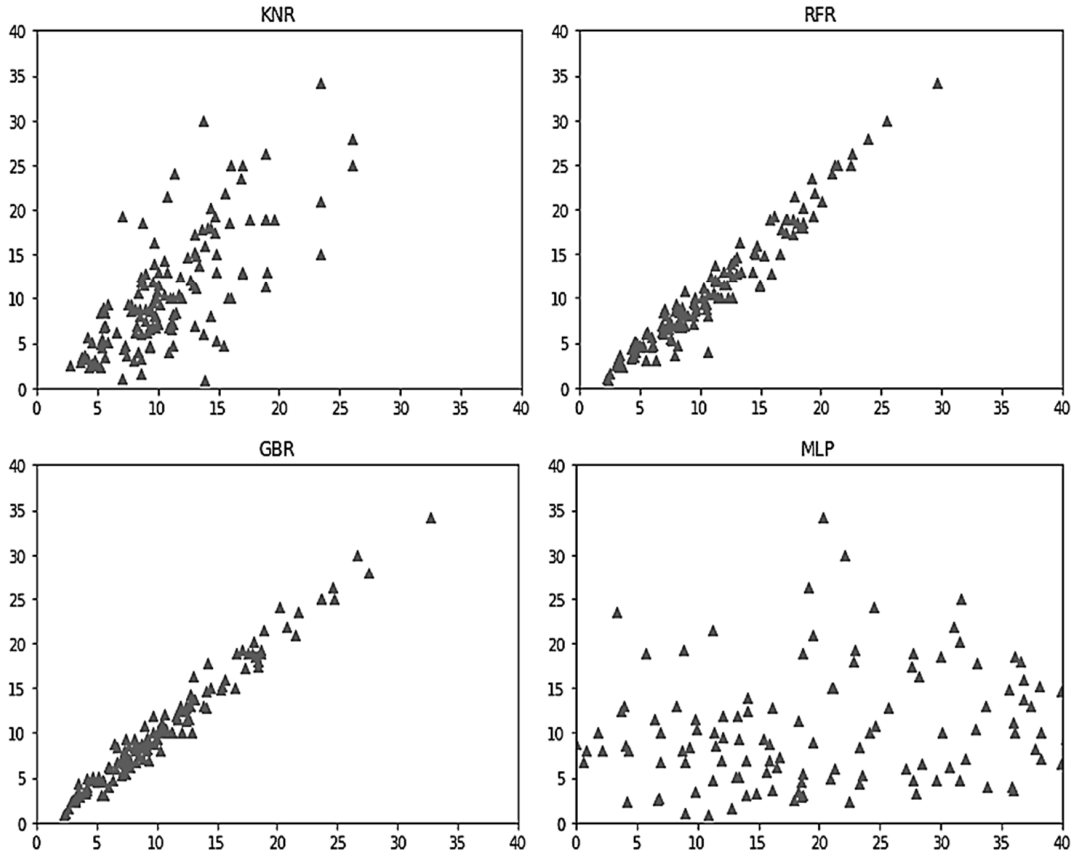

Figure 6. Scatter plots comparing predicted (x-axis) and observed (y-axis) chlorophyll-a concentrations using a) k-nearest neighbor regressor (KNR), b) random forest regressor (RFR), c) gradient-boosted regressor (GBR), and d) multi-layer perceptron (MLP) algorithms.

The RFR and GBR models had significant predictive power for 2019, capturing 58% and 73% of the variance in observed chlorophyll-a (compared with only 36% for the multiple linear regression model), although MAE values were much higher than the 2009-2018 training set. (For reference, a temperature-nutrient model captured <10% of variance in observed chlorophyll-a, underscoring the complex relationships governing algal productivity in the Lake.)

Table 6. Mean absolute error between predicted and observed chlorophyll-a concentrations and variance captured by machine learning and multiple linear regression models (2019 validation set).

Model (TMDL #1)	MAE (µg/L)	Variance Captured
Random Forest Regressor (RFR)	4.5	0.58
Gradient-Boosted Regressor (GBR)	5.9	0.73
Multiple Linear Regression	6.3	0.36

B. Internal Recycling and Hypolimnetic Mass Balance

Internal nutrient recycling is recognized as an important part of the nutrient budget of the Lake (Santa Ana Water Board, 2005). Ortho-phosphate-P (PO_4-P), sometimes also referred to as soluble reactive P (SRP), is released from bottom sediments via reductive dissolution of ferric iron-bound phosphate phases under anoxic conditions and through microbially-mediated dephosphorylation of organic matter. Similarly, NH_4-N is released from bottom sediments by deamination of organic matter. Under stratified conditions, PO_4-P and NH_4-N accumulate in the hypolimnion and their increase in concentrations allows calculation of *in situ* recycling rates.

Station #1 nearest the dam is the deepest of the four main sampling stations and is often observed to exhibit some thermal stratification during the spring through early-mid summer. One consequence of the development of thermal stratification is that nutrients released from sediments accumulate in the bottom waters and their concentrations increase over time, with NH_4-N and PO_4-P reaching, *e.g.,* up to 0.8 mg/L and 0.2 mg/L in the summer of 2010 (Figure 7).

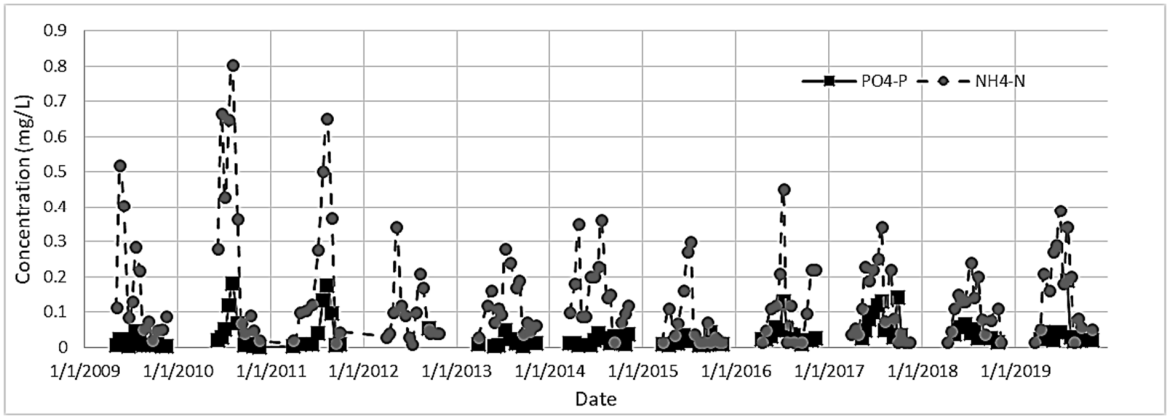

Figure 7. Concentrations of PO4-P and NH4-N in bottom water samples at TMDL station #1 (dam).

The concentrations in bottom waters tracked quite closely the magnitude of stratification, represented by △T (the difference in temperature between the 1 m and bottom depths) (e.g., Figure 8). That is, concentrations tended to increase with increasing △T, while mixing of the water column (△T near 0°C) was associated with sharp reductions in dissolved nutrients due to their mixing throughout the water column.

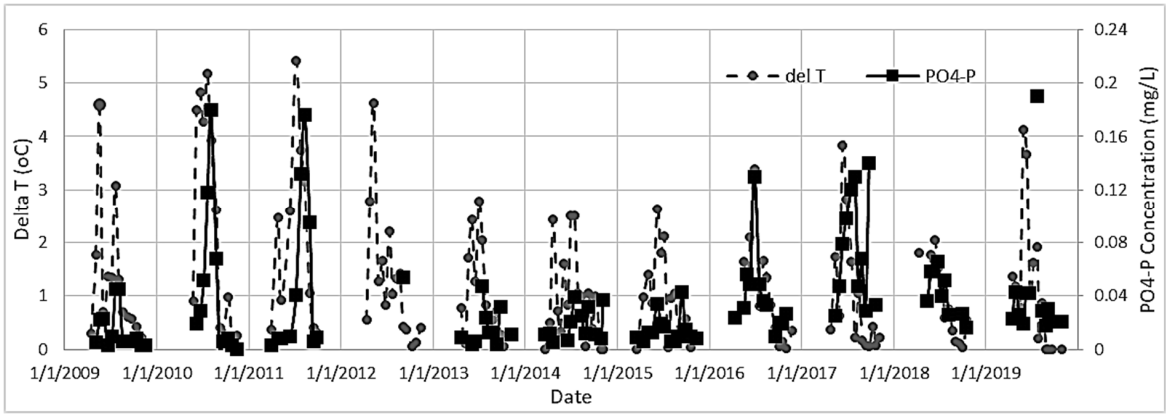

Figure 8. Relationship between bottom water PO_4-P concentrations and temperature difference between 1 m and bottom depths (△T or del T).

Stratification also results in widely-recognized loss of dissolved oxygen (DO), as aerobic bacteria consume DO; with DO unable to be replenished through exchange with the upper well-aerated mixed portion of the water column (epilimnion), oxygen demand quickly depletes DO in the hypolimnion, and is restored when the water column mixes later in the summer (Figure 9).

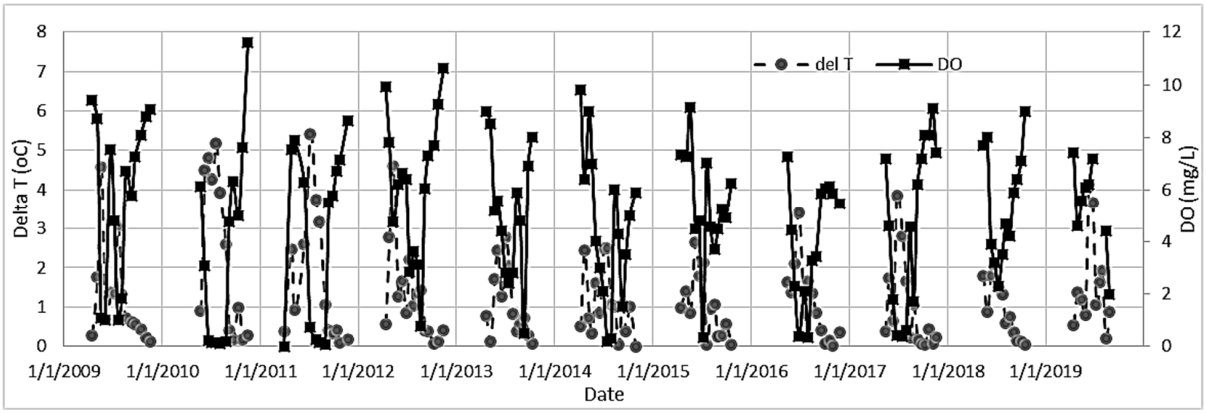

Figure 9. Relationship between bottom water DO concentrations and temperature difference between 1 m and bottom depths (△T or del T).

The increases over time in NH_4-N and PO_4-P and loss of DO (Figures 7-9) during periods of stratification (△T > 0.5 - 1°C) were used to calculate *in situ* internal recycling and areal hypolimnetic oxygen deficit (AHOD) at TMDL station #1 (Table 7). Included in this table are results from laboratory core-flux measurements in 2002-03 and following alum applications in 2004-06 and 2015 in which intact sediment cores were collected from the lake and incubated in the lab at temperature and DO conditions present at the time of sampling. Good agreement was found between 2002-03 laboratory and 2010-11 *in situ* PO_4-P flux values, while lower *in situ* values were found for NH_4-N flux. *In situ* estimates of PO_4-P flux preceding and following the 2015 alum application were in good agreement with pre- and post-laboratory core-flux incubations. AHOD

rates have not previously been measured in the Lake, so *in situ* calculations provide valuable new information about this important process. Moreover, i*n situ* AHOD values are consistent with the trophic state of the lake, and were reduced following the 2015 alum treatment. It should also be noted that similar PO_4-P and NH_4-N flux rates were measured in lab core-flux incubations following 2004 and 2015 alum treatments, indicating general reliability of alum treatments to inhibit PO_4-P release.

Table 7. Internal nutrient loading and areal hypolimnetic oxygen demand (AHOD) rates measured in laboratory and estimated from in situ hypolimnetic mass balance approach.

	Lab			*In Situ*	
Parameter	2002-03	2004-06 (post-alum)	2015 (post-alum)	2010-11	2015-17 (post-alum)
PO_4-P Flux (mg/m^2/d)	13.0 ± 2.8	3.3 ± 2.2	0.7 ± 0.2	15.9 ± 0.1	3.2 ± 1.0
NH_4-N Flux (mg/m^2/d)	92.6 ± 19.7	38.7 ± 2.7	40.3 ± 6.3	50.9 ± 10.4	26.0 ± 13.3
AHOD (g/m^2/d)	NA	NA	NA	0.46 ± 0.04	0.31 ± 0.05

Summary

To augment the water quality summaries provided in the TMDL annual reports, additional statistical and advanced machine learning analyses were conducted. Analyses focused on chlorophyll-a as the key response variable. The ratio of total N to total P), often used to identify nutrient limitation, confirm P-limitation principally in place regulating algal production. Correlations developed between total P, total N, TIN and chlorophyll-a for each of the 4 TMDL sampling stations (n=150 for each station) indicate relatively weak correlations with nutrient concentrations, so it is clear that phytoplankton levels are a more complex function of conditions in the lake. Multiple linear regression (MLR) using TN, TP, TIN, TDS and lake level yielded R^2-values of 0.31-0.55 depending upon TMDL sampling station.

Since significant portions of variance in observed chlorophyll-a concentrations remained uncaptured using MLR, machine learning was also evaluated. Random forest and gradient-boosted regressor algorithms applied to TMDL station #1 data using day of year, lake level, TDS concentration and windspeed were able to capture most (0.92-0.96) of the observed variance in chlorophyll-a for the 2009-2018 training set, notably without considering concentrations of total N or total P. For comparison, MLR using this same set of independent variables captured 0.43 of variance. The gradient-boosted regressor model also demonstrated strong forecasting power, capturing 0.73 of variance in predicted chlorophyll-a concentrations of the 2019 data set (compared with 0.36 for the equivalent MLR model). Machine learning was thus able to identify relationships and develop regressor models that reproduce and forecast concentrations with considerable accuracy.

Water column profile data were also used to quantify rates of internal nutrient recycling and AHOD. Internal nutrient recycling rates have been measured on a limited number of dates since 2002 using the laboratory core-flux method, while AHOD rates have not previously been measured at the lake. The *in situ* hypolimnetic mass balance approach using measured water

column concentrations of ammonium as N (NH_4-N) and orthophosphate as P (PO_4-P) yielded recycling rates for 2010-2011 and 2015-2017 that were similar to previously measured values confirming the importance of nutrient recycling in lake biogeochemistry and nutrient budgets, and establishing the reliability of alum treatments in suppressing PO_4-P release. The analysis also yielded *in situ* estimates of late spring-early summer AHOD rates at TMDL station #1 of approximately 0.5 $g/m^2/d$.

III. DEVELOPMENT OF 2-D HYDRODYNAMIC- WATER QUALITY MODEL FOR BIG BEAR LAKE

Numerical modeling with process-based models is routinely used to simulate historical/baseline and future conditions in lakes and reservoirs. Water quality models represent lake properties and processes through mathematical equations that can vary widely in their complexity, from simple 0-D models such as BATHTUB that involves basic mass balance calculations combined with empirical chlorophyll-a-nutrient responses (Walker, 1987), to highly complex 2-D models such as CE-QUAL-W2 (Wells, 2020) and 3-D hydrodynamic water quality models such as AEM3D (Hodges and Dallimore, 2014; Hipsey, 2014) that solve the Navier-Stokes equation and have highly complex sets of mathematical equations describing ecological interactions and water quality. Nonetheless, even with the most complex models, such models are inherently simplifications of lake ecosystems. The complexity of the model developed and its parameterization is also dependent upon the information available about the lake ecosystem. Big Bear Lake exhibits significant horizontal and vertical gradients in water quality and hydrodynamics, indicating that a 2-D laterally-averaged or 3-D representation of the lake is appropriate. Solution to the Navier-Stokes equation in 3-D is computationally extremely demanding, so 3-D hydrodynamic-water quality models are generally limited to relatively short-term simulation periods, often just months to a few years in duration, making calibration to and simulation of longer time periods often impractical. A 2-D laterally-averaged hydrodynamic-water quality model often provides sufficient resolution to capture longitudinal and vertical gradients in conditions, including local effects of inflows and outflows, while allowing for multi-year calibration of complex biogeochemical processes and simulations of decade-plus time scales.

A 2-D (longitudinal-vertical) hydrodynamic water quality model for Big Bear Lake was developed using CE-QUAL-W2 (Wells, 2018). The model was originally developed at the U.S. Army Corps of Engineers Waterways Experiment Station, extensively refined over time, and has been used for over 450 lakes and reservoirs, nearly 300 rivers, and numerous estuaries and other waterbodies (Wells, 2018). The model quantifies heat and water budgets, 2-D hydrodynamics, and predicts concentrations of nutrients, DO, chlorophyll-a, turbidity, and other parameters. The 2-D (longitudinal-vertical) representation assumes the primary gradients in water column properties and water quality are in the vertical and longitudinal directions, and well-mixed in the lateral direction; model branches can be added for embayments that allow a quasi-3-D representation of the lake. Advantages of CE-QUAL-W2 over the WASP model, which was used in early TMDL work (RWQCB, 2005), include the better spatial representation of the lake, hydrodynamic and water quality models are incorporated into a single model within CE-QUAL-W2, and it allows for multiple algal, macrophyte, and epiphyte species simulating their growth, respiration and mortality, and corresponding influence on nutrient cycling and other processes. CE-QUAL-W2 was recommended to replace the use of WASP in the 2010 TMDL Action Plan (Big Bear Lake TMDL Task Force, 2010).

A. Approach

Development and application of the model requires extensive bathymetric, hydrologic, meteorological, water quality, and other data. The model was developed focusing on the 2009-2019 time period. This period was selected based upon a number of factors, including the wide range of hydrologic and water quality conditions in the lake, and availability of extensive lake monitoring and meteorological data, as well as some watershed monitoring data. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006), including the original dam, which was represented as an internal weir within the model. The model grid included 85 segments with 1 m vertical layers and 5 branches: branch 1, with 58 segments representing the main Lake spanning Stanfield Marsh to the Dam; and branches 2-5 representing Kidd Bay, Boulder Bay, Metcalf Bay and Grout Bay, respectively (Figure 10). Good agreement was in place between model-derived and survey-derived elevation-volume curves, with 0.36% difference in volumes at full pool (Figure 10). The model grid includes Stanfield Marsh, which was not included in original WASP simulation, and allows simulation of supplemental water through the marsh to the main lake.

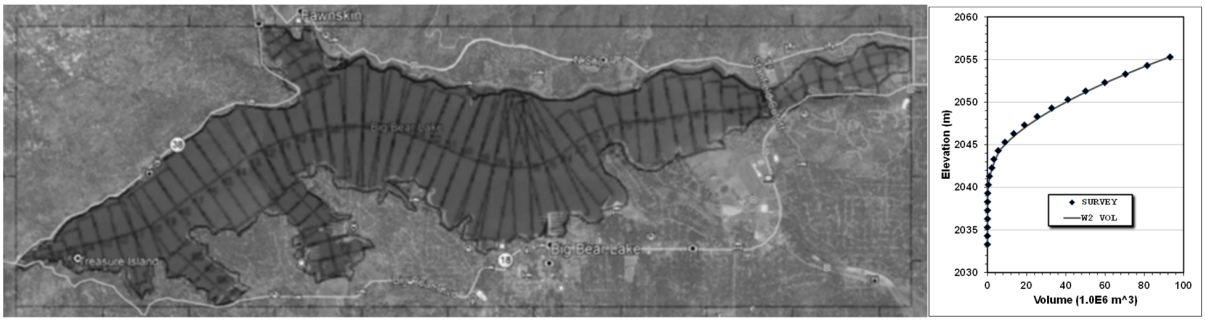

Figure 10. CE-QUAL-W2 model grid developed for Big Bear Lake. Inset depicts agreement between model and measured volume-elevation relationships.

Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Water Master reports. The annual Water Master reports use measured outflows at the dam and water withdrawals by Bear Mountain Ski Resort, evaporative losses estimated using the Blaney Criddle equation, and measured lake surface elevations to derive monthly inflows to the lake. Hourly meteorological conditions were taken from Big Bear Airport and CIMIS Station #199 located at the golf course. Data included solar shortwave radiation (W/m^2), air temperature (°C), dewpoint temperature (°C), windspeed (m/s), wind direction (°) and cloud cover (%). Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and dissolved oxygen (DO), and laboratory analyses of water samples collected at the lake.

1. Initial calibration and simulations of lake level, temperature and TDS

The initial model calibration efforts focused on reproducing observed lake levels (water balance) and water column temperatures (heat budget). Surface heat exchange was calculated term-by-term (shortwave, longwave, evaporative, and convective heat flux) with ice cover algorithm and fetch correction active. Vertical eddy viscosity was determined using the turbulent kinetic energy (TKE) formulation, with the Chezy bottom friction solution. Default heat exchange and hydraulic coefficients were generally used in simulations and are summarized in Appendix A.

Evaporation plays a dominant role in both water budget and heat budget calculations. As noted above, the Watermaster uses the Blaney Criddle equation, which is a very simple relationship that uses monthly average temperature and mean daily fraction of annual daylight hours (based on site latitude), to estimate monthly average reference evapotranspiration rate (ET_0) and evaporation rate. In contrast, CE-QUAL-W2 uses local windspeed and the vapor pressure gradient between water surface (based on water surface temperature) and overlying atmosphere (based on air temperature-relative humidity-dewpoint temperature) to determine evaporative heat and water flux on a sub-hourly basis, similar to approaches described in Chapra (2008) and Martin and McCutcheon (1999). The Blaney Criddle equation has been replaced in most applications by more sophisticated models, such as that described above for evaporation from free water surface, or the Penman-Montieth equation for reference ET_0 for estimated water demand for crops. One consequence of the use of a more accurate approach to calculating evaporation from the Lake is that inflows, which were calculated as residuals of water balance equation based upon monthly evaporation from Blaney Criddle equation, were not consistent with the improved evaporative flux rates in CE-QUAL-W2, resulting in over-estimates of water level (not shown). Thus, consistent with the Water Master approach, inflows were calculated from water balance with known lake levels, volumes and losses (with improved evaporative losses) using the CE-QUAL-W2 water balance utility. Also, as noted, the Blaney Criddle equation calculates monthly average evaporative loss, so the Water Master reports present monthly average inflows. Since weekly water surface elevation data was available, the water balance utility was able to provide finer resolution to the computed inflow data (Figure 11a). Outflow and seasonal withdrawals by the ski resort were used as reported in the Water Master Reports (Figure 11b). The severe storms and runoff generated in early 2011 represented the only substantial outflows from the lake beyond the in-stream flow requirements for Bear Creek downstream of the dam (Figure 11b). For initial water balance and TDS simulations, the distributed tributary approach was used. Allocations for specific creek discharges were used in water quality simulations and are described in more detail below.

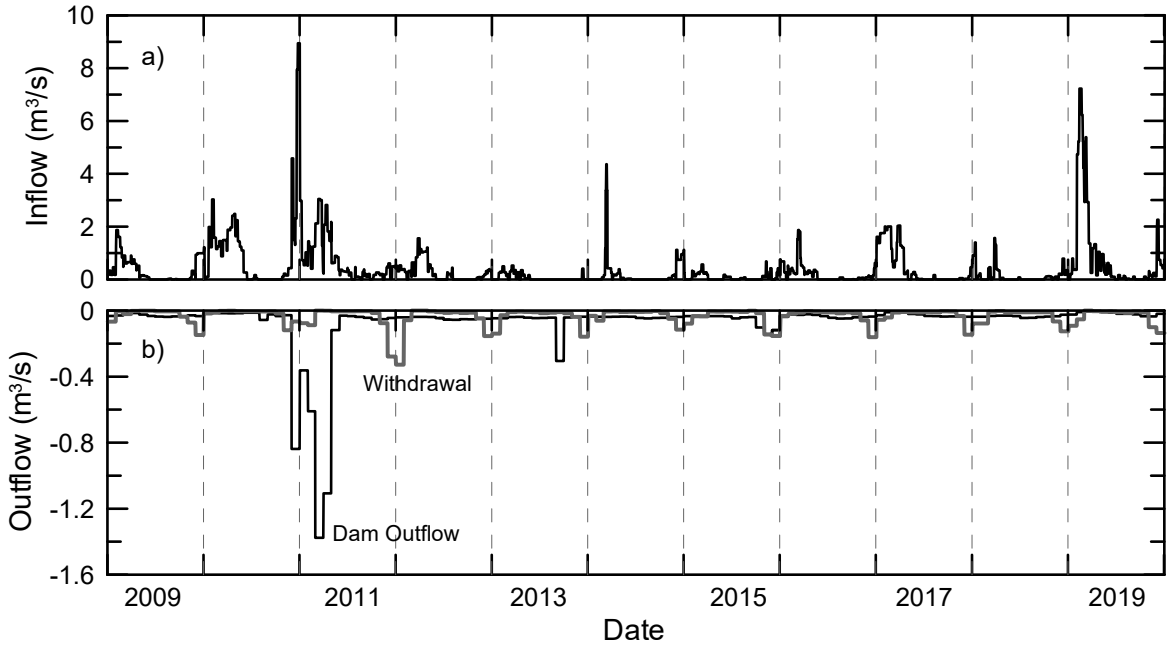

Figure 11. Hydrologic temporal boundary conditions for model calibration (2009-2019): a) total inflow and b) outflows due to withdrawals and dam outflow (from Water Master reports).

The outcome of the water balance calculations was an accurate prediction of lake level over the 2009-2019 calibration period (Figure 12). With the fitting of inflows, mean absolute error (MAE) between predicted and observed lake surface elevation was 3.6 cm.

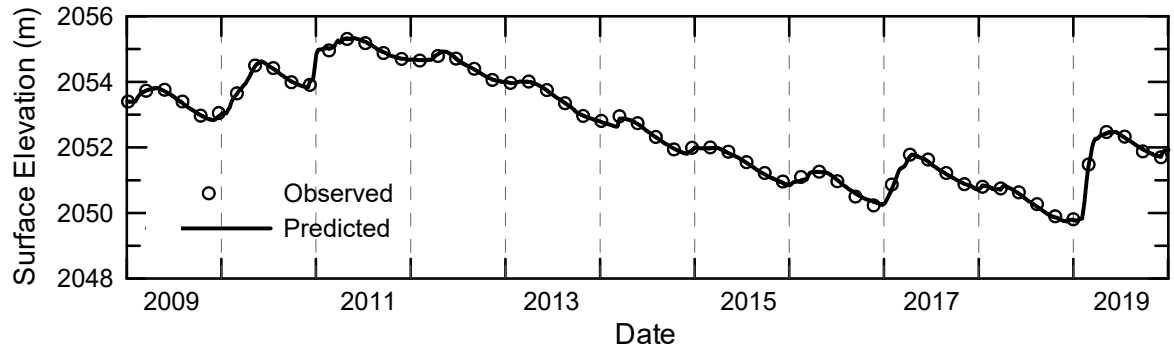

Figure 12. Predicted and observed water surface elevations.

Agreement between predicted and observed water levels is only partial confirmation of the suitability of the model for predicting water balance, since heat flux associated with evaporation is also a key component of the heat budget of lakes (Martin and McCutcheon, 1999). That is, water budgets and heat budgets are explicitly linked through the specific heat of vaporization of water. This is especially important for Big Bear Lake, where evaporation represents the principal mechanism for water loss from the lake (Santa Ana Water Board, 2005). The model quite

accurately reproduced temperature profiles in the lake (Figure 13). (Additional profile calibration figures are provided in Appendix B.)

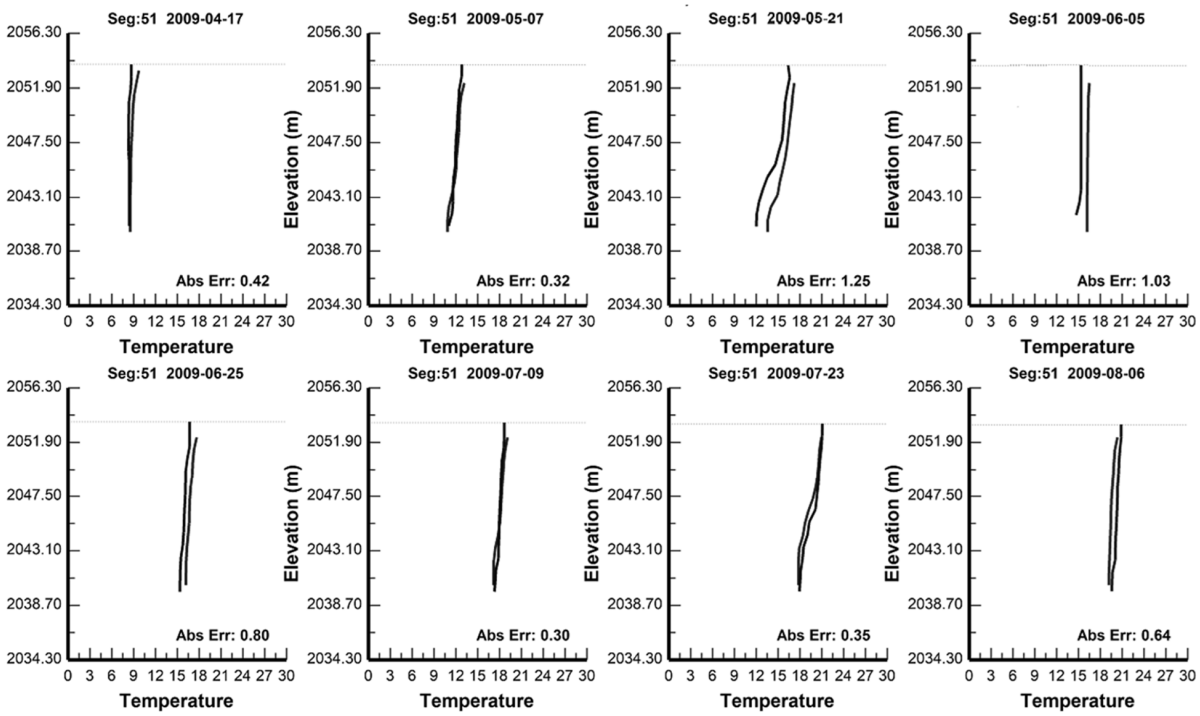

Figure 13. Model predicted and observed water column temperature profiles at station #1 (April 17 – August 6, 2009).

Mean absolute error (MAE) for temperature for profiles collected at the four TMDL sampling stations ranged from 0.95 – 1.14 °C (145 profiles, with 858-1974 discrete temperature measurements depending upon station) (Table 8).

Table 8. Mean absolute error for model predictions of water column temperatures at the four TMDL sampling stations (145 profiles; 858-1974 discrete measurements in each profile).

	#1 (Dam)	#2 (Gilner Pt)	#6 (Mid-lake)	#9 (Stanfield)
MAE (°C)	1.14	0.99	0.95	1.02

TDS concentrations were also simulated in the preliminary phase of model development and calibration. TDS concentration (g/L) was calculated from *in situ* specific conductance (mS/cm) in profile measurements with a proportionality constant of 0.65. Information about TDS (conductivity) of inflowing water was available only for very limited points in time, generally under low-moderate flow conditions. It was thus not feasible to develop comprehensive discharge-TDS relationships from available data. As an alternative, a general form of the discharge-TDS relation (inverse power law) developed from USGS gage #10260500 at Deep Creek was fitted to the Big Bear watershed of the form:

$$TDS\ (mg/L) = 36 * Q\ (m^3/s)^{-0.26} \qquad (1)$$

where Q represents the total flow to the lake derived from water budget calculations described previously. The relationship yielded a MAE of 13.3 mg/L (relative error of 15.4%) when applied to Metcalf and Summit Creek data.

Application of the TDS-flow equation to lake inflows, and simulation with CE-QUAL-W2 captured main features and trends in measured lake TDS (from conductivity) for 2009-19 (Figure 14). The MAE between predicted and observed lake TDS concentrations was 11.9 mg/L (4.8% relative error).

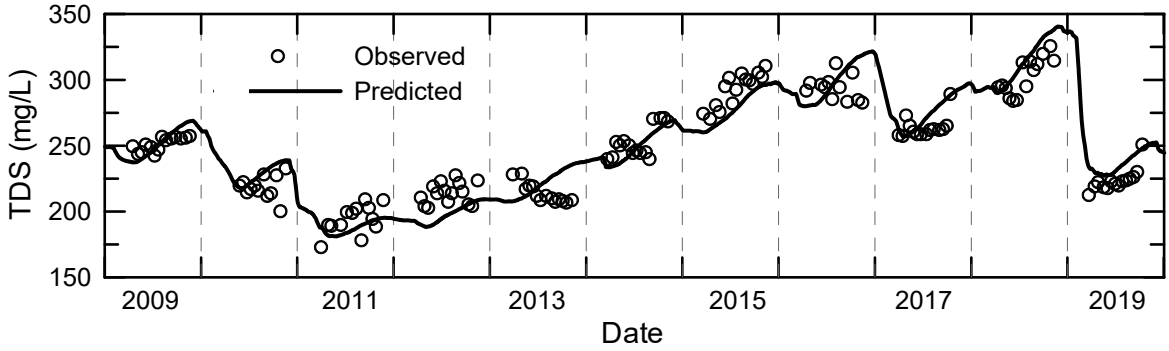

Figure 14. Predicted and observed TDS concentrations.

With the model reasonably representing lake level, water column temperature and TDS concentrations over the wide range of conditions present during 2009-2019, attention was then turned to water quality, focusing on nutrient and chlorophyll-a concentrations.

2. Calibration to Water Quality Data for Big Bear Lake

Lakes are recognized as complex ecosystems influenced by complicated physical, chemical, and biological properties, processes, and inter-relationships. Through the well-designed and high quality lake monitoring program conducted in support of the TMDL at Big Bear Lake, an excellent record of water column conditions and water quality is available with which to calibrate the CE-QUAL-W2 model. Watershed sampling has also been incorporated into the monitoring program, thus providing more extensive empirical information about nutrient and sediment contributions to the lake that were not available in earlier work, which chiefly relied on HSPF simulations of watershed runoff and loading to the lake.

As thoroughly described in the TMDL staff report, loading of nutrients to Big Bear Lake is from (i) external loading from point and nonpoint sources within the watershed, (ii) atmospheric deposition, (ii) internal recycling from bottom sediments, and (iv) macrophyte growth, senescence and death (Santa Ana Water Board, 2005). These processes were integral to the development and application of the CE-QUAL-W2 model for the lake, and are discussed in some detail below.

(i) External loading from the watershed

External loading (EL) (kg/d) from the watershed is the product of inflow rate Q_i (m^3/d) and influent concentrations C_i (kg/m^3) for each source i:

$$EL = \sum_{i=1}^{n} Q_i \, C_i \qquad (2)$$

Runoff rates from specific source areas were derived in previous modeling from HSPF simulations (Figure 15) and linked to WASP model segmentation, which excluded Stanfield Marsh (Figure 16) (Tetra Tech, 2004).

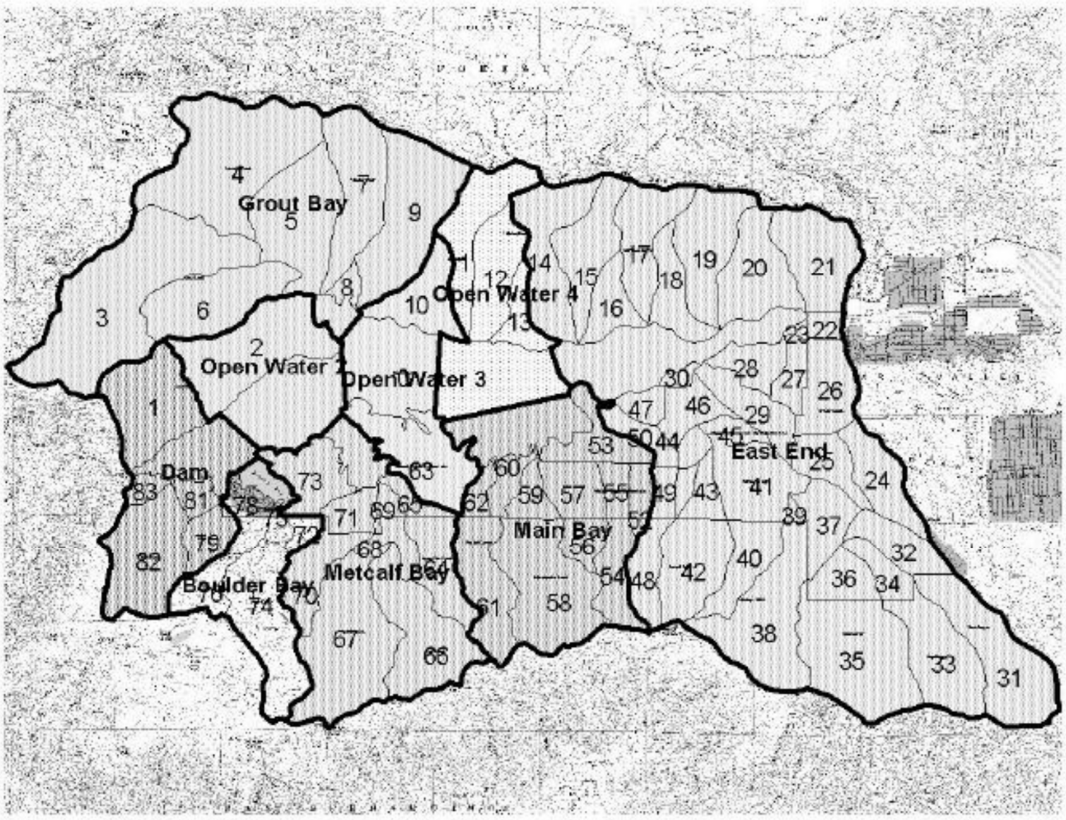

Figure 15. Contributing watershed areas to WASP segments developed from HSPF watershed model (Tetra Tech, 2004).

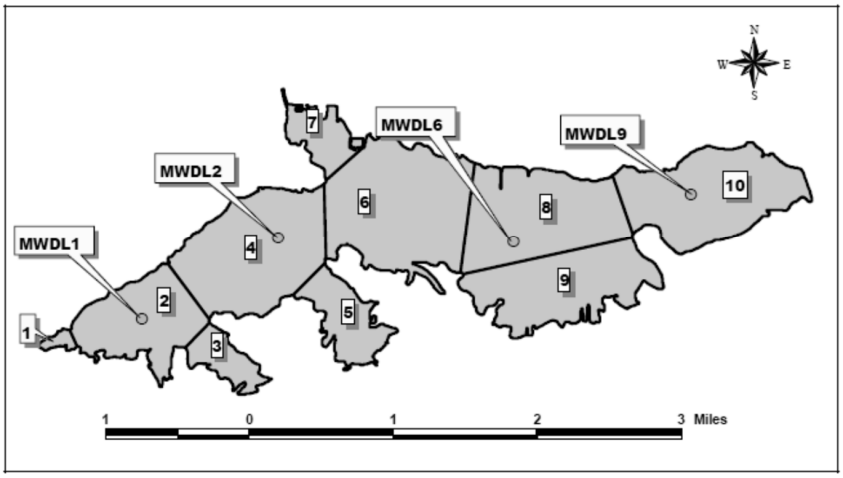

Figure 16. Model segmentation in previous WASP model simulations (Tetra Tech, 2004).

Total inflows, derived from water balance calculations described above, were allocated to regions of the lake following the approach used in the original WASP model. Total inflows (Figure 11a) were allocated to Boulder Bay, Metcalf Bay, Grout Bay and Rathbun Creek (Figure 17), based upon median % flows from prior HSPF simulation results. One difference with the earlier HSPF-WASP model approach is that the WASP model included flows to WASP segment 9 (Figure 16) as a distinct input; the coarse level segmentation in WASP does not map onto the 2-D laterally averaged grid of the CE-QUAL-W2 model, so distributed flow was used to represent both flows to segment 9 and from additional non-point sources (e.g., WASP segments 8 and 4 on the north side of the lake) (Figure 17). Distributed and Rathbun Creek flows in the CE-QUAL-W2 model collectively comprised over 65% of the total inflows to the lake.

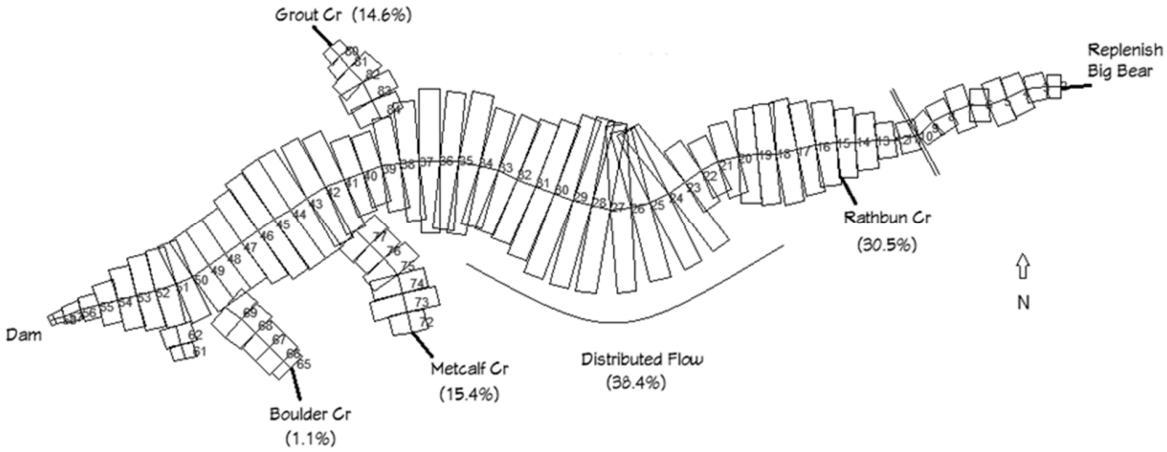

Figure 17. CE-QUAL-W2 model segmentation showing branch, tributary and distributed inflows.

Concentrations of nutrients within these different inflows over time were determined from available watershed monitoring data, rather than HSPF simulations as done in the initial WASP

model (More recent HSPF simulations have apparently been conducted, but results were unavailable.) Median concentrations based upon available data are provided in Table 9, while concentration ranges are presented in Table 10. A very limited set of measurements were identified for Boulder Creek and Grout Creek based on sampling in 2010-2011 (n=7 and 12, respectively). More extensive sampling was conducted for Knickerbocker, Rathbun, and Summit Creeks over 2010-2011 and 2016-2019 (n=53, 28 and 27, respectively). Although complete laboratory analyses on all samples were not always available. For example, laboratory measurements of total Kjeldahl N (TKN), dissolved Kjeldahl N (DKN), total organic carbon (TOC) and dissolved organic carbon (DOC) were only available for samples collected since 2016.

Table 9. Median concentrations (mg/L) of nutrients and organic C in creek water samples.

Creek	**TP**	**o-P**	**TN**	**TKN**	**DKN**	**NH_4-N**	**NO_3-N**	**TOC**	**DOC**
Boulder (n=7)	0.009	0.007	0.184	-	-	0.011	0.022	-	-
Grout (n=12)	0.024	0.015	0.282	-	-	0.008	0.121	-	-
Knickerbocker(n=53)	0.055	0.038	0.374	0.34	0.22	0.130	0.130	2.9	2.7
Rathbun (n=28)	0.055	0.038	0.786	0.46	0.36	0.419	0.419	5.1	4.9
Summit (n=27	0.069	0.021	0.530	0.52	0.25	0.180	0.180	6.0	3.6

Concentrations of total and dissolved forms of N and P varied widely, often by an order of magnitude or more, within the sampling conducted at the creeks (Table 8).

Table 10. Range in concentrations (mg/L) of nutrients and organic C in creek water samples.

Creek	**TP**	**o-PO_4-P**	**TN**	**NH_4-N**	**NO_3-N**
Boulder	0.005 - 0.017	0.005 - 0.009	0.130 - 1.103	0.007 - 0.040	0.002 - 0.042
Grout	0.010 - 0.037	0.010 - 0.026	0.083 - 1.263	0.005 - 0.057	0.011 - 1.054
Knickerbocker	0.020 - 0.320	0.010 - 0.160	0.142 - 1.770	0.005 - 0.290	0.021 - 1.200
Rathbun	0.020 - 0.180	0.010 - 0.100	0.270 - 1.890	0.008 - 0.300	0.005 - 1.190
Summit	0.020 - 0.378	0.003 - 0.155	0.023 - 1.300	0.007 - 0.220	0.003 - 0.602

Table 10 (contd). TOC and DOC values not reported for Boulder or Grout Creek.

Creek	**TKN**	**DKN**	**TOC**	**DOC**
Knickerbocker	0.12 - 1.20	0.012 - 0.67	1.3 - 12.0	1.4 - 8.8
Rathbun	0.077 - 1.40	0.21 - 0.77	2.9 - 7.7	2.6 - 7.1
Summit	0.10 - 0.95	0.00 - 0.78	2.8 - 7.5	2.2 - 7.0

Water quality in runoff can vary strongly depending upon characteristics of the basin, including land use, land cover, amount of impervious surfaces and other factors, and are reflected in the higher concentrations of nutrients in Knickerbocker, Rathbun, and Summit Creeks compared with Boulder and Grout Creeks (Tables 9, 10). The nature and intensity of storms (rain, snow, rain-on-snow), meteorological, and antecedent watershed conditions influence discharge and also influence water quality, contributing to the wide range in concentrations observed at the creeks (Table 10). Since a very limited number of point estimates of flow were available, it was not feasible to develop reach-specific discharge-water quality relationships, but total flows to the lake were known from water balance considerations. Measured nutrient concentration were statistically evaluated for possible correlations with total flow rates (Table 11). Sample sizes varied by creek, with only 7 and 12 samples collected from Boulder Creek and Grout Creek, respectively, while Knickerbocker, Rathbun, and Summit Creeks were sampled 53, 28 and 27

times, respectively. Weak correlations with total flow were observed for most variables, although total flow accounted for a meaningful fraction of the total variance in NO_3-N concentrations (up to R-value of 0.62, or R^2 of 0.38, representing 38% of observed variance in NO_3-N concentration for Rathbun Creek). Nonetheless, regressions even for NO_3-N had modest predictive power (Table 11, Figure 18). Assumptions about inflows and influent concentrations were necessitated by the limited amount of data and thus represent a significant source of uncertainty in model predictions.

Table 11. Correlation coefficients between flow and constituent concentrations.

Creek	**TP**	**o-P**	**TN**	**TKN**	**DKN**	**NH_4-N**	**NO_3-N**	**TOC**	**DOC**
Boulder	0.41	0.31	-0.13	-	-	0.29	-	-	-
Grout	0.52	0.61	0.52	-	-	0.42	0.48	-	-
Knickerbocker	0.00	0.06	-0.03	0.01	0.00	-0.14	0.19	0.13	0.34
Rathbun	-0.21	-0.20	0.28	0.04	0.38	-0.12	0.62	0.43	0.53
Summit	-0.05	0.04	0.08	0.21	0.66	-0.02	0.52	0.18	0.38

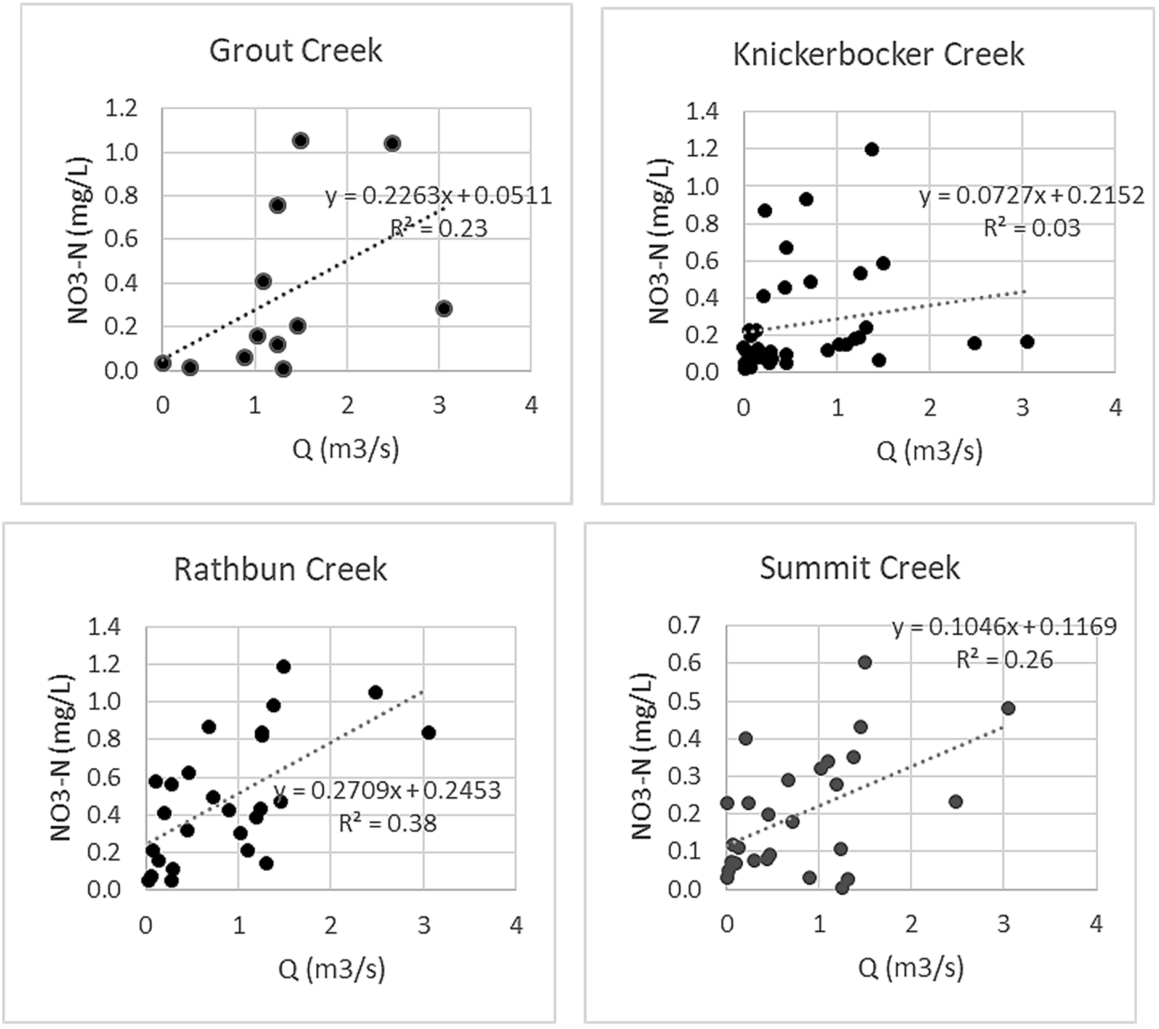

Figure 18. Plots and regression lines between NO3-N concentrations and total (lakewide) flow for a) Grout Creek, b) Knickerbocker Creek, c) Rathbun Creek, and d) Summit Creek.

Measured nitrogen and phosphorus concentrations were used when available and assumed to represent influent concentrations for the entire month in which the measurements were made; for time periods when measured values were not available, median values were used, except as follows: NO_3-N (all creeks except Boulder) and PO_4-P (Grout and Knickerbocker only), when concentrations were estimated from regressions with total flow for that date. The incorporation of measured, median, and regression-based influent concentrations into model input time-series is illustrated for Rathbun Creek (Figure 19).

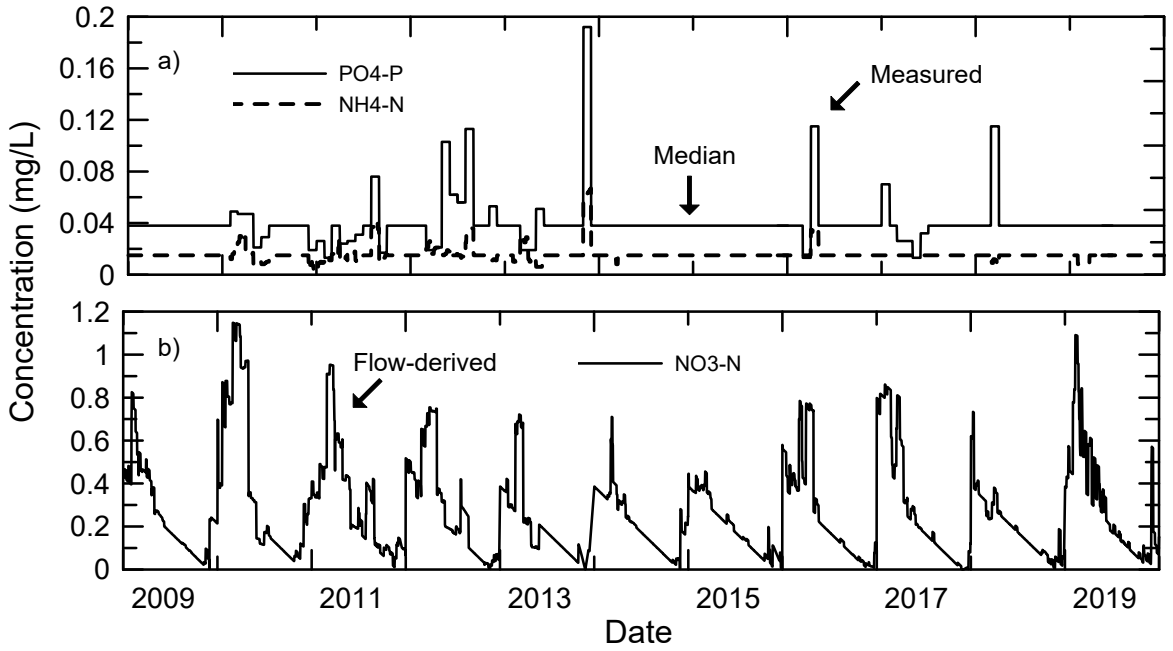

Figure 19. Modeled input nutrient concentrations in Rathbun Creek: a) PO4-P and NH4-N illustrating use of measured values when available and median values when not, and b) NO3-N concentrations derived from regression with total flow rate.

Particulate forms of N, P, and C were calculated by difference between total and dissolved forms. Following White et al. (2010) and Wetzel (1984), organic matter was further partitioned into labile and refractory forms (approximately 25 and 75%, respectively).

(ii) Atmospheric deposition

In addition to external loading from the watershed, atmospheric deposition is also an important source of N and P to Big Bear Lake. Based upon available studies by Mark Fenn and others in the San Bernardino Mountains, direct deposition of N onto the lake (assumed for modeling purposes to be equimolar NH_4 and NO_3) was estimated to be approximately 10 kg/ha/yr, while direct deposition of total P was assumed to be $1/20^{th}$ that of N, or 0.5 kg/ha/yr (Santa Ana Water Board, 2005). The CE-QUAL-W2 model does not simulate transformations and release of P bound to inorganic particles, so it was assumed that 40% of the total P (chiefly as fine inorganic dust particles) was in a bioavailable form and deposited as PO_4-P.

(iii) Internal recycling from bottom sediments

Release from bottom sediments through mineralization of organic matter and reductive dissolution of ferric oxyhydroxides was simulated in CE-QUAL-W2 using the dynamic 1st-order sediment decay model combined with the 0-order SOD model. The 1st-order sediment model uses a sediment compartment to accumulate organic sediments as a result of settling of algae and particulate organic matter, and allow their decay, releasing NH_4-N and PO_4-P back to the water column (Figure 20).

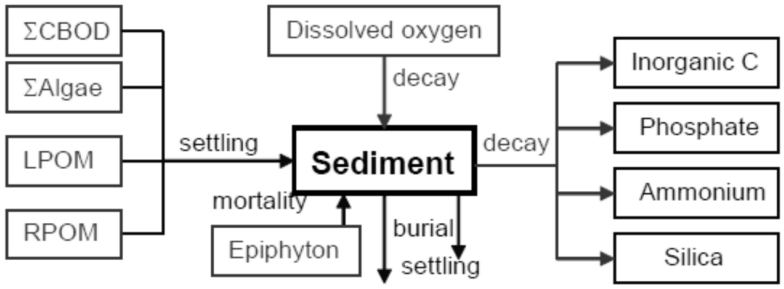

Figure 20. Schematic of 1st-order sediment subroutine in CE-QUAL-W2.

As a 1st-order process, the greater the amount of organic matter settling to the sediment compartment results in greater amounts of organic matter decayed, and N and P mineralized and released back to water column (i.e., recycled). Simulation values are provided in Table 12.

Table 12. 1st-order sediment model parameter values used in simulations. Default W2 values from Wells (2019).

Parameter	Default	Value	Description
SEDCI	0	4.4	Initial reactive sediment concentration (g/m^3)
SEDS	0.1	0.08	Sediment settling rate (m/d)
SEDK	0.1	0.1	Sediment decay rate (d^{-1})
FSOD	1	0.23	Fraction of 0-order SOD rate used
FSED	1	1	Fraction of 1st-order sediment concentration used
SEDBR	0.01	0.01	Sediment burial rate (d^{-1})

The 1st-order model simulates aerobic decomposition reactions, so sediment oxygen demand is also dynamically calculated based upon amount and type of organic matter and temperature, and depletion of DO in turn reduces rates of organic matter mineralization and deamination-dephosphorylation reactions. The 1st-order sediment model thus doesn't simulate nutrient release under anaerobic conditions, although, anaerobic decomposition and reductive dissolution reactions can be important processes within nutrient cycling. As a result, the 0-order SOD model (Figure 21) was used to simulate N and P nutrient release during anaerobic conditions. Maximum values for SOD were varied from 0.1 for shallow low organic matter sediments to 1.0 g/m^2/d at TMDL station #1 and 1.2 g/m^2/d for deepest high organic sediments adjacent to the dam; rates were assumed to vary linearly with temperature between 4 and 30°C, corresponding to a maximum summer 0-order SOD rate of about 0.6 g/m^2/d at TMDL station #1.

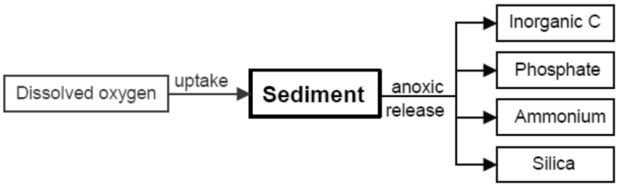

Figure 21. Schematic of 0th-order sediment oxygen demand subroutine in CE-QUAL-W2.

(iv) Macrophyte growth, senescence, and death

Macrophytes are an important component of Big Bear Lake's ecosystem, providing habitat for fish, zooplankton, larval aquatic insects, a variety of benthic animals, and epiphytic periphyton. Aquatic vegetation surveys have periodically been conducted, with coontail, common waterweed, and Eurasian watermilfoil often comprising much of the total macrophyte biomass. Macrophyte growth, senescence, and death are also important features of the nutrient cycle of the lake. Harvesting and herbicide applications have helped control macrophyte growth, with harvesting also serving as strategy to export nutrients from the lake. CE-QUAL-W2 includes macrophyte subroutines that simulate plant life cycles and their effect on hydrodynamics, nutrients, light, and other factors.

Since detailed information about the species composition, density, and distribution of macrophytes over the 2009-2019 timeframe was not available, a composite macrophyte group was incorporated into the model. CE-QUAL-W2 modeling conducted by the USGS (2013) for the Klamath River upstream of Keno Dam, Oregon served as the basis for macrophyte submodel parameterization (Table 13). The composite macrophyte extracted nutrients from the water column, as coontail and to a slightly lesser extent milfoil do, and from bottom sediments, as typical rooted aquatic vascular plants do.

Table 13. Macrophyte model parameter values used in simulations.

Parameter	USGS[a]	Value	Description
MG	0.34	0.3	Maximum macrophyte growth rate (d^{-1})
MR	0.09	0.09	Maximum macrophyte respiration rate (d^{-1})
MM	0.06	0.06	Maximum macrophyte mortality rate (d^{-1})
MSAT	5	10	Light saturation intensity at max photosynthesis rate (W/m^2)
MPOM	0.7	0.7	Fraction of macrophyte biomass converted to POM upon death
LRPMAC	0.2	0.2	Fraction of POM that becomes labile POM
PSED	0.4	0.27	Fraction of P uptake from sediments
NSED	0.4	0.27	Fraction of N uptake from sediments
MBMP	40	40	Threshold concentration when growth to next layer (g/m^3)
MMAX	108	1000	Maximum macrophyte concentration (g/m^3) (W2 default = 500 g/m^3)
CDDRAG	0	1	Macrophyte drag coefficient
MT1	14	14	Lower temperature for rising growth rate function (°C)
MT2	24	24	Upper temperature for rising growth rate function (°C)
MP	0.004	0.005	Stoichiometric ratio between P and biomass (g/g)
MN	0.054	0.05	Stoichiometric ratio between N and biomass (g/g)
MC	0.51	0.5	Stoichiometric ratio between C and biomass (g/g)

[a]composite macrophyte based on average of values for Coontail and Common Waterweed. USGS (2013).

v. Epiphyton dynamics

A vast majority of algal species can colonize surfaces, including macrophytes, and can approach or exceed primary production of macrophytes (*e.g.,* Jones, 1984). Given the relatively shallow depths in the embayments and eastern end of the lake and relatively high water clarity much of the year, epiphyton were also included in the model. Epiphyton are subject to the same

environmental factors and processes as phytoplankton with the exception of settling loss from the water column (Table 14).

Table 14. Epiphyton model parameter values used in simulations. Default W2 values from Wells (2019).

Parameter	Default	Value	Description
EG	2	2	Maximum epiphyton growth rate (d^{-1})
ER	0.04	0.045	Maximum epiphyton respiration rate (d^{-1})
EE	0.04	0.045	Maximum epiphyton excretion rate (d^{-1})
EM	0.1	0.1	Maximum epiphyton mortality rate (d^{-1})
EB	0.001	0.001	Epiphyton burial rate (d^{-1})
EHSP	0.003	0.003	Epiphyton half-saturation for P-limited growth (g/m^3)
EHSN	0.014	0.014	Epiphyton half-saturation for N-limited growth (g/m^3)
EHSSI	0	0	Epiphyton half-saturation for Si-limited growth (g/m^3)
ESAT	75	75	Light saturation intensity at max photosynthesis rate (W/m^2)
EHS	35	82	Biomass limitation factor (g/m^2)
ENEQN	2	2	Ammonia preference factor equation (1 or 2)
ENPR	0.001	0.001	N-half saturation preference constant (g/m^3)
EP	0.005	0.003	Stoichiometric ratio between P and biomass (g/g)
EN	0.08	0.082	Stoichiometric ratio between N and biomass (g/g)
EC	0.45	0.45	Stoichiometric ratio between C and biomass (g/g)

vi. Phytoplankton dynamics

With information about external nutrient loading from the watershed, atmospheric deposition, internal nutrient recycling, and role of macrophytes and epiphyton, attention was then turned to parameterization of the model to reproduce seasonal and interannual phytoplankton dynamics as expressed through trends in chlorophyll-a. Algal levels are governed by the availability of nutrients and light, and regulated by a complex set of processes, including respiration, settling, grazing, and mortality (Figure 22):

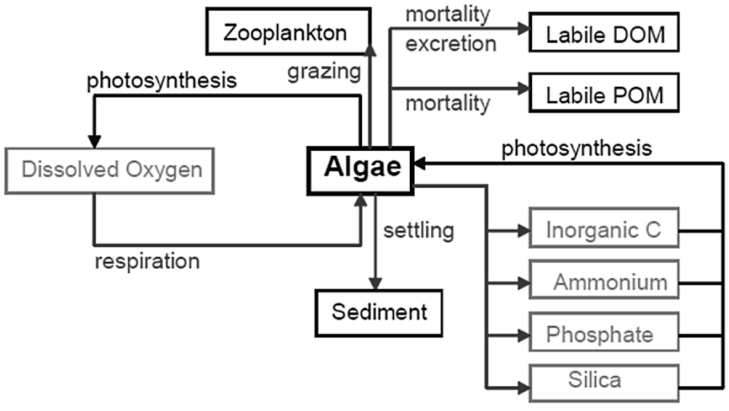

Figure 22. Schematic of phytoplankton subroutine in CE-QUAL-W2.

No specific genus or species was simulated and parameter values at or near CE-QUAL-W2 default values were used (Table 15). Two phytoplankton groups were simulated, with algal group #2 capable of N_2-fixation.

Table 15. Phytoplankton model parameter values used in simulations. Default W2 values from Wells (2019).

Parameter	Default	Algae 1	Algae 2	Description
AG	2	2	1.7	Maximum algal growth rate (d^{-1})
AR	0.04	0.04	0.05	Maximum algal respiration rate (d^{-1})
AE	0.04	0.04	0.05	Maximum algal excretion rate (d^{-1})
AM	0.1	0.1	0.1	Maximum algal mortality rate (d^{-1})
AS	0.1	0.1	0.1	Algal settling rate (d^{-1})
AHSP	0.003	0.003	0.005	Algal half-saturation for P-limited growth (g/m^3)
AHSN	0.014	0.03	0	Algal half-saturation for N-limited growth (g/m^3)
AHSSI	0	0	0	Algal half-saturation for Si-limited growth (g/m^3)
ASAT	100	90	100	Light saturation intensity at max photosynthesis (W/m^2)
ALPOM	0.8	0.8	0.8	Fraction of algae lost by mortality to POM
ANEQN	2	1	1	Ammonia preference factor equation (1 or 2)
ANPR	0.001	0.001	0.001	N-half saturation preference constant (g/m^3)
AP	0.005	0.003	0.0031	Stoichiometric ratio between P and biomass (g/g)
AN	0.08	0.09	0.09	Stoichiometric ratio between N and biomass (g/g)
AEC	0.45	0.45	0.45	Stoichiometric ratio between C and biomass (g/g)

3. Model Calibration Results

As previously noted, water quality in Big Bear Lake varied widely over 2009-2019 (Table 1). The model reproduced seasonal and inter-annual variations in chlorophyll-a concentrations reasonably well, including increased concentrations in the latter half of the 2009-2019 study period associated with lower lake levels (Figure 23).

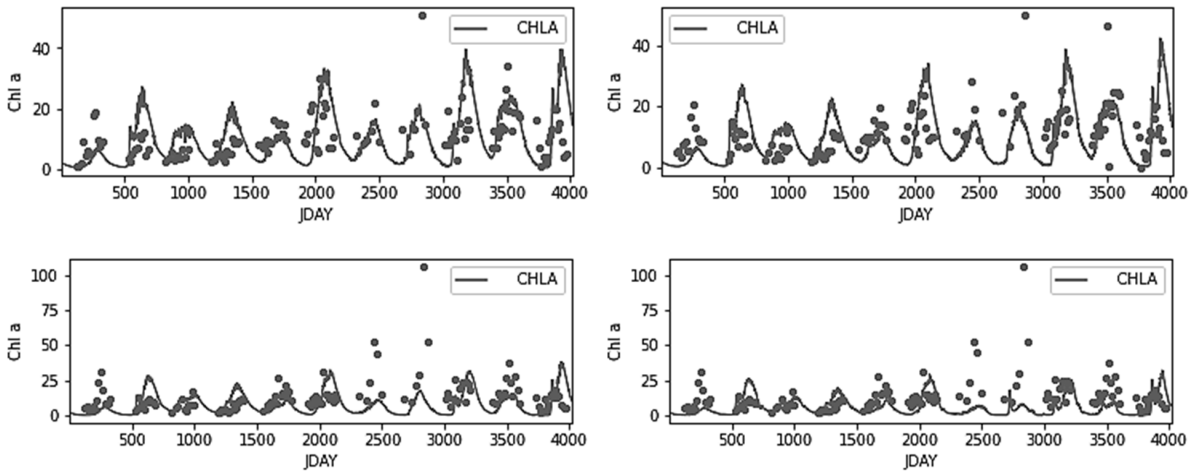

Figure 23. Predicted (line) and observed (circles) chlorophyll-a concentrations (µg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake), and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

The model also reproduced central tendencies present in measured TP concentrations, including seasonal variations and trends of increased concentrations in the latter half of the 2009-2019 study period, but predicted seasonal variations that were dampened relative to reported data (Figure 24). In particular, the model over-predicted total P around day 2300-2600 which corresponds to the alum application in 2015. CE-QUAL-W2 doesn't have subroutines specifically simulating an alum application, and after some effort, it was deemed not readily feasible to accurately simulate the flocculation, sorption, and settling of alum and sorbed P and N within CE-QUAL-W2. Some limitations to the macrophyte submodel were also identified (Appendix C).

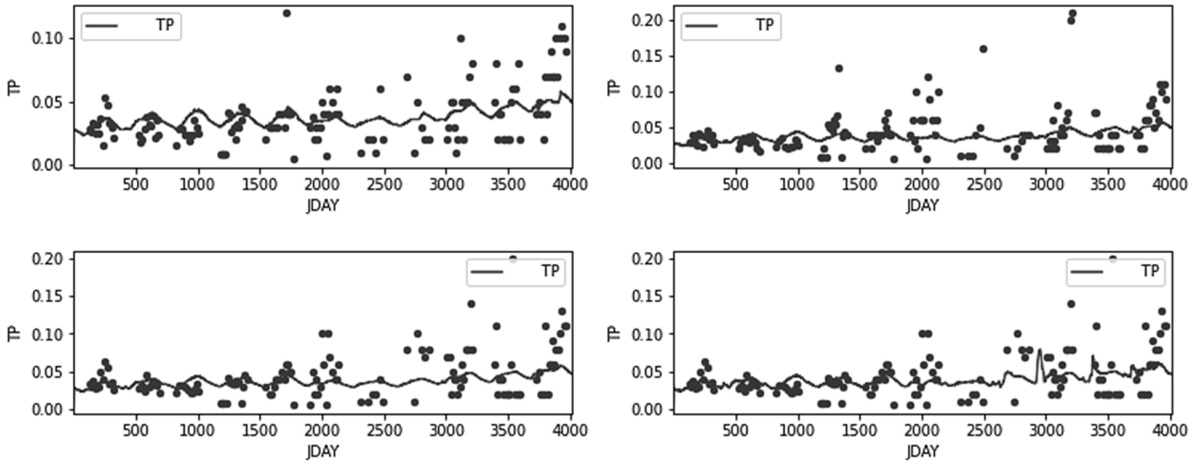

Figure 24. Predicted (line) and observed (circles) total P (TP) concentrations (mg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake) and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

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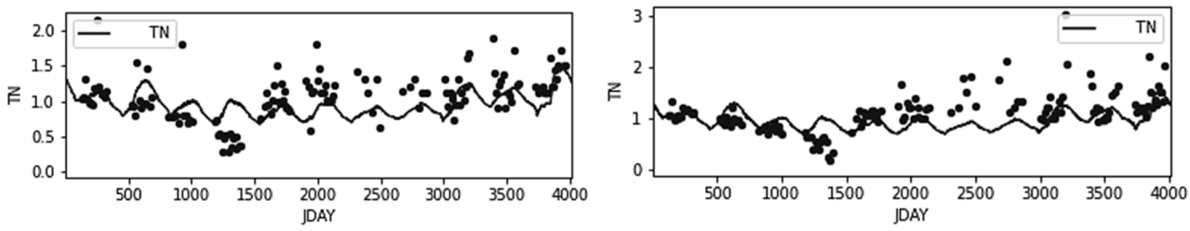
might be expected to increase N concentrations somewhat, as further P-limitation would restrict amount of N also incorporated into algal biomass.



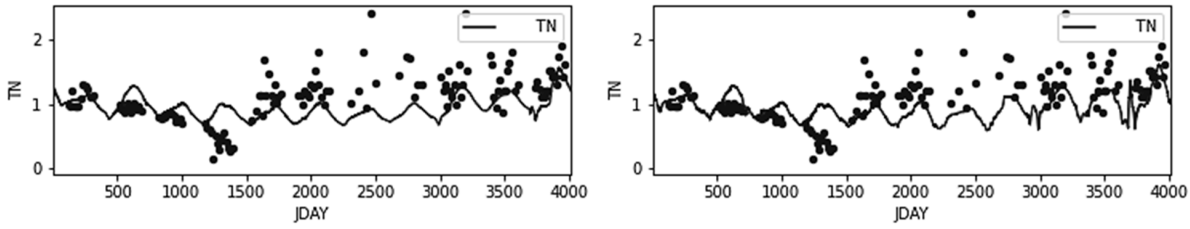


Figure 25. Predicted (line) and observed (circles) total N (TN) concentrations (mg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake) and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

As evident in Figures 23-25, very wide swings in reported total nutrient and chlorophyll-a concentrations were sometimes present, with sample concentrations occasionally up to 3-5 times higher than samples collected immediately prior to or immediately thereafter (e.g., Figure 24, TP concentration of 0.12 mg/L around day 1700 for TMDL station #1). While analytical error is present in all measured values, a Grubbs outlier test was used to identify outliers at $p<0.01$ prior to calculation of model error statistics. A total of 7/424 outliers were statistically identified for chlorophyll-a, 5/600 for total P, 2/600 for total N and 6/600 for total inorganic N. Outliers removed due to analytical, sample handling, or other errors thus constituted only 0.33-1.6% of total reported values. Even with removal of outliers at $p<0.01$, it nonetheless bears noting that model calibration errors have field and laboratory errors imbedded within them, as well as from other factors (Harmel et al., 2006). Model error statistics, including mean error, mean absolute error, and root mean square error, are summarized in Table 16.

Table 16. Model error results for nutrients and chlorophyll-a.

Property	N	Range	ME	MAE	RMSE	RRMSE (%)[a]
Chlorophyll-a (µg/L)	417	0.5 – 43.2	-1.3	7.9	10.3	24.0
Total P (mg/l)	595	0.005 - 0.180	-0.010	0.022	0.031	17.7
Total N (mg/L)	598	0.126 - 2.415	-0.148	0.310	0.413	18.0
Total Inorganic N (mg/L)	594	0.007 - 0.319	-0.049	0.050	0.092	29.5

[a]=(RMSE/Range)*100

Dissolved oxygen concentrations are influenced by, and also often regulate, the biogeochemical processes operating in the lake. It was previously shown that the model adequately reproduced water column temperatures (Figure 13, Table 8); the model was also generally successful in reproducing measured DO concentrations (*e.g.*, Figure 26, Table 17). (Additional profiles provided in Appendix D). While the lake was often relatively well-mixed vertically, low DO concentrations above the sediments were frequently present as a result of aerobic decomposition and respiration reactions.

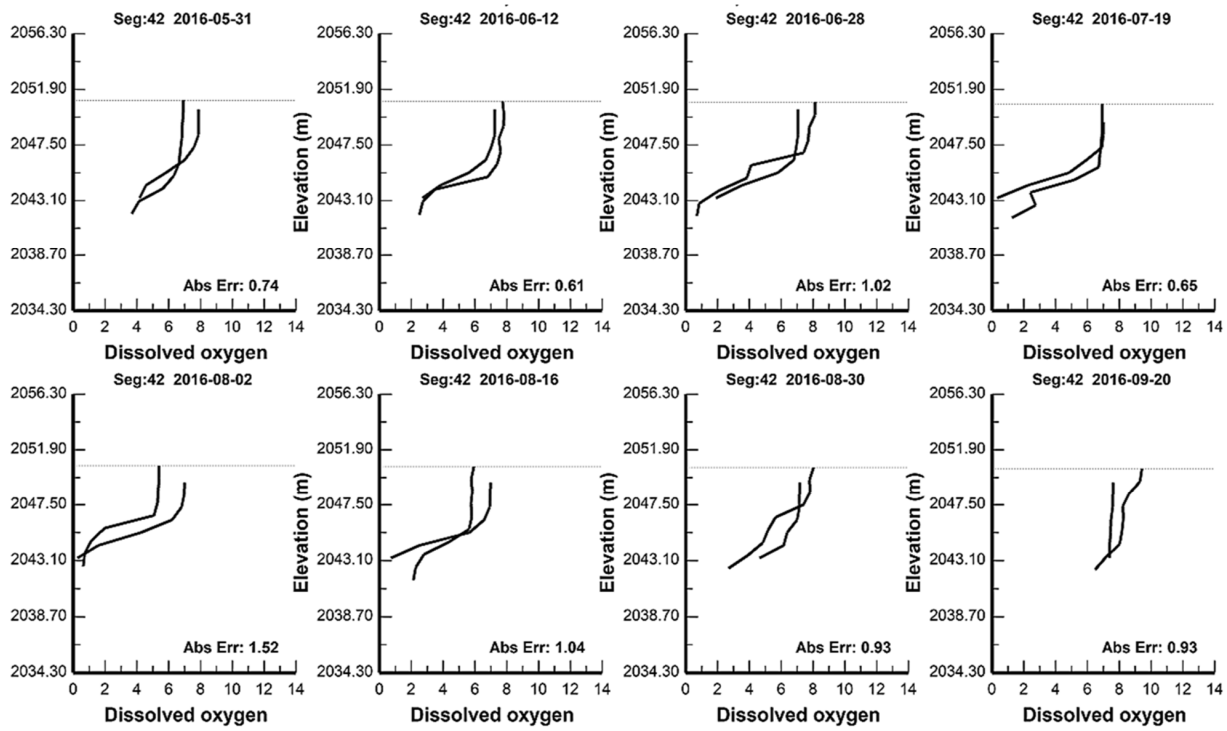


Figure 26. Example dissolved oxygen profiles at TMDL station #2 highlighting agreement between predicted and measured concentrations and periodic loss of DO in lower water column.

Table 17. Mean absolute error for model predictions of water column DO concentrations at the four TMDL sampling stations (145 profiles; 858-1974 discrete measurements in each profile).

	#1 (Dam)	#2 (Gilner Pt)	#6 (Mid-lake)	#9 (Stanfield)
MAE (mg/L)	1.40	1.25	1.16	1.02

Summary

A 2-D (longitudinal-vertical) hydrodynamic -water quality model for Big Bear Lake was developed using CE-QUAL-W2. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006). Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Big Bear Water Master reports. Hourly meteorological conditions were taken from Big Bear Airport and California Irrigation Management Information System (CIMIS) Station #199 located at the golf course. Data included solar shortwave radiation, air temperature, dewpoint temperature, windspeed, wind direction and cloud cover. Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and DO, and laboratory analyses of water samples collected at the lake for 2009-2019. The model was first developed and calibrated for lake level, water column temperature profiles and TDS, where generally very good agreement was achieved (mean absolute errors of 3.6 cm, 0.79-0.89 °C, and 11.9 mg/L, respectively). Following this, model calibration to water quality data was conducted. The model included external nutrient loading from the watershed,

atmospheric deposition, internal nutrient recycling, and nutrient uptake and release associated with macrophyte and epiphyton growth, senescence and death. Two algal groups were simulated, included one representing cyanobacteria capable of N_2-fixation. The 1st-order dynamic sediment model was combined with the 0th-order SOD model to simulate nutrient recycling and DO uptake in the surficial bottom sediments. Relative root mean square error was 17.7% for total P, 18.0% for total N, 29.5% for TIN, and 24.0 % for chlorophyll-a. Mean absolute errors for DO ranged from 1.02 – 1.40 mg/L for the 4 TMDL sampling stations.

IV. APPLICATION OF MODEL TO EVALUATE CONDITIONS WITH REPLENISH BIG BEAR PROJECT

With some confidence that the model is able to reproduce trends in water quality over a wide range of conditions, the model was used to evaluate changes in lake level and water quality under selected Replenish Big Bear project treatment scenarios. For these simulations, 1,920 af of BBARWA WWTP effluent was delivered annually through Stanfield Marsh and subsequently to the Lake. Three progressive levels of treatment assuming advanced nutrient removal and reverse osmosis (RO) technologies were evaluated (Treatment Alternatives):

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO (70% RO + 30% TIN & TP Removal)
(iii) Alternative 3: 100% RO

The composition of the supplemental water used in simulations varied quite substantially depending upon level of treatment (Table 18).

Table 18. Water quality of supplemental water used in model simulations (WSC, 2020b).

Constituent (mg/L)	Alternative 1	Alternative 2	Alternative 3
TDS	450	150	50
NO_3-N	0.6	0.2	0.05
NH_4-N	0.2	0.1	0.05
PO_4-P	0.25	0.06	0.02
Dissolved Organic N	1.33	0.76	0.5
Dissolved Organic P	0.24	0.04	0.01
Particulate Organic N	0.07	0.04	0.00
Particulate Organic P	0.01	0.002	0.00

These three Treatment Alternatives, with varying concentrations of TDS, phosphorus, and nitrogen (Table 18), and a flow rate of 1,920 af/yr were simulated to evaluate effects of supplementation on lake levels and concentrations of TDS, nutrients and chlorophyll-a concentrations for comparisons with baseline (2009-2019) conditions. This analysis thus allows one to compare how different Replenish Big Bear Treatment Alternatives would have altered lake conditions over the past decade, which included extreme variations in lake level and water quality.

A. Lake Level

A simple water balance calculation indicates that 1,920 af/yr of water added to Big Bear Lake would add approximately 0.2 m/yr to lake level. This level of supplementation represents about a 20% increase in average total annual inflow on a calendar year basis, with substantially larger relative contributions during periods of drought (e.g., nearly doubling the very low inflow shown in Fig. 11a during 2013). Simulations confirm that supplemental water would have increased lake level substantially over the natural 2009-2019 period (Baseline scenario), up to 1.7 m by late 2018 relative to no project (Figure 27).

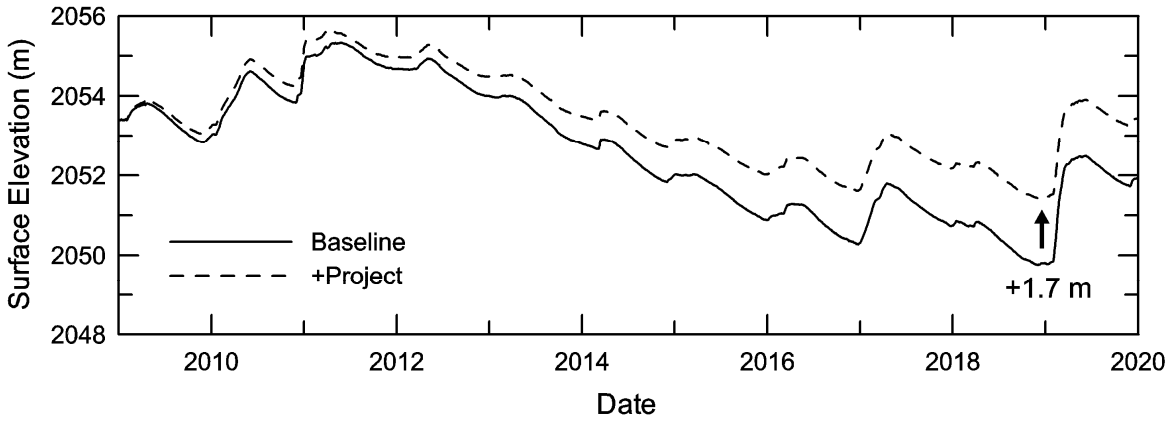


Figure 27. Predicted lake surface elevations over 2009-2019: baseline and with project.

B. Lake Area

The supplemental water also translates to increased lake surface area (Figure 28) that is a function of elevation-volume-area relationships for the Lake basin (Figure 9). Benefits of increased Lake area are especially evident during periods of drought, when Lake shoreline has substantially receded, limiting recreational and homeowner access, and resulting in extensive loss of the littoral community. For example, supplementation with project water would have increased lake area by about 300 acres, from less than 1,900 acres in 2018 to nearly 2,200 acres (Fig. 28). Moreover, the benefits of supplementation to Lake level and Lake surface area in terms of recreational access, aesthetics, ecological habitat, etc. accrue over time, especially evident during drought, until large inflows restore lake level and reset hydrologic conditions in the Lake.

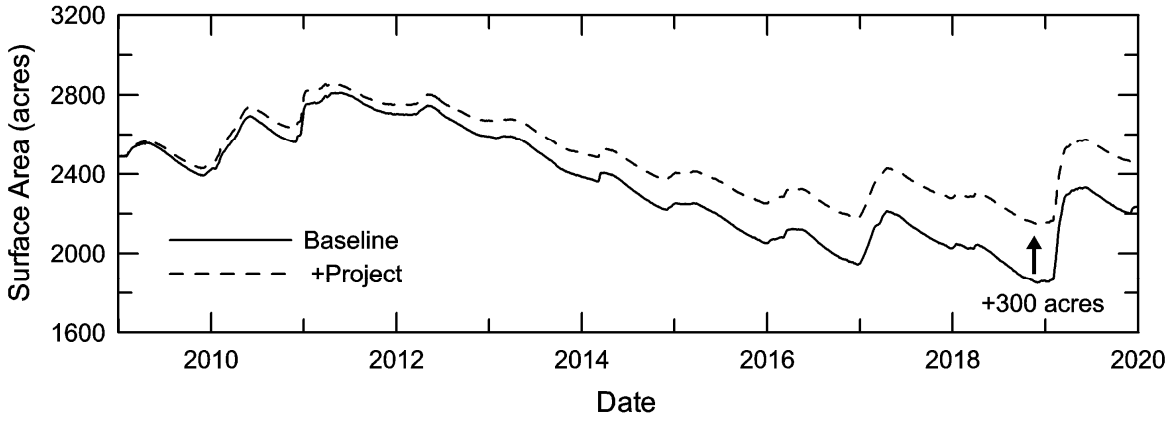


Figure 28. Predicted lake surface area over 2009-2019: baseline and with project.

C. TDS

Addition of 1,920 AFY of Alternative 1 effluent with a TDS of 450 mg/L, predictably increased TDS relative to the Baseline scenario, while Alternative 2 effluent yielded predicted TDS concentrations similar to those present in 2009-2019, and Alternative 3 effluent lowered TDS levels below the Baseline scenario (Figure 29; Table 19).

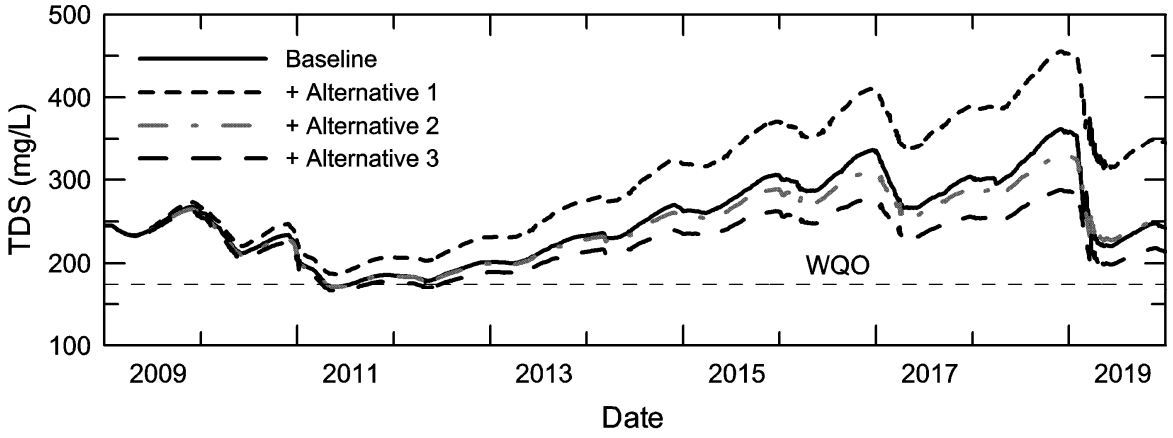


Figure 29. Predicted TDS concentrations over 2009-2019: baseline and with project.

Predicted TDS for the Baseline scenario exceeded the WQO of 175 mg/l (dashed line) 97.6% of the time over 2009-2019, a frequency equivalent to that of the Alternative 2 treatment scenario, and greater than that with Alternative 3 treatment scenario (Table 19).

Table 19. Summary of TDS concentrations for 2009-2019 under natural conditions and with project.

Scenario	Average TDS (mg/L)	Range TDS (mg/L)	WQO Exceedance Frequency (%)
Baseline	251	172-362	97.6
Alternative 1	300	187-455	100.0
Alternative 2	244	171-329	97.6
Alternative 3	226	166-287	93.3

D. Nutrients and Chlorophyll-a

Nutrients entering the lake add to the inventory of nutrients already present, which are subject to a wide array of biogeochemical processes. To help put nutrients derived from supplemental water of differing levels of treatment into context, it is useful to consider their composition and loading relative to watershed sources. Median watershed concentrations and concentrations in Alternative 1-3 effluents are provided in Table 20. Alternative 1 effluent substantially exceeds median watershed concentrations for virtually all nutrients, while addition of RO in Alternatives 2 and 3 lowers concentrations, often to levels comparable to or in some cases below median watershed levels.

Table 20. Comparison of nutrient concentrations in watershed runoff and supplemental water with the three Treatment Alternatives.

	Median Watershed Concentrations (mg/L)					Nutrient Concentrations (mg/L)		
Variable	Boulder Cr	Grout Cr	Knickerb Cr	Rathbun Cr	Summit Cr	Alt 1	Alt 2	Alt 3
NO_3-N	0.05	0.183	0.13	0.419	0.19	0.6	0.2	0.05
NH_4-N	0.011	0.01	0.015	0.015	0.015	0.2	0.1	0.05
PO_4-P	0.007	0.015	0.038	0.038	0.021	0.25	0.06	0.02
Total N	0.184	0.378	0.312	0.716	0.481	2.2	1.1	0.6
Total P	0.009	0.023	0.055	0.055	0.075	0.5	0.1	0.03
TN/TP	20.4	16.4	5.7	13.0	6.4	4.4	11	20

Normalizing project concentrations as ratios to median watershed concentrations allows comparison of relative enrichment factors for supplemental water (concentration basis) (Table 21):

Table 21. Concentration enrichment factors (supplemental/watershed).

	Concentration Enrichment Factor		
Variable	Alternative 1	Alternative 2	Alternative 3
NO_3-N	3.3	1.1	0.3
NH_4-N	13.3	6.7	3.3
PO_4-P	11.9	1.6	0.5
Total N	5.8	2.3	0.8
Total P	9.1	1.8	0.4

One thus recognizes that Alternative 1 (TIN & TP Removal) effluent represents about 6-times and 9-times greater concentrations of TN and TP, respectively, compared with the watershed, while Alternative 2 (70% RO) is on the order of about 1-2 times higher concentrations, and Alternative 3 (100% RO) is significantly lower than typical concentrations of most forms of nutrients delivered from the watershed (Table 21). Importantly, Alternative 1 effluent is not only much higher in nutrient concentrations, it also has a very low TN:TP ratio (Table 20), that could potentially favor N_2-fixing blue-green algae.

Simulations demonstrated that water quality in the Lake is broadly similar between the Baseline scenario and the Alternative 2 and 3 treatment scenarios, but is significantly degraded with Alternative 1 effluent, with marked predicted increases in TP, TN, and chlorophyll-a concentrations (Figure 30).

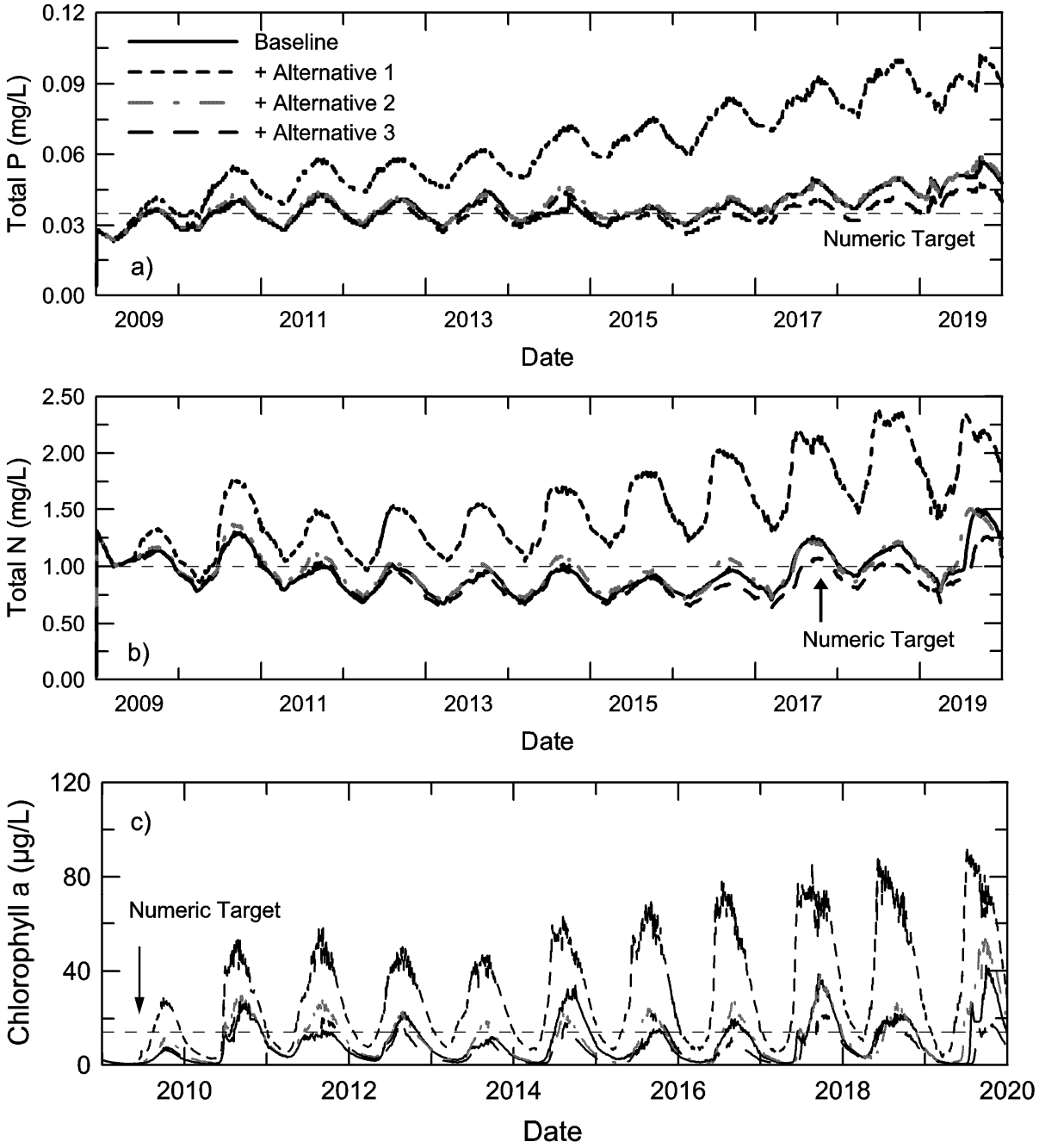


Figure 30. Predicted concentrations of a) total P, b) total N, and c) chlorophyll-a at TMDL station #2 (photic zone).

Supplementation with Alternative 1 effluent also significantly increased littoral plant production, often doubling peak values relative to that predicted under the Baseline scenario and with treatment alternatives 2 and 3 (Figure 31).

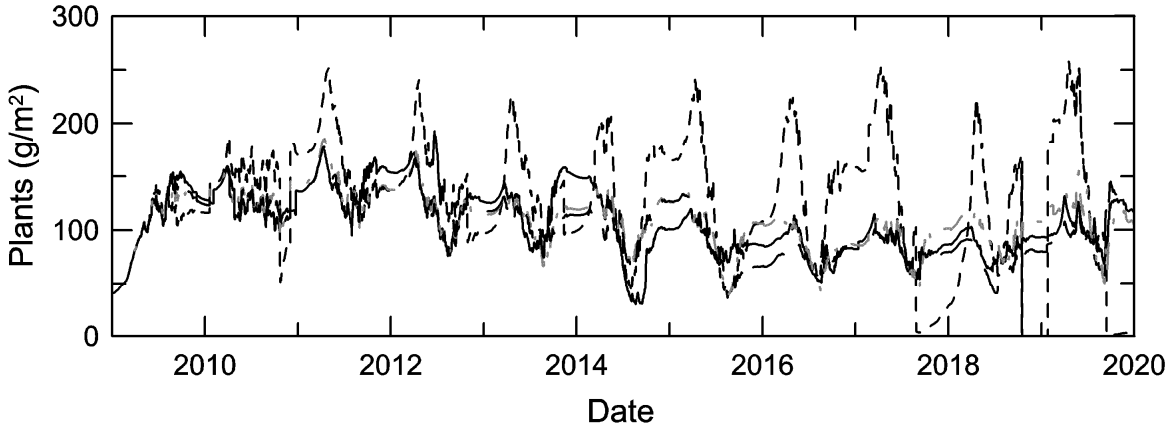


Figure 31. Predicted plant biomass at TMDL station #2 (photic zone). Legend shown in Fig. 30a.

Average concentrations at TMDL station #2 (Gilner Point) for the 11-yr simulation period highlight substantial predicted increases in total P, PO_4-P, and total N resulting from supplementation with Alternative 1 effluent (Table 20). The large increase in P concentrations also yielded a substantial increase in predicted average chlorophyll-a concentration (30.5 vs 9.3 µg/L). Supplementation with Alternative 1 effluent also increased TIN concentrations compared with the Baseline scenario and increased (non-phytoplankton) plant production. Supplementation with Alternative 2 effluent yielded predicted average water quality quite similar to the Baseline scenario, while supplementation with Alternative 3 effluent was predicted to improve average water quality somewhat (Table 22).

Table 22. Average concentrations of nutrients and chlorophyll-a for 2009-2019 period under the Baseline scenario and with supplementation with water from the three Treatment Alternatives.

Scenario	Total N (mg/L)	Total P (mg/L)	Chl a (µg/L)	PO_4-P (µg/L)	TIN (mg/L)	Plants (g/m^2)
Baseline	0.948	0.037	9.3	3.5	0.049	106.9
Alternative 1	1.511	0.063	30.5	7.8	0.120	126.3
Alternative 2	0.979	0.038	10.9	3.6	0.047	110.2
Alternative 3	0.894	0.035	7.1	3.3	0.046	103.1

Supplementation of treated effluent from the BBARWA WWTP is thus predicted to yield different water quality in Big Bear Lake depending upon effluent water quality. Supplementation with Alternative 1 effluent is predicted to substantially increase lake total P and PO_4-P concentrations, which may also increase N_2-fixing blue-green algae, as well as increase epiphyte and macrophyte production. Supplementation with Alternative 2 effluent is predicted to yield water quality conditions similar to natural conditions, while providing increased lake volume, lake surface area, and additional (non-planktonic) plant biomass. Further treatment of effluent in Alternative 3 was predicted to slightly improve water quality compared with that predicted for the 2009-2019 Baseline scenario.

Cumulative distribution functions for basin-wide volume-averaged concentrations of TP and TN highlight the substantial increase in nutrients that would result from the addition of Alternative

1 effluent, while also demonstrating that Alternative 2 effluent is predicted to yield nutrient levels similar to predicted 2009-2019 levels, while supplementation with Alternative 3 effluent is predicted to yield slightly improved (lower) concentrations (Figure 32).

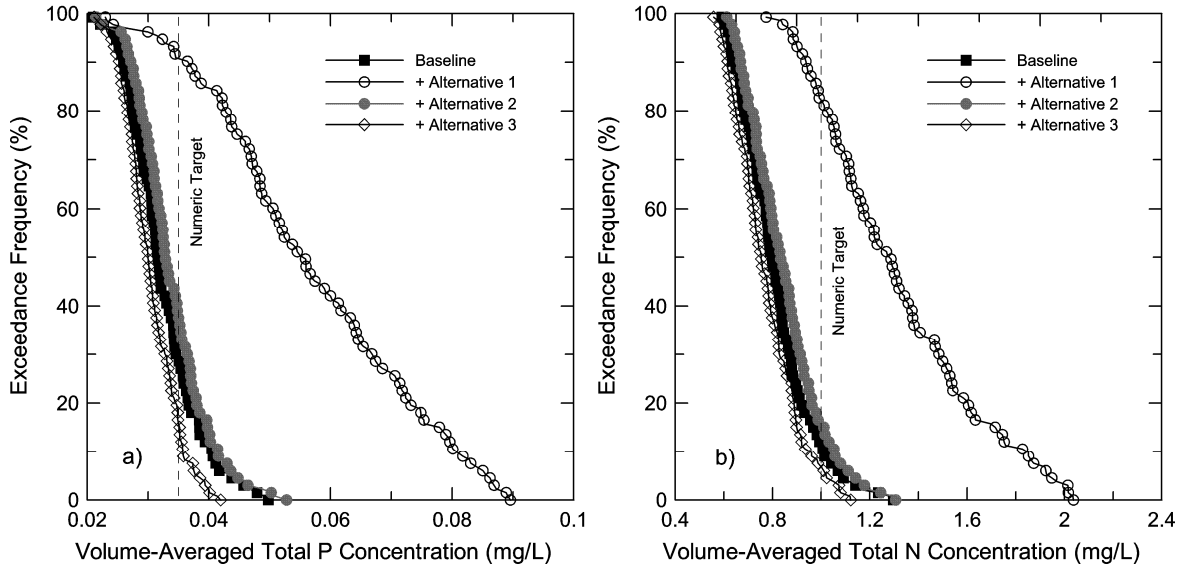


Figure 32. Cumulative distribution functions for predicted baseline and supplementation scenarios of volume-weighted concentrations of a) total P and b) total N.

Summary

Supplementation of natural flows with 1,920 af/yr of Replenish Big Bear water was predicted to add about 0.2 m annually to the lake relative to levels observed in 2009-2019 (baseline), and which accrued over time such that the lake was predicted to be 1.7 m higher in late 2018 compared to the level present at that time. Supplementation also increased lake volume and surface area, with lake area about 300 acres (16%) larger in late 2018 compared with actual area (approximately 2200 acres vs 1900 acres, respectively). Addition of 1,920 af/yr of Alternative 1 water significantly increased TDS levels in the lake, increasing average predicted TDS from 251 mg/L for the baseline (natural) condition for 2009-2019 to 300 mg/L, while Alternatives 2 and 3 were predicted to yield slightly lower average TDS concentrations of 244 and 226 mg/L, respectively. Exceedance of the TDS water quality objective of 175 mg/L was predicted to occur 97.6% of the time for both the baseline condition and for Alternative 2, while exceedance frequency increased to 100% for Alternative 1 and was reduced to 93.3% for Alternative 3.

Nutrient concentrations in the Replenish Big Bear water varied markedly with treatment, with total N and total P concentrations in Alternative 1 being about 6-9x higher than median watershed concentrations, while concentrations in Alternative 2 were projected to be 1.8-2.3x larger and Alternative 3 being about 0.4-0.8x that of median watershed values. The increased nutrient loading from Alternative 1 had a strongly detrimental effect on water quality, increasing average concentrations over 2009-2019 baseline of total N by about 50%, total P by 70%, and chlorophyll-a by 300%. In comparison, further treatment of effluent yielded average

concentrations comparable to (Alternative 2) or slightly improved (Alternative 3) relative to the baseline (natural no-project) condition.

V. PREDICTED LONG-TERM FUTURE CONDITIONS WITH REPLENISH BIG BEAR PROJECT

Simulations were extended from the reference period (2009-2019) to include 30 additional years, for a total of 41 simulation years that yielded potential trajectories for water level, area, TDS, and nutrients out to the beginning of 2050. As previously noted, the model requires extensive data for meteorological conditions (air temperature, dewpoint temperature, wind speed, wind direction, cloud cover, and solar radiation), as well as water inflows, outflows, and withdrawals. While hourly weather forecasts are available 7-10 days in advance from the National Weather Service (NWS) and 5-10 day flow forecasts are available for limited gaged stations from the NWS River Forecast Centers, we obviously do not know *a priori* these detailed meteorological and hydrological conditions for the next 30 years. Similarly, while downscaled global climate models provide some projections about trends in air temperature and precipitation, they do not provide information with sufficient resolution to allow direct use in our simulations.

Given these constraints, existing meteorological and flow data for 2009-2019 were used as the basis for forecasts. (An effort was made to expand the meteorological record to include additional years, but available weather data for the Big Bear Airport only go back to April 2007, thus providing only one additional full year of record, so existing data were used.) The 2009-2019 period included record or near record air temperatures and intervals of both extreme drought and very high precipitation/runoff that captured much of the anticipated inter-annual variability in meteorology and hydrology (e.g., Table 23). For example, average precipitation over 2009-2019 period was not statistically significantly different than that of the past 43 years (e.g., 31.7±15.6 vs 34.8±14.7 in/yr at Bear Valley Dam). Precipitation was better described as log-normally distributed; however, with geometric mean values very similar to median values, and both being slightly lower (reflecting increased prevalence of drought) but well-captured in the 2009-2019 dataset. Perhaps more importantly, minimum and maximum values for the 2009-2019 period were also similar to the larger 1977-2019 dataset (e.g., the highest annual precipitation at the Big Bear Community Services District (BBCCSD) was recorded in 2010, within the 2009-2019 record).

Table 23. Annual precipitation (calendar year) recorded at Bear Valley Dam and BBCCSD. (Water Master, 2019).

Precipitation (in/yr)	Bear Valley Dam		BBCCSD	
	1977-2019	2009-2019	1977-2019	2009-2019
Average	34.8	31.7	14.9	17.5
Geometric Mean	31.6	29.1	13.3	16.3
Median	31.8	27.8	14.1	14.8
Minimum	13.2	14.4	3.8	8.2
Maximum	73.8	64.1	33.2	33.2

Assuming that 2009-2019 is broadly representative of likely future meteorological and hydrologic conditions, Monte Carlo techniques were used to randomly select 100 different 30-year annual records from this set of data. Thus, any given future year was assumed to essentially have a 1-in-11 chance of looking like any one of the years from the 2009-2019 period in terms of meteorological conditions, inflows, withdrawals, and releases for downstream flow

requirements. Impacts of climate change were considered; air temperature increases would increase evaporation losses from lake, but also likely yield more rain and rain-on-snow events that would increase runoff and inflows to lake. Without detailed watershed modeling, it is not possible to resolve these conflicting impacts on the water budget for the lake, so for the purposes of this analysis, they were assumed to cancel out. The Monte Carlo analysis yielded 30-year average flow rates that ranged from 6,891 to 15,115 af/yr (Figure 33). Individual year flow rates varied more widely, ranging from 1,961 – 27,579 af/yr (not shown).

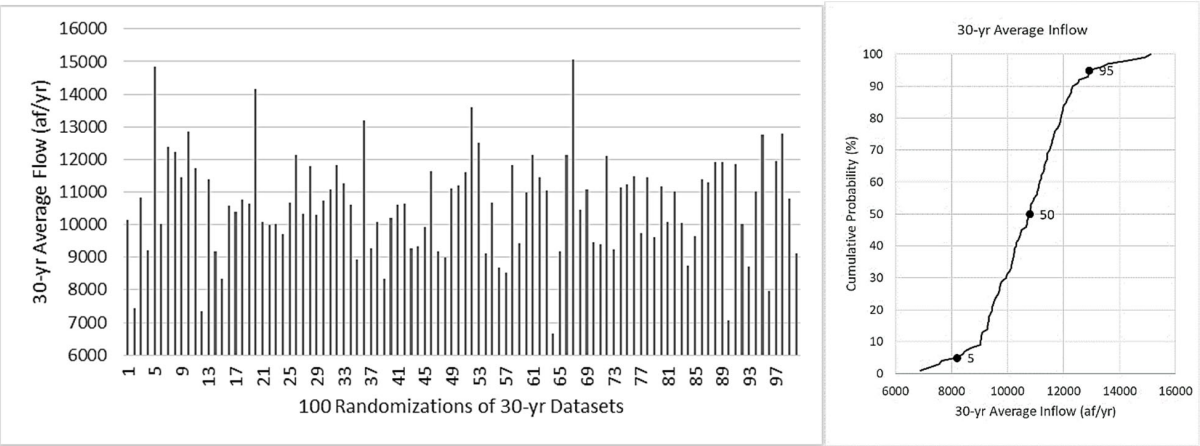


Figure 33. Thirty year average flow rates for 100 random datasets.

From this dataset (Figure 33), three hydrologic scenarios were selected for further analysis corresponding to the 5th-percentile, 50th-percentile (median), and 95th-percentile 30-yr average flow rates. The 5th-percentile corresponds to an average inflow rate of 8,646 af/yr and represents extended drought, not unlike that present in the 1950's-60's, while the 50th-percentile hydrologic scenario corresponds to intervals of both high runoff and drought, comparable to 2009-2019 (average annual inflow of 10,595 af/yr), and the 95th-percentile represents a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr). Cumulative inflows for these 3 hydrologic scenarios are presented in Figure 34. The corresponding meteorological, outflow and withdrawal conditions were used as input for CE-QUAL-W2 simulations. The 3 simulations represent forecasts of conditions subject to the temporal boundary conditions (inflows, meteorological conditions, etc.), and thus are not predictive of conditions at specific points of time in the future. On that basis, results are presented as cumulative distribution functions rather than time-series to convey information in a statistical-probabilistic framework rather than as strict forecasts in time. Lake properties are contrasted between baseline conditions under the 3 hydrologic scenarios and with implementation of the Replenish Big Bear project.

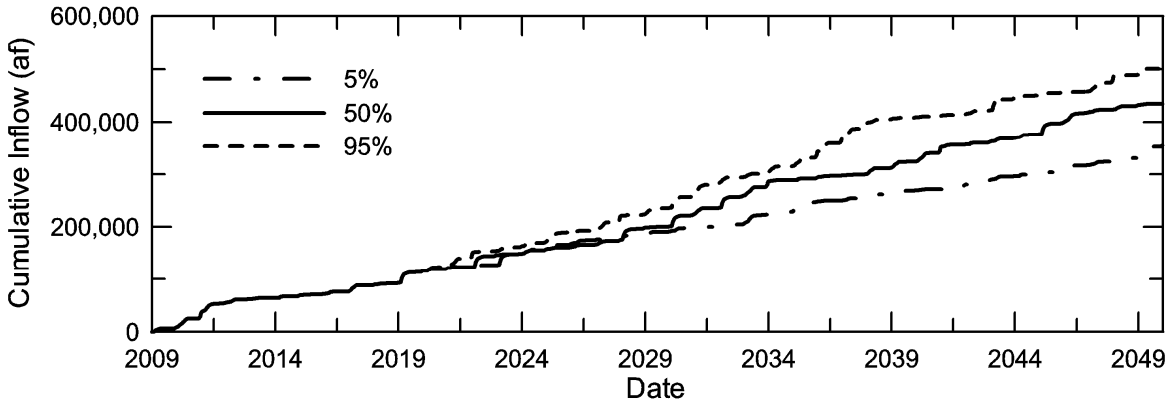


Figure 34. Cumulative inflows under 5th-, 50th- and 95th-percentile 30-yr average hydrologic scenarios.

A. Lake Surface Elevation

The 3 hydrologic scenarios had pronounced effects on predicted lake levels, with the 5th-percentile (chronic drought) scenario yielding elevations as low as 2044.9 m above MSL and a median elevation of 2048.8 m (Figure 35a). The 50th- and 95th-percentile hydrologic scenarios yielded predictably higher lake levels (e.g., median levels of 2052.2 and 2053.1 m, respectively) (Figure 35a). Supplementation with 1,920 af/yr of Replenish Big Bear water markedly increased lake levels, *e.g.*, raising the minimum level for 5th-percentile scenario by up to 4.6 m and increasing median level from 2048.8 m for baseline to 2052.0 m (Figure 35b).

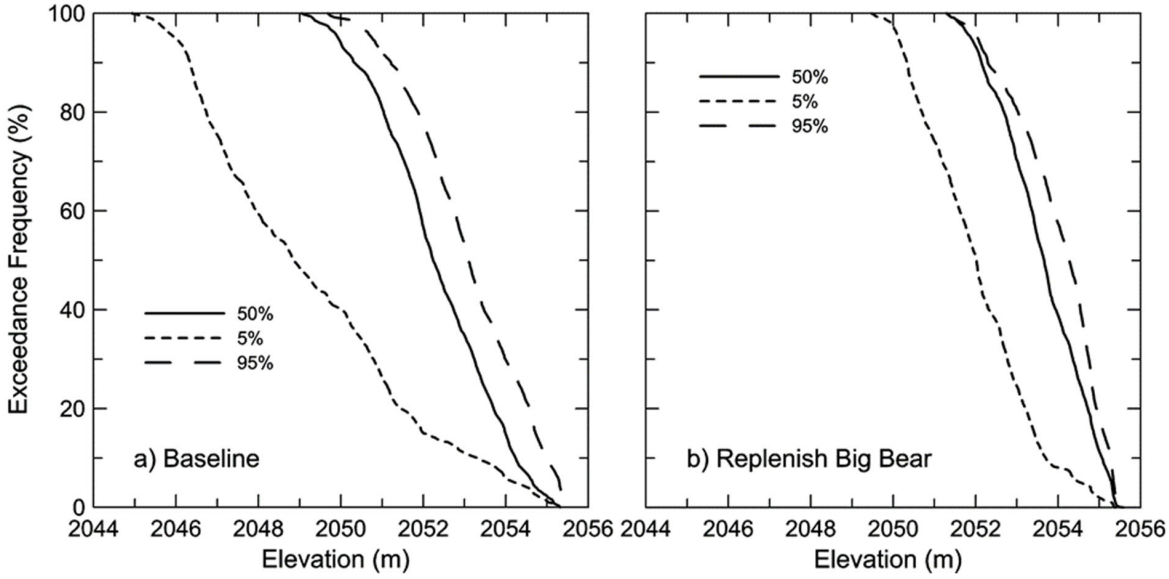


Figure 35. CDFs of predicted lake elevations at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

B. Lake Volume

Supplementation also substantially increased lake volumes, with volumes potentially as low as 6,000 af and a median volume of about 23,000 af for the 5th-percentile (drought) scenario (Figure 36). Supplementation with Replenish Big Bear water resulted in significant increases in lake volume for the other hydrologic scenarios as well (Figure 36).

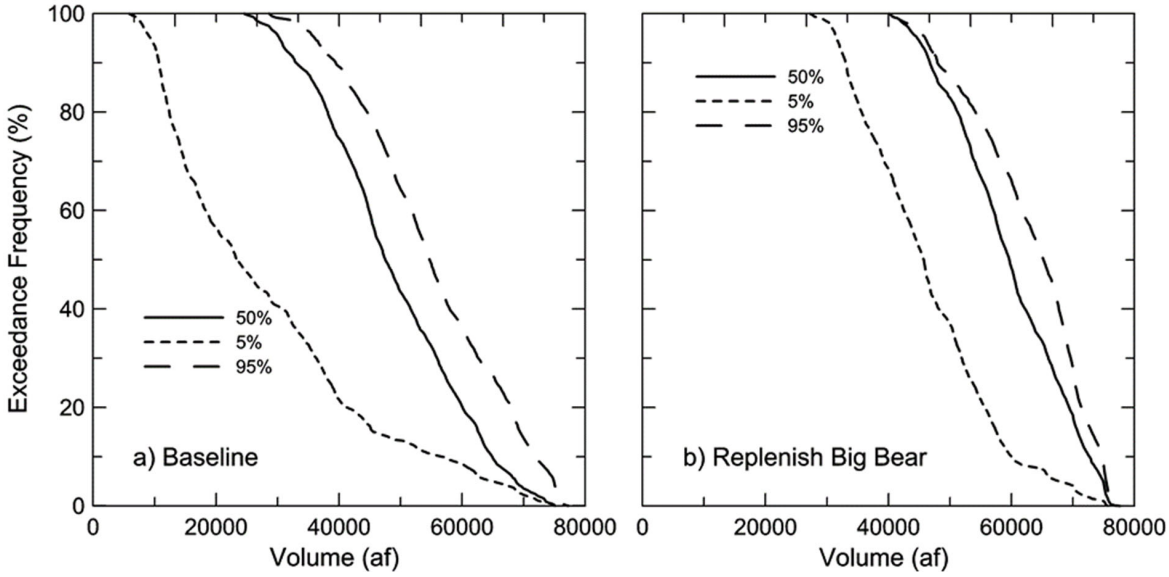


Figure 36. CDFs of predicted lake volumes at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

C. Lake Surface Area

The 5th-percentile hydrologic scenario also yielded very low lake surface areas, potentially <1000 acres and a median area of about 1700 acres (Figure 37a). The minimum predicted lake surface areas were about 2x larger and median surface areas were approximately 2300 and 2500 af for the 50th- and 95th-percentile hydrologic scenarios, respectively. Supplementation substantially increased lake area, shifting all CDFs to higher area values (Figure 37b). This can be seen more graphically in Figure 38, where the areas corresponding to the minimum and 75% exceedance frequencies (predicted to occur 25% of the time under the simulated protracted drought condition) are projected onto the natural lake boundary for the baseline and with project. At the minimum area, the lake divides into the impounded area behind the dam and a 2nd very shallow mid-basin, while the Project is able to maintain an extensive and contiguous lake area through the main body of the lake (Figure 38a). A considerable additional area is also maintained at the 75% exceedance frequency with supplementation (Figure 38b).

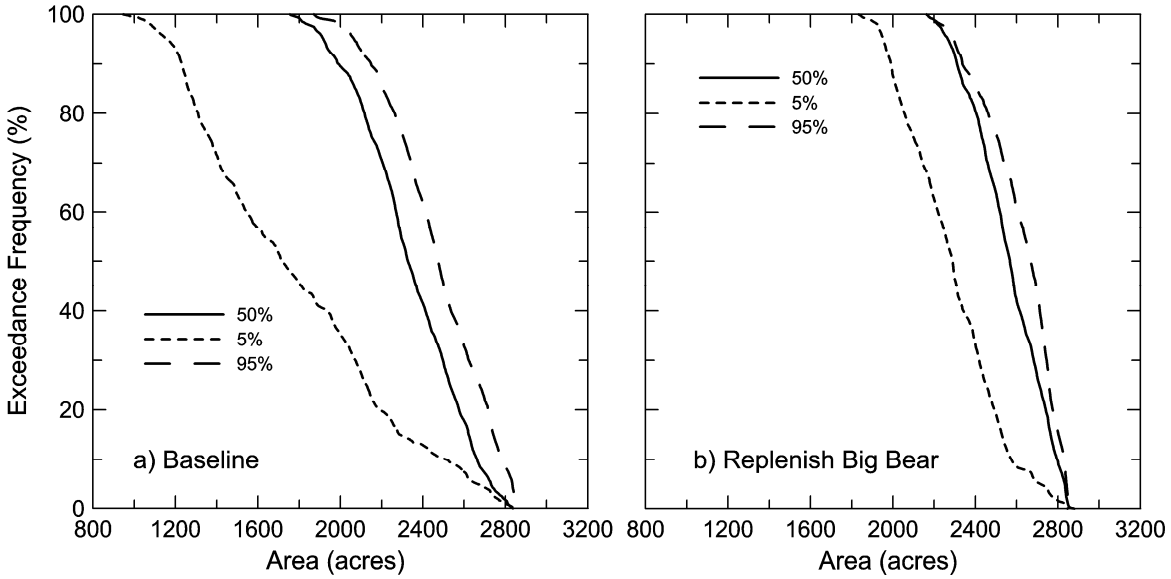


Figure 37. CDFs of predicted lake areas at 5th-,50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

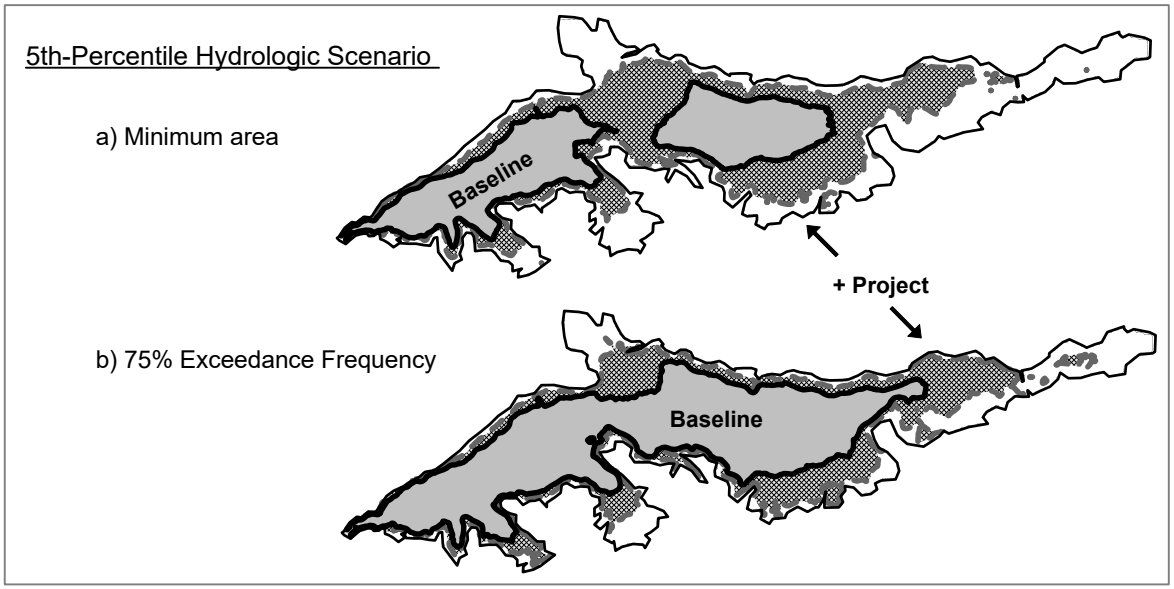


Figure 38. Lake surface under 5th-percentile flows (protracted drought) depicting areas under baseline conditions (solid gray) and with project (cross-hatched) at a) minimum area and b) 75% exceedance frequency (predicted to occur 25% of the time under the simulated protracted drought condition).

D. Total Dissolved Solids

The concentrations of TDS in Big Bear Lake vary naturally as a function of lake level as a result of runoff inputs and evapoconcentration. Thus, predicted TDS concentrations were greatest for the 5th-percentile hydrologic scenario (protracted drought) and lower for the 50th- and 95th-percentile hydrologic scenarios (Figure 39a). Unlike lake elevation, volume and area which are independent of the type of effluent treatment, predicted TDS concentrations in the lake are quite sensitive to it (Figure 39b-d).

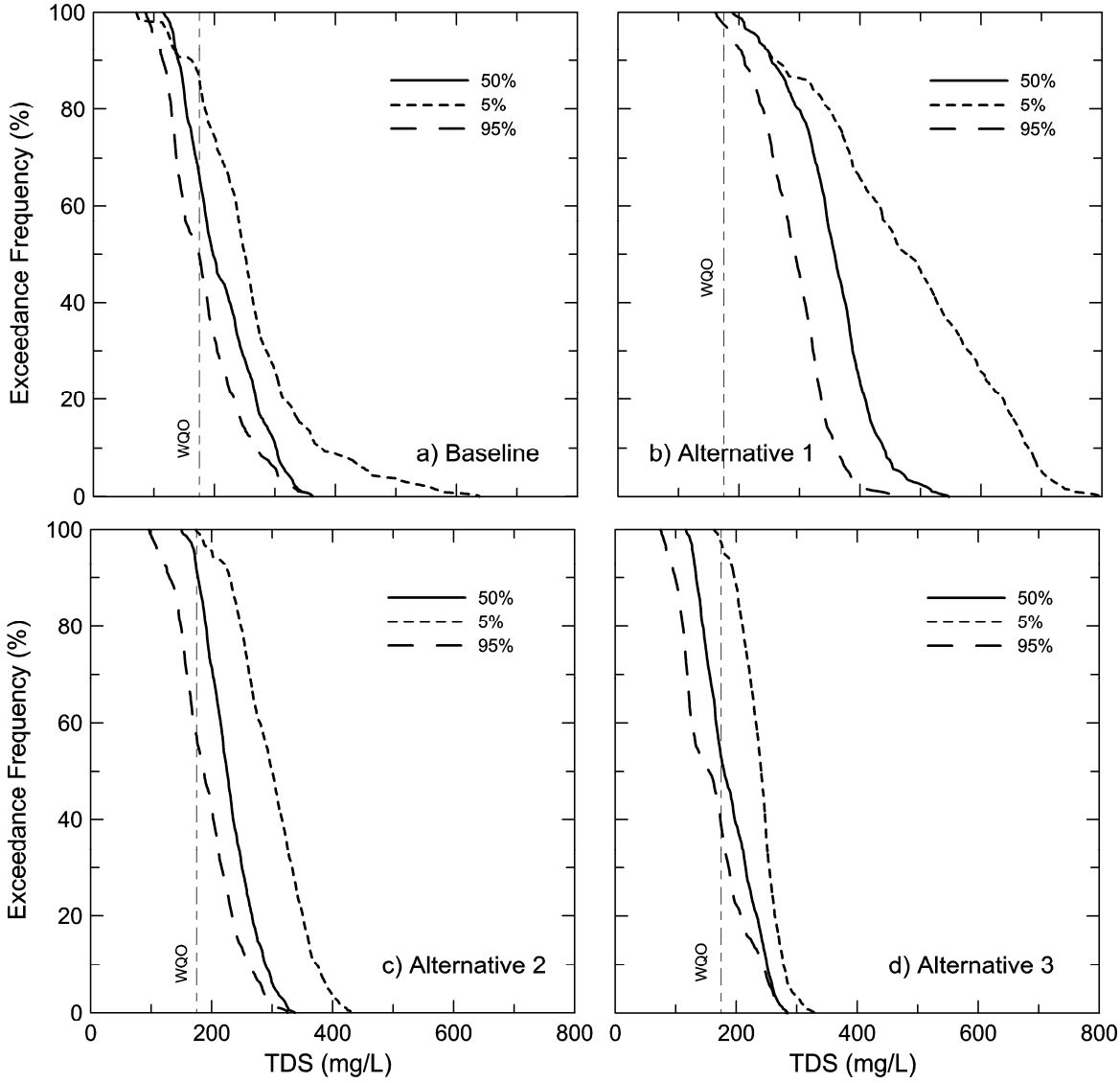


Figure 39. CDFs of predicted lake TDS at 5th-,50th- and 95th-percentile flows for a) baseline conditions, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

Alternative 1 treatment, involving only nutrient removal, yielded high concentrations of TDS that was predicted to exceed the water quality objective by wide margins (Figure 38b), while Alternative 2 shifted CDFs from baseline to slightly higher TDS levels, and the highest level of treatment (Alternative 3) yielded slightly lowered concentrations relative to Baseline scenario (Figure 39c,d).

E. Total P

Total P concentrations for the baseline condition were predicted to vary under the 3 hydrologic scenarios, exceeding 0.05 mg/L with some frequency under the drought scenario (Figure 40a).

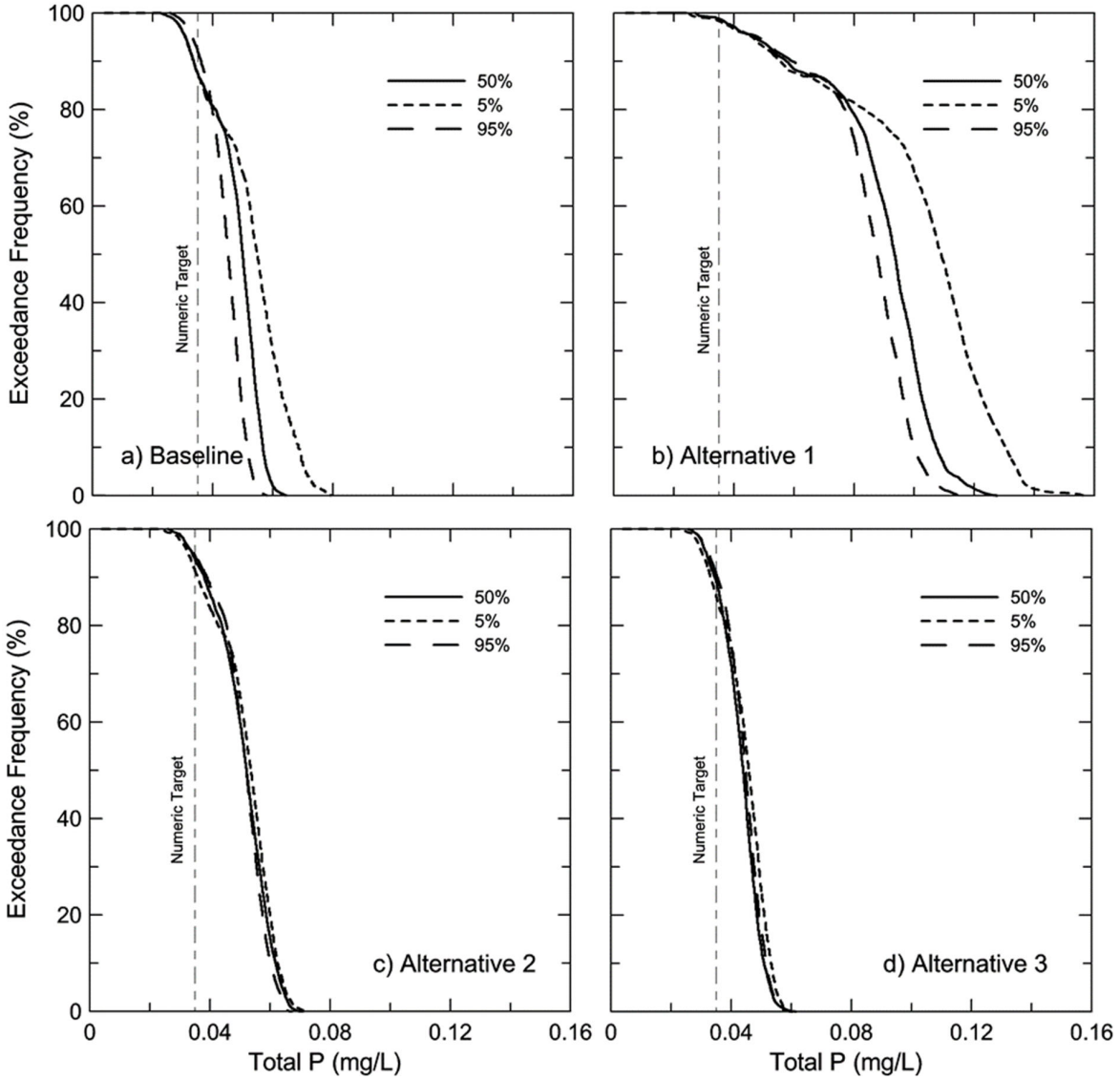


Figure 40. CDFs of predicted total P levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) Baseline, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

As noted in simulations for 2009-2019, supplementation with Replenish Big Bear effluent substantially degraded predicted water quality, and increased total P (Figure 40b), as well as total N (Figure 41b) and chlorophyll-a (Fig. 42b). Supplementation with higher quality Alternative 2 and 3 water reduced natural variability and provided comparable or lower levels (Figure 40c,d).

F. Total N

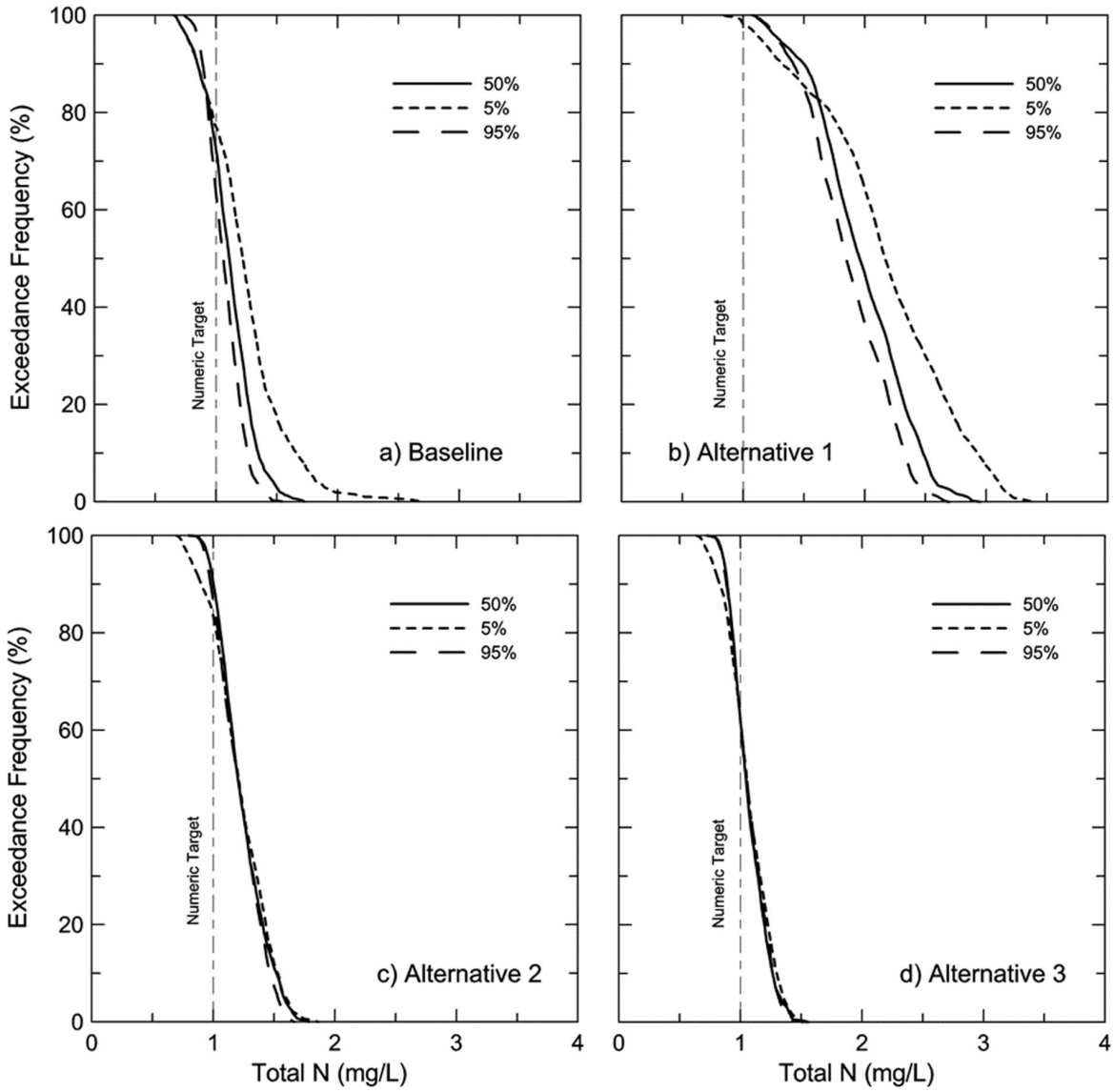


Figure 41. CDFs of predicted total N levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

Predicted total N concentrations (Figure 41) followed the same trends as total P (Figure 40), with Alternative 1 significantly increasing concentrations, while Alternatives 2 and 3 reduced variability in baseline case due to stabilization of lake level with high quality water (Figure 41).

G. Chlorophyll-a

Chlorophyll-a concentrations followed similar trends as noted for total P and total N, with a >5x increase in median predicted concentrations with Alternative 1 compared with baseline, while Alternatives 2 and 3 yielded comparable or slightly higher predicted concentrations (Figure 42).

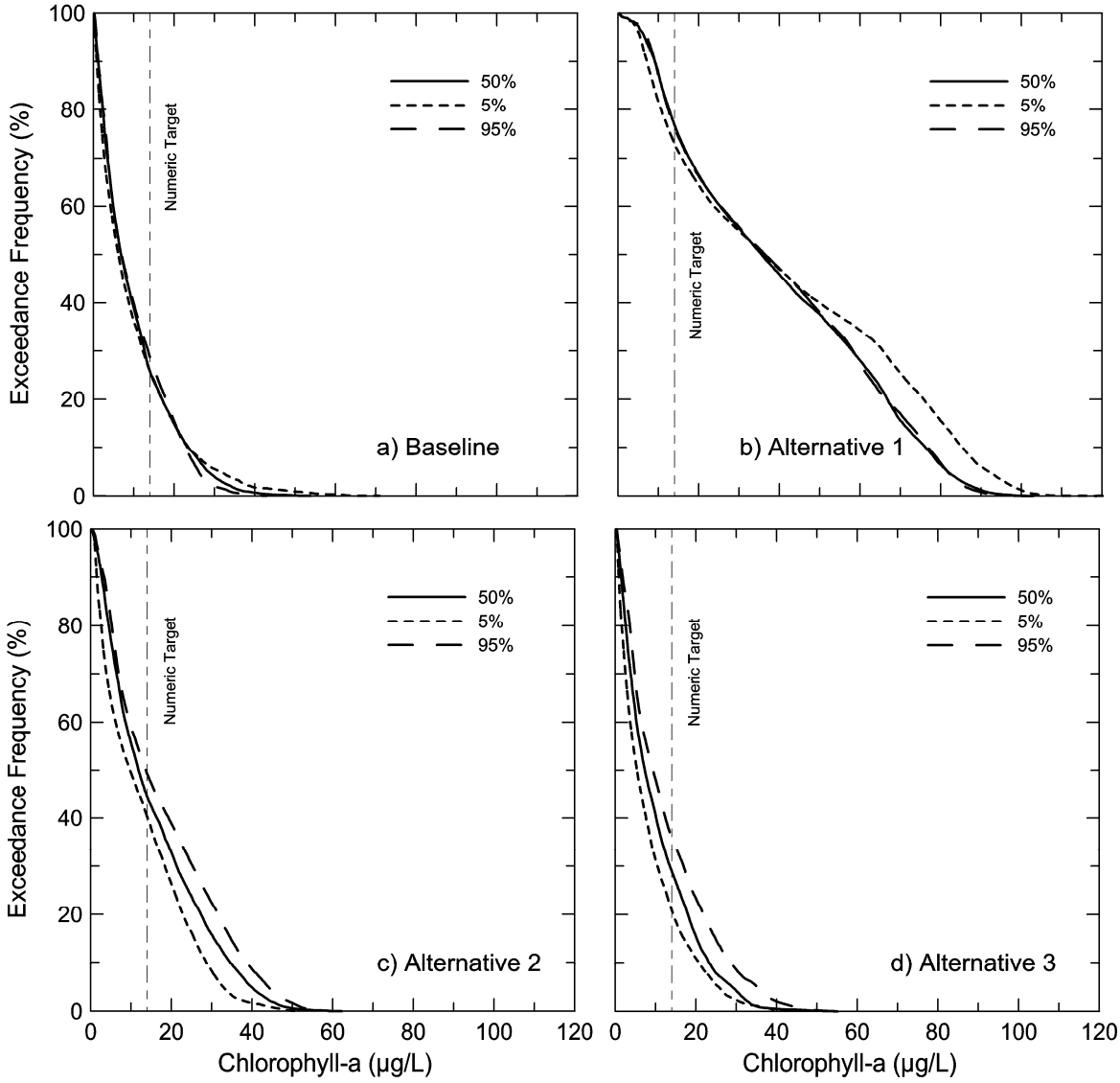


Figure 42. CDFs of predicted chlorophyll-a levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) Baseline, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

CDF Summary

CDFs convey a great deal of information, although it is often not easy to readily resolve differences across multiple graphs. Median lake dimensions for the 3 different hydrologic scenarios with and without supplementation with water from the Replenish Big Bear project from Figures 34-36 are summarized in Table 24.

Table 24. Influence of hydrologic scenarios and supplementation on median lake dimensions.

Parameter	Scenario	5th-Percentile	50th-Percentile	95th-Percentile
Elevation (m)	Baseline	2048.9	2052.2	2053.1
	+Project	2052.0 (+3.2)	2053.7 (+2.2)	2054.3 (+1.6)
Volume (af)	Baseline	23,404	47,536	54,724
	+Project	45,746 (+22,342)	59,664 (+12,128)	65,204 (+10,480)
Area (acres)	Baseline	1717	2328	2474
	+Project	2290 (+572)	2568 (+240)	2669 (+195)

Median concentrations of TDS, total N, total P and chlorophyll-a under the different hydrologic scenarios and levels of treatment are summarized in Table 25. As evident in the CDFs, the level of treatment of the supplemental water substantially affects the resulting water quality in the lake. Treated effluent with nutrient removal (Alternative 1), without additional treatment, offsets or other strategies, is predicted to have significant negative impacts to water quality in the lake, nearly doubling median concentrations of total P and total N, and increasing median chlorophyll-a concentrations by >5x relative to levels predicted for the natural (baseline) scenario (Table 25). Further advanced treatment of effluent (Alternatives 2 and 3), however, yielded predicted water quality broadly similar to or slightly better than the baseline case (Table 25).

Table 25. Influence of hydrologic scenarios and supplementation with alternative levels of treatment on predicted median concentrations of TDS, total N, total P and chlorophyll-a.

Parameter	Scenario	5th-Percentile	50th-Percentile	95th-Percentile
TDS (mg/L)	Baseline	250	198	175
	Alternative 1	478	358	293
	Alternative 2	300	225	187
	Alternative 3	241	180	155
Total P (mg/L)	Baseline	0.055	0.050	0.045
	Alternative 1	0.109	0.094	0.088
	Alternative 2	0.054	0.052	0.052
	Alternative 3	0.046	0.044	0.045
Total N (mg/L)	Baseline	1.22	1.11	1.06
	Alternative 1	2.17	1.96	1.85
	Alternative 2	1.21	1.20	1.20
	Alternative 3	1.05	1.05	1.05
Chlorophyll-a (µg/L)	Baseline	6.2	6.9	7.0
	Alternative 1	36.1	35.6	36.5
	Alternative 2	9.7	11.9	13.7
	Alternative 3	5.4	7.3	9.4

Summary

Simulations for 2009-2019 were extended to 2050 to evaluate possible long-term conditions in the lake under natural hydrologic variability with and without supplemental water from

Replenish Big Bear. Three hydrologic scenarios representing the 5th-, 50th- and 95th-percentile 30 year average annual flow records were used for predictions of future conditions in the lake. The 5th-percentile corresponded to an average inflow rate of 8,646 af/yr and represents extended drought, while the 50th-percentile (median) corresponded to intervals of both high runoff and drought comparable to 2009-2019 (average annual inflow of 10,595 af/yr), and the 95th-percentile represented a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr).

Supplementation with Replenish Big Bear was predicted to influence long-term (2009-2050) conditions in the lake which varied under the 3 hydrologic scenarios. Under the 50th-percentile hydrologic scenario, Replenish Big Bear was predicted to increase average lake level by 1.5 m, lake volume by nearly 13,000 af, and lake area by 260 acres relative to the predicted long-term baseline (no-project) condition. Water quality varied with level of effluent treatment, with Alternative 1 nearly doubling predicted long-term average concentrations of TDS, total P and total N and quadrupling average predicted chlorophyll-a levels. Long-term simulations indicate slight increases in average TDS, total P and total N and modest increase in chlorophyll-a for Alternative 2, and generally slight reductions or no significant change in concentrations with Alternative 3. Supplementation was predicted to have more substantial effects under the 5th-percentile hydrologic (drought) scenario, providing an average increase in lake level of 3.4 m, increase in volume of 16,104 af, and an additional average 638 surface acres (about 40% increase) relative to baseline. As with the 50th-percentile hydrologic scenario, supplementation with Alternative 1 effluent substantially degraded lake water quality, while further treatment as provided in Alternatives 2 and 3 yielded comparable or slightly improved water quality in the lake. Effects of Replenish Big Bear were more modest at the 95th-percentile runoff scenario, when supplementation is less important, owing to the lower overall contributions of water and TDS and nutrients relative to the watershed.

VI. ROUTING OF SUPPLEMENTAL WATER THROUGH STANFIELD MARSH

Simulations involved the delivery of Replenish Big Bear project water through Stanfield Marsh and into the main body of the lake. Wetlands are often very good at improving water quality by filtering and settling out of particulate matter, biological uptake of dissolved forms of nutrients, and under favorable conditions also denitrification and loss of NO_3-N to the atmosphere. Stanfield Marsh was predicted to be an effective sink for total P in supplemental water with Treatment Alternatives 1 and 2 but was a modest source of total P for Alternative 3 water (Figure 43, Table 26).

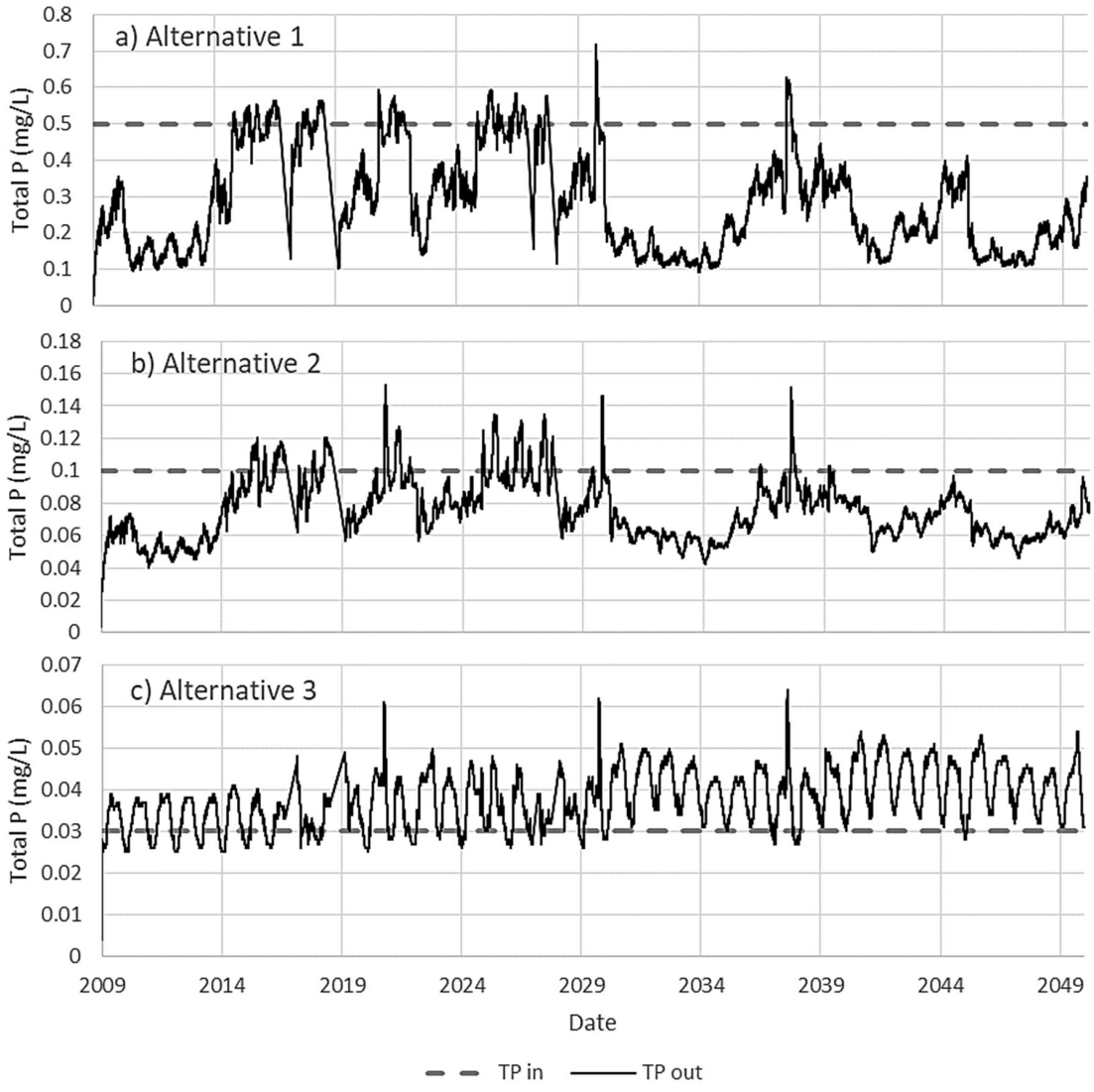


Figure 43. Total P concentrations into and out of Stanfield Marsh: a) Alternative 1, b) Alternative 2, and c) Alternative 3.

Interestingly, the marsh was predicted to be a net source of N for all 3 treatment scenarios; the basis for this is not entirely clear at this time, but sediment mineralization and potentially some N_2-fixation may be occurring during periods of intense primary production that could increase the total N concentration. Stabilization of the water level within the marsh through some hydraulic control would presumably increase nutrient retention and could promote denitrification, although additional work is needed to understand the dynamics within the Marsh, especially given natural variations in lake levels and intervals of wetting and desiccation.

Table 26. Predicted average total P and total N removal in Stanfield Marsh.

	Alternative 1		Alternative 2		Alternative 3	
	% Removal	kg/yr	% Removal	kg/yr	% Removal	kg/yr
Total P	14.8	175	8.4	20	-10.3	-7
Total N	-22.5	-1174	-17.0	-442	-19.0	-270

Summary

Simulations indicate net removal of total P from Alternative 1 and Alternative 2 effluents during flow through Stanfield Marsh, while the Marsh was predicted to be a modest source of total P to Alternative 3 water with very low influent concentrations. Interestingly, the Marsh was predicted to be a source of total N across all levels of treatment, due presumably to sediment decay, some N_2-fixation and subsequent decay in response high PO_4-P concentrations and high TN:TP ratios in the effluent. Further work is needed, however, to better understand the role of the Marsh as a net sink and/or source for nutrients.

VII. SUMMARY

Lake conditions and water quality in Big Bear Lake varied significantly over 2009-2019, with wide natural variations in lake level, volume and surface area, as well as concentrations of TDS, nutrients and chlorophyll-a. Statistical, machine learning and hypolimnetic mass balance analyses provided valuable new information about water quality in Big Bear Lake, while CE-QUAL-W2 was able to reproduce observed trends in lake conditions. Supplementation of natural runoff with Replenish Big Bear water significantly increased lake levels, volumes and surface areas, especially during periods of drought, with resulting recreational, aesthetic, community and related benefits. The level of treatment had dramatic effects on water quality, however. Nutrient removal (Alternative 1) was not sufficient to protect water quality in Big Bear Lake, although nutrient removal with further treatment (Alternatives 2 and 3) was predicted to yield water quality comparable to or slightly improved relative to baseline conditions.

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APPENDIX C: REPLENISH BIG BEAR: MODELING OF HIGHER FLOWS AND WITH ZERO TP LOAD

REPLENISH BIG BEAR: MODELING OF HIGHER FLOWS AND WITH ZERO TP LOAD

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Coeur d'Alene, ID

February 24, 2022

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Introduction

It was previously noted that water quality was predicted to vary markedly with the level of treatment of added Replenish Big Bear (RBB) recycled water, with Alternative 1 (TIN and TP removal) significantly degrading water quality in Big Bear Lake relative to predicted baseline conditions, while Alternative 2 (70% RO) modestly increased average predicted concentrations of TN, TP and chlorophyll-a, and Alternative 3 (100% RO) was predicted to slightly improve average water quality for the 2009-2019 period (Anderson, 2021, Table 22). Long-term simulations for different hydrologic scenarios yielded similar results, with 100% RO yielding predicted water quality typically comparable to baseline conditions. Notwithstanding, some subtle differences were observed between predicted median baseline concentrations and those for Alternative 3 which assumed steady annual flows of 1920 af/yr of 100% RO water (Anderson, 2021, Table 25).

Recent engineering work indicates that slightly higher inflows, up to 2210 af/yr, can be attained by the Replenish Big Bear project by employing additional brine minimization technology (Table 1). Note that a portion of the water produced by RBB may be discharged to Shay Pond and the earlier "Alternative 3" scenario had excluded those flows (up to 80 af/yr) from the analysis. However, to be conservative for permitting purposes, this analysis is based on discharging all of the recycled water produced to the Lake.

Table 1. Initial and recently updated Replenish Big Bear (RBB) flow projections.

Scenario	**Annual RBB Inflow (af)**	**Daily RBB Inflow (MGD)**
Baseline	0	0
Alternative 3 [(a)]	1920	1.71
High Flow (99% recovery) [(b)]	2210	1.57 – 2.18
Mid Flow (90% recovery) [(b)]	2009	1.42 – 1.98

Notes:

[(a)]Alternative 3 was assessed in the 2021 Lake Analysis and assumed that of the total Replenish Big Bear effluent contribution considered in the Lake Analysis (i.e., 2,000 AFY), 80 AFY would be delivered to Shay Pond. Therefore, only 1,920 AFY would be discharged to the Lake.

[(b)]The updated model analysis assumed that no discharge to Shay Pond would occur and all recycled water would be discharged to the Lake under two different total recovery rates scenarios.

Moreover, deliveries are expected to vary seasonally (Fig 1), thus varying from the earlier "Alternative 3" scenario that assumed uniform flows of 1.71 MGD throughout the year. Inflows to the WWTP are lower in the summer months due to reduced inflow.

Since the Replenish Big Bear project does not have a waste load allocation for total P (TP) in the current TMDL, it is proposing to offset the TP load in the project inflows delivered to Big Bear Lake. While RO is extremely effective at removing dissolved and particulate substances, there nonetheless is a small quantity of TP that is expected to evade treatment (the projected RO effluent concentration is 0.03 mg/L, principally as o-PO_4-P). Elimination of all TP through the treatment process is not practicable, so removal of an equivalent load of TP (up to 200 lbs/yr) from elsewhere in the lake or watershed will be necessary.

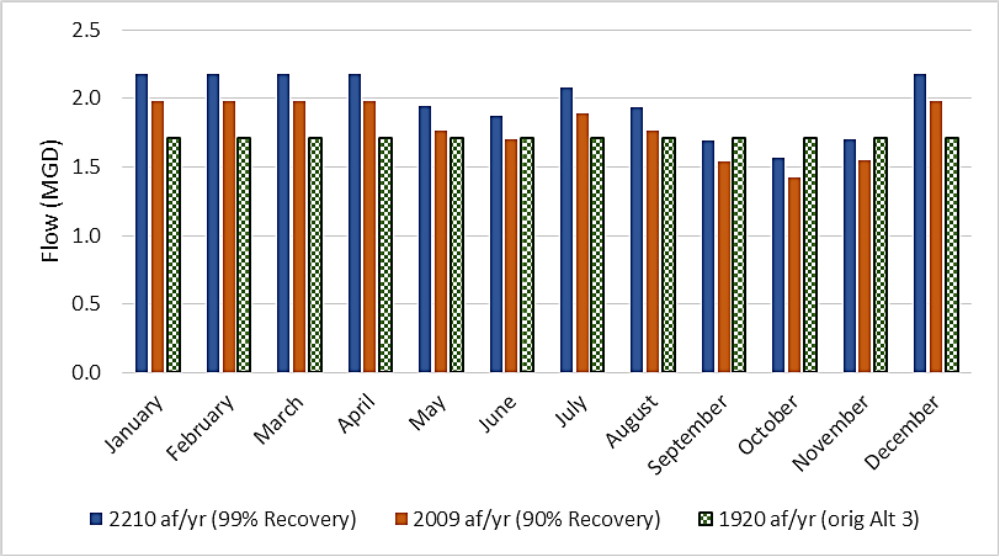

Fig. 1. Monthly flow rates (projected 2040) for Replenish Big Bear under three project inflow scenarios.

In light of these factors, further modeling was conducted to evaluate predicted water quality under these operational scenarios (increased and time-varying flows, with and without TP offset) for comparison with the previously predicted baseline condition and Alternative 3 scenario. Given the complexity of nutrient budgets of lakes, array of possible offset strategies, and equivalence of a given form of nutrient irrespective of its particular origin, TP offset will be modeled as equivalent to 0 influent concentration. This is an approximation that holds when considering whole-lake nutrient budget, but is nonetheless a simplification; depending upon details of offset, hydrodynamic considerations and other factors, some modest lateral gradients in water quality may result. The 50th percentile hydrologic scenario for 2009-2050 was used in this analysis, noting that it includes a wide array of runoff conditions, included extended drought and as well as periods of high runoff. All other hydrologic, meteorological, biological, chemical and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021).

Results

Long-term averaged predicted concentrations of TDS, TIN, total P, total N and chlorophyll-a were lower with addition of RBB water compared with predicted baseline conditions (no supplementation) (Table 2). For reference, TMDL target values are included in the table. Focusing on chlorophyll-a as the key response target, baseline conditions were predicted to yield growing-season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the TMDL target value of 14 µg/L, while Alternative 3 matched the target value, and larger inputs of RBB inflow that varied seasonally (Fig. 1) yielded values below baseline and TMDL target values (Table 2). Zeroing out the load of TP in RBB inflow yielded further reductions in chlorophyll-a; larger inflow volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 - 10.2 µg/L, significantly below predicted baseline and TMDL concentrations (Table 2).

Table 2. Long-term average predicted concentrations of total P, total N and chlorophyll-a in Big Bear Lake under different operational scenarios (total P and total N expressed as annual average concentrations; chlorophyll-a shown as growing season average concentrations).

Operational Scenario (all at 50th % hydrology)	**TDS (mg/L)**	**TIN (mg/L**	**Total P (µg/L)**	**Total N (mg/L)**	**Chlorophyll-a (µg/L)**
Baseline	**195**	**0.069**	**47.7**	**1.15**	**14.1**
Alternative 3 (1920 af)	182	0.052	43.3	1.07	14.0
2210 af (99% recovery)	**179**	**0.045**	**42.3**	**1.04**	**13.1**
2009 af (90% recovery)	**180**	**0.041**	**43.4**	**1.06**	**12.9**
2210 af + 0 total P	179	0.072	39.9	1.00	10.2
2009 af + 0 total P	180	0.040	40.9	1.00	9.5
TMDL target			***35.0***		***14.0***

Supplementation with RBB inflow also lowered concentrations of total P and total N relative to predicted baseline levels (Table 2). This is consistent with the reduced concentrations of total N and total P (and most dissolved forms of N and P) in RO water relative to watershed runoff concentrations (Anderson, 2021, Table 20), with concentrations projected to be only 40% - 80% of average watershed runoff concentrations (Anderson, 2021, Table 21). Interestingly, zeroing out the influent TP concentration not only lowered the predicted average total P concentration but also reduced the predicted total N concentrations, highlighting the complex biogeochemical coupling of these two key nutrients. While it is important to recognize the uncertainty in model predictions, it is nonetheless noteworthy that revised project flows, with varying seasonal flow and TP offset, yielded average chlorophyll-a concentrations significantly below baseline and TMDL values and also yielded long-term average TN concentrations approaching or reaching 1 mg/L, which is being considered by the Regional Water Board. Predicted long-term average TP concentrations remained above the TMDL target, but were nonetheless meaningfully lower than the predicted baseline level (Table 2). Average TDS and TIN concentrations were also lower than predicted baseline conditions (with exception of 2210 af + 0 TP, where a period of higher NO_3-N was predicted).

Inter-annual differences in water quality are nonetheless expected to persist. Cumulative distributions functions (CDFs) highlight the predicted wide range in annual and growing season average concentrations (Fig. 2). While addition of RBB inflow shifted CDFs to lower annual average total P and total N concentrations and growing season average chlorophyll-a concentrations, wide ranges in predicted concentrations remained in place (Fig. 2). Thus, the growing season average chlorophyll-a target of 14 µg/L was predicted to be exceeded about 53% of the time under baseline conditions, and exceeded about 41% and 31% of the time with RBB inflows of 2210 af/yr without and with TP offset, respectively (Fig. 2c; Table 3). Results for all scenarios are summarized in Table 3.

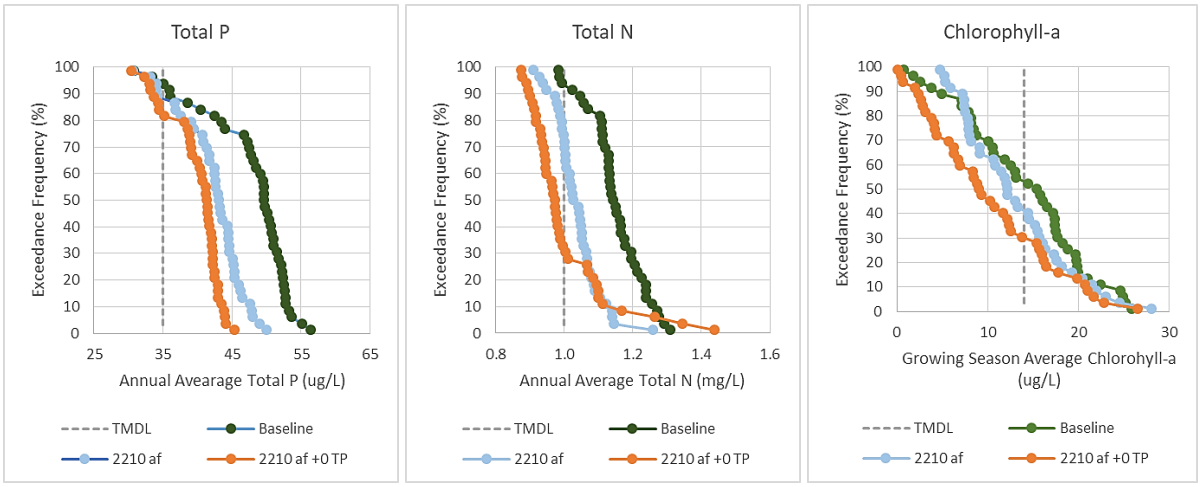

Fig. 2. Cumulative distribution functions for predicted annual total P and total N concentrations and growing season average chlorophyll-a concentrations for baseline condition and with 2210 af RBB inflow with and without TP offset.

Table 3. Predicted frequency of exceeding TMDL target under baseline conditions and different RBB inflow and TP offset scenarios (annual average or growing season average basis). Observed annual exceedance frequencies for 2009-19 period shown in parentheses under Baseline.

Variable	**Baseline**	**1920 af**	**2210 af**	**2210 af+0 TP**	**2009 af**	**2009 af+0 TP**
Total P	94 % (100%)	87 %	87 %	82 %	91 %	90 %
Total N[a]	91 % (na)	72 %	72 %	30 %	80 %	55 %
Chlorophyll-a	53 % (55%)	51 %	41 %	31 %	40 %	22 %

[a]*possible TMDL target*

References

Anderson, M.A. 2021. *Big Bear Lake Analysis: Replenish Big Bear.* Final Report. 65 pp.

REPLENISH
Big Bear

Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/Big Bear Lake and Shay Pond

Prepared by:

Water Systems Consulting, Inc &
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February 2022

Acknowledgment of Credit

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LIST OF ACRONYMS

4,4' DDT	4,4' Dichlorodiphenyltrichloroethane
AF	Acre Foot
AFY	Acre Feet Per Year
AGR	Agricultural Supply Beneficial Benefit
APU	Administrative Procedures Update
BBARWA	Big Bear Area Regional Wastewater Agency
BBCCSD	Big Bear City Community Service District
BBLDWP	Big Bear Lake Department Of Water And Power
BBMWD	Big Bear Municipal Water District
BO	Biological Opinion
BOD	Biological Oxygen Demand
BVBGSA	Bear Valley Basin Groundwater Sustainability Agency
CCC	Criterion Continuous Concentration
CDFW	California Department Of Fish And Wildlife
CEQA	California Environmental Quality Act
COLD	Cold Freshwater Habitat Beneficial Benefit
CSA53	County of San Bernardino Service Area
CTR	California Toxics Rule
CWA	Clean Water Act
DAC	Disadvantaged Community
DDW	California State Water Resources Control Board Division Of Drinking Water
DO	Dissolved Oxygen
EIR	Environmental Impact Report
GPM	Gallons Per Minute
GSP	Groundwater Sustainability Plan
GWR	Groundwater Recharge Beneficial Benefit
LWA	Larry Walker Associates
MCL	Maximum Contaminant Level
MG	Million Gallons
MGD	Million Gallon Per Day
MUN	Municipal And Domestic Supply Beneficial Benefit
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
MBAS	Methylene Blue-Activated Substances
MDL	Method Of Detection Limit

mg/L	Milligrams Per Liter
MSL	Mean Sea Level
Mutual	Bear Valley Mutual Water Company
N/A	Not Applicable
ND	Non-Detect
NS	Not Sampled
O&M	Operations And Maintenance
PCB	Polychlorinated Biphenyls
REC1	Water Contact Recreation Beneficial Benefit
REC2	Non-Contact Water Recreation Beneficial Benefit
RARE	Rare, Threatened, Or Endangered Species Beneficial Benefit
RL	Reporting Limit
RO	Reverse Osmosis
ROWD	Report Of Waste Discharge
SAR	Santa Ana River
SBNF	San Bernardino National Forest
SBVMWD	San Bernardino Valley Municipal Water District
SPWN	Spawning, Reproduction, and/or Early Development Beneficial Benefit
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TOT	Transient Occupancy Tax
TP	Total Phosphorus
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish And Wildlife Service
UV	Ultraviolet
VOCs	Volatile Organic Compounds
WARM	Warm Freshwater Habitat Beneficial Benefit
WDR	Waste Discharge Requirements
WILD	Wildlife Habitat Beneficial Benefit
WLA	Wasteload Allocation
WOTUS	Waters Of The U.S

WQO	Water Quality Objective
WSC	Water Systems Consulting
WWTP	Wastewater Treatment Plant

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EXECUTIVE SUMMARY

Project Description

The Big Bear Area Regional Wastewater Agency (BBARWA) operates an existing regional wastewater treatment plant (WWTP) and related facilities in the Big Bear Valley (Valley). BBARWA has partnered with Big Bear City Community Service District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), collectively known as the Agency Team, to develop the Replenish Big Bear Program. The Replenish Big Bear Program is intended to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The program is comprised of several elements; the first project includes treatment upgrades at the BBARWA WWTP to produce disinfected, advanced treated effluent by providing tertiary filtration, reverse osmosis (RO) treatment, and ultraviolet (UV) disinfection for 100% of the water proposed to be discharged to Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), a tributary of Big Bear Lake (Lake) and a separate discharge to Shay Pond, a tributary of Shay Creek. These discharges are referred to as the "Lake discharge" and the "Shay Pond discharge" and the approximate discharge locations are shown in **Figure ES-1**.

The new BBARWA WWTP facilities will be designed for a treatment capacity of 2.2 million gallons per day (MGD). By 2040, accounting for expected growth, it is estimated that the WWTP could produce 2,210 acre-feet per year (AFY) of advanced treated effluent, assuming a 99% total recovery rate could be achieved (90% RO recovery and 90% recovery of brine through brine minimization). Up to 80 AFY of the disinfected, advanced treated effluent will be sent to Shay Pond discharge, and any remaining disinfected, advanced treated effluent will be sent to the Lake discharge. All remaining flows in excess of the new treatment train's 2.2 MGD capacity will continue to be treated to undisinfected secondary standards and conveyed to BBARWA's existing Lucerne Valley site, which is regulated by the Colorado River Basin Regional Water Quality Control Board.

As described in the Technical Memorandum (Attachment B of the ROWD package) titled *Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency (WSC & LWA, 2022)*, the Agency Team proposes to implement a total phosphorus (TP) Offset Program for the Lake discharge to attain net zero TP loads to the Lake to be consistent with the assumptions of the Big Bear Lake Nutrient Total Maximum

Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions. While a portion of the disinfected, advanced treated effluent is planned for discharge to Shay Pond, the maximum anticipated Lake discharge of 2,210 AFY, coupled with the TP Offset Program in the Lake, is the basis of the antidegradation analysis for the Lake discharge. Modeling analysis has also been conducted to evaluate a range of additional scenarios; these results are presented herein to provide additional information.

The proposed Lake discharge will be physically discharged at the east end of Stanfield Marsh, then flow through the Marsh into the Lake through a set of culverts under Stanfield Cutoff. Due to prolonged drought conditions, Stanfield Marsh has been mostly dry since 2015. Therefore, current ambient water quality data is not available. Additionally, the water quality objectives (WQOs) specified for the Lake in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) are more stringent than those for Stanfield Marsh. Therefore, this antidegradation analysis focuses on the impacts to water quality in the Lake.

This antidegradation analysis provides the Santa Ana Regional Water Quality Control Board (Regional Water Board) with the information needed to determine whether the proposed Lake discharge and Shay Pond discharge are consistent with the State of California (State) and federal antidegradation policies.

Note that the Replenish Big Bear Program also includes subsequent uses of Lake water for purposes such as 1) landscape irrigation, construction uses, and snowmaking at the golf course and ski resort and 2) direct groundwater recharge in Sand Canyon. It is anticipated that these uses will be regulated separately and are not discussed in this antidegradation report. Coordination with the California State Water Resources Control Board Division of Drinking Water (DDW) is underway to regulate these recycled water uses.

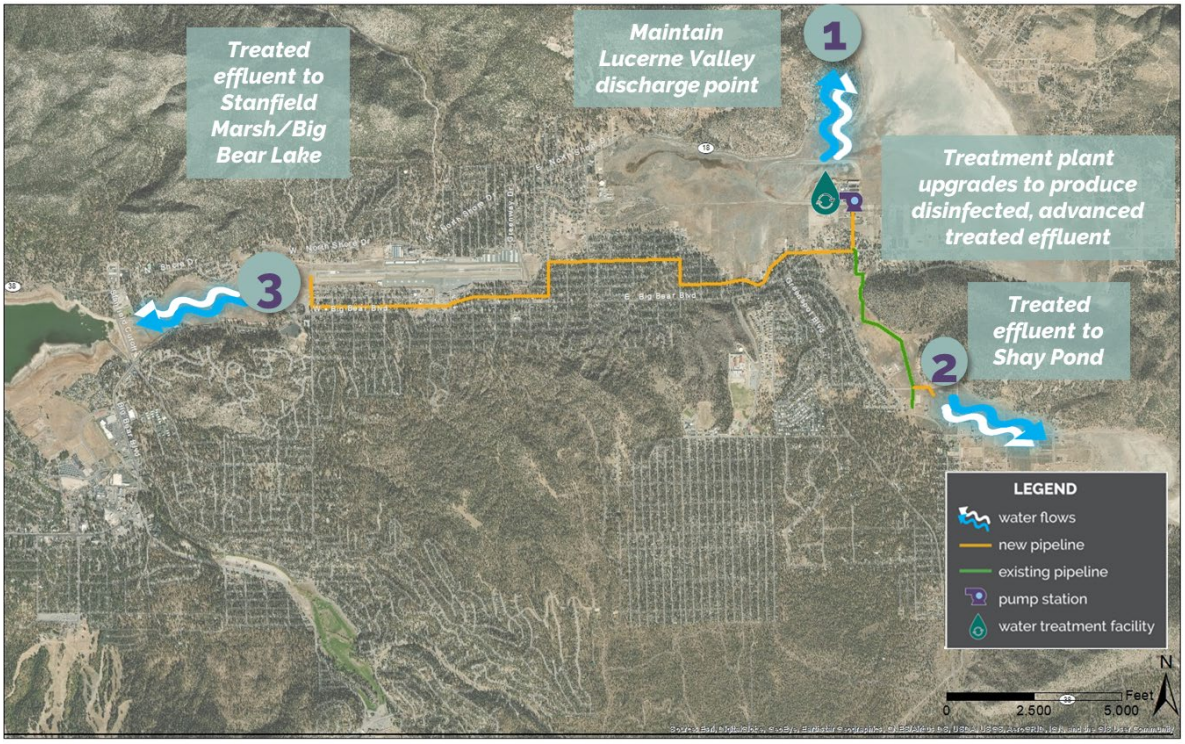


Figure ES - 1. Replenish Big Bear Program Lake and Shay Pond Discharge Locations

Water Quality Impacts of Proposed Discharges

The Replenish Big Bear Program Lake discharge is anticipated to improve Lake water quality for total dissolved solids (TDS), total phosphorus (TP), total nitrogen (TN), and chlorophyll-a as compared to modeled baseline (no project) conditions, and result in similar water quality for total inorganic nitrogen (TIN) as compared to the modeled baseline. In addition, the proposed discharge is anticipated to feature concentrations similar to or lower than ambient water quality and the most stringent WQO or criterion for all constituents evaluated except for boron. For boron, concentrations in the Lake are anticipated to increase as compared to baseline conditions, but remain well below the most stringent WQO of 0.75 mg/L.

The Shay Pond discharge is anticipated to be of better quality than the current potable water supply and ambient water quality for most constituents of interest. However, additional data may be needed to confirm these findings. Like the Lake discharge, boron may be the only constituent in the disinfected, advanced treated effluent discharged to Shay Pond that could be above existing ambient water quality for the constituent. However, it is well below the WQO of 0.75 mg/L that exists for the protection of water used to irrigate boron-sensitive agricultural crops, which is not a use of the water in Shay Pond. Additional coordination with the California Department of Fish and Wildlife (CDFW) will be conducted to ensure the Unarmored Threespine Stickleback (Stickleback) fish, a federally and State listed endangered species, and located in Shay Pond are protected.

Consistency with Antidegradation Policies

The proposed project, the discharge of disinfected, advanced treated BBARWA effluent to (1) Stanfield Marsh/ Lake at a discharge rate up to 2,210 AFY and (2) Shay Pond at a discharge rate up to 80 AFY, is determined to comprise best practicable treatment and control and is consistent with federal and State antidegradation policies for the following reasons:

- The proposed discharge to both Stanfield Marsh/ Lake and Shay Pond will not adversely affect existing or probable beneficial uses of either receiving water or downstream receiving waters, nor will the discharges cause water quality to not meet applicable water quality objectives.
- Overall, the proposed discharge is estimated to improve water quality in the Lake for TDS, TN, TP, and chlorophyll-a, maintain similar water quality for TIN, and have a very minor impact on boron. Future boron concentrations in the Lake are estimated to increase very slightly due to the proposed BBARWA discharge but are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron (see **Table 7** and **Section 5.3.2**). The Lake Analysis shows that projected ambient Lake concentrations of TIN and chlorophyll-a with the proposed discharge will exist below their relevant WQO (TIN) or TMDL target (chlorophyll-a). The Lake Analysis also shows that ambient Lake concentration of TDS and TP with the proposed discharge are estimated to exceed the 175 mg/L TDS WQO and the 35 µg/L TP TMDL target, respectively. However, the modeled baseline (no project) condition is projected to result in Lake concentrations for TDS, TP, TIN, and chlorophyll-a that exceed those concentrations more often than all modeled BBARWA discharge scenarios. Modeled results for the proposed BBARWA discharge, when combined with a TP Offset Program (see Attachment B of the ROWD package), show the greatest improvements to future, ambient Lake concentrations as compared to the modeled baseline (no project) condition.

- Overall, the proposed BBARWA discharge is estimated to have a very minor impact on Shay Pond water quality and Shay Creek water quality downstream of the pond. The proposed project is estimated to potentially cause a very minor increase in boron concentrations in the pond and downstream in Shay Creek, but concentrations are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron. The disinfected, advanced treated effluent proposed for discharge to the pond is anticipated to lower the concentrations of those constituents listed in **Table 13** as compared to existing ambient concentrations that are largely influenced by the groundwater currently discharged by BBCCSD to the pond to maintain water levels for the endangered Stickleback.
- Based on the above, the request to permit a new discharge to both Stanfield Marsh/ Lake and Shay Pond is consistent with federal and State antidegradation policies in that the minor lowering of water quality boron in the Lake (see **Table 7**) and Shay Pond (see **Table 13**) is necessary to accommodate important economic or social development[1], will not unreasonably affect beneficial uses, will not cause further exceedances of applicable WQOs, and is consistent with the maximum benefit to the people of the State.
- Based on the above, the request to permit new discharges to Stanfield Marsh/ Lake and Shay Pond are consistent with the Porter-Cologne Act in that the resulting water quality will constitute the highest water quality that is reasonable, considering all demands placed on the waters, economic and social considerations, and other public interest factors.

The proposed discharge of disinfected, advanced treated BBARWA effluent to Stanfield Marsh/ Lake and Shay Pond also fully supports California's *Recycled Water Policy* (SWRCB, 2013) in that it would result in an increased use of recycled water from municipal wastewater sources, would incrementally reduce reliance on the vagaries of annual precipitation, and would assist in the sustainable management of surface and groundwater resources.

[1] Maintain and improve recreation and tourism in the Big Bear Lake region which in turn stimulates the local and regional economies.

1 INTRODUCTION

This section provides an overview of the Replenish Big Bear Program, description of the proposed discharges to Stanfield Marsh, a tributary of the Lake, and a separate discharge to Shay Pond, a tributary of Shay Creek. This section also discusses the purpose and approach used in this antidegradation analysis report.

1.1 Program Overview

BBARWA is a joint powers authority formed in 1974 to provide centralized wastewater conveyance, treatment, and disposal for the City of Big Bear Lake, representing approximately 47% of the total connections, BBCCSD, representing approximately 48% of the total connections, and County of San Bernardino Service Area 53B (CSA53), representing approximately 5% of the total connections. Each of these member agencies maintains and operates its own wastewater collection system that conveys wastewater to BBARWA's interceptor system for transport to the BBARWA WWTP. The BBARWA service area includes the entire Valley and covers about 79,000 acres. BBARWA owns and operates a regional WWTP to treat the Valley's wastewater and currently discharges undisinfected secondary effluent to Lucerne Valley, which is located outside the Santa Ana Watershed.

The Replenish Big Bear Program is a collaborative regional water resources program being implemented by Agency Team to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation through the recovery of this local water resource currently discharged outside of the watershed.

The Replenish Big Bear Program is comprised of three independent projects:

1) Discharge of disinfected, advanced treated effluent to Stanfield Marsh, which is tributary to the Lake, and a separate discharge to Shay Pond;
2) Use of Lake water for purposes such as landscape irrigation of the local golf course, construction uses and snowmaking; and
3) Use of Lake water for groundwater recharge in Sand Canyon.

The first project is the subject of this antidegradation analysis and is foundational to the Replenish Big Bear Program and necessary to enable implementation of the subsequent uses of Lake water. As part of the first project, the BBARWA WWTP will be upgraded to produce disinfected, advanced treated effluent through tertiary filtration using ultrafiltration, and RO treatment with UV disinfection for the proposed discharges to the Lake and Shay Pond.

Although the proposed Lake discharge will be physically discharged at the east end of Stanfield Marsh, then flow through the Marsh into the Lake through a set of culverts under Stanfield Cutoff, this antidegradation analysis was completed for the Lake since Stanfield Marsh has been mostly dry since 2015. Therefore, current ambient water quality data is not available for this antidegradation analysis. Additionally, the WQOs specified for the Lake in the Basin Plan are more stringent than those for Stanfield Marsh.

Figure 1 shows the WWTP and proposed discharge locations, which are components of the first project. The proposed project's two discharge points will allow BBARWA to minimize the discharge of disinfected, advanced treated effluent outside of the watershed. The Lake discharge will increase Lake levels to better support beneficial uses including recreation and habitat, particularly during times of drought. The Shay Pond discharge will replace potable water currently discharged to the waterbody to maintain the water flow through the pond. Up to 80 AFY of disinfected, advanced treated effluent will be sent to Shay Pond, and any remaining disinfected, advanced treated effluent will be sent to the Lake.

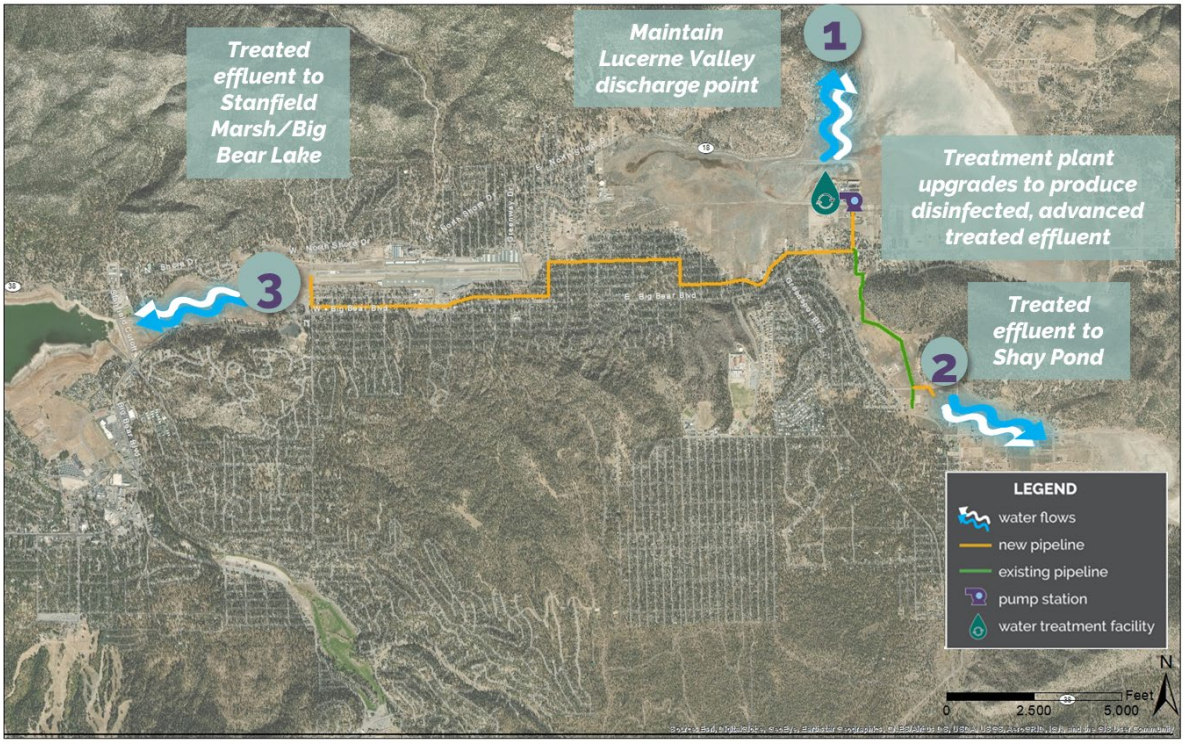


Figure 1. Replenish Big Bear Program Lake and Shay Pond Discharge Locations

The other two projects will utilize Lake water for purposes such as1) landscape irrigation, construction uses, and snowmaking at the ski resort, and 2) direct groundwater recharge in Sand Canyon. **Figure 2** shows the general location of these two projects. The golf course irrigation, construction uses, and snowmaking project can be implemented using existing infrastructure used for snowmaking that draws water from the Lake. The Sand Canyon recharge project will require construction of a pump station, pipeline, recharge ponds and monitoring wells and may be implemented in parallel with the Lake discharge.

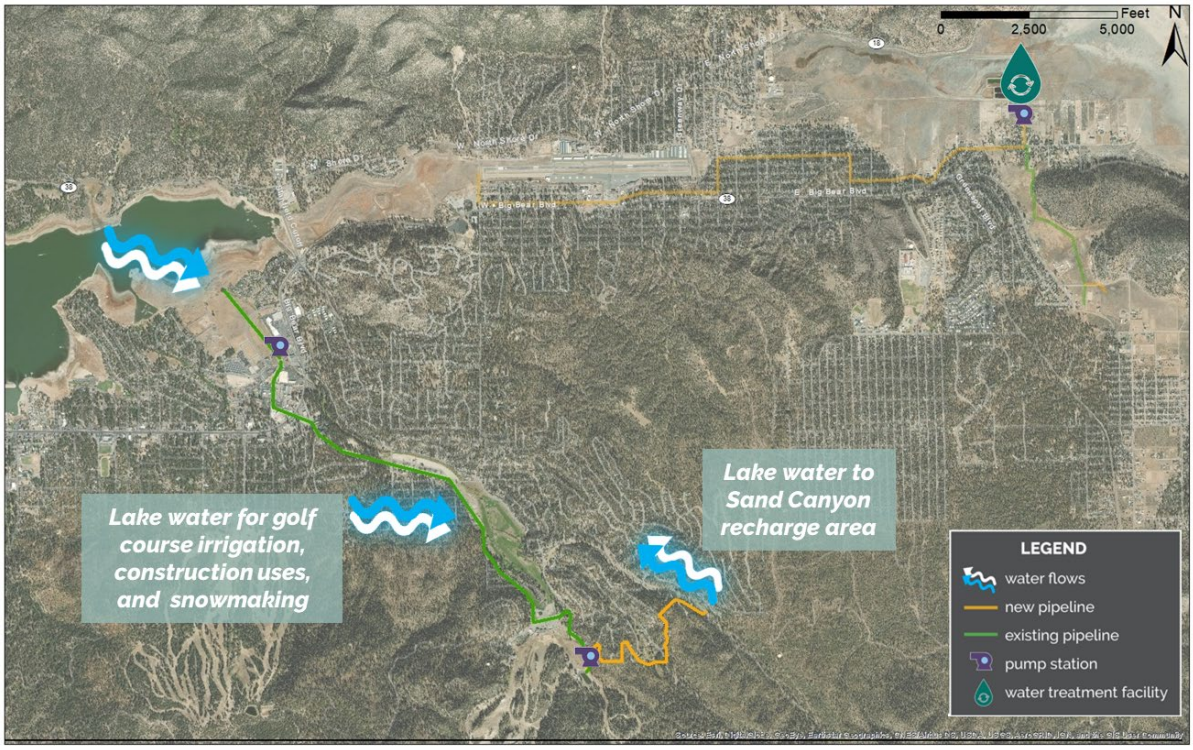


Figure 2. Replenish Big Bear Program Subsequent Uses of Lake Water

1.2 Project Description

The discharge of disinfected, advanced treated effluent to Stanfield Marsh, which is tributary to the Lake, and a separate discharge to Shay Pond is the subject of this antidegradation analysis. The proposed discharges require the construction of WWTP upgrades, an effluent booster pump station at the WWTP site and approximately seven (7) miles of pipeline to convey water to the discharge locations.

Figure 3 shows a process flow diagram of the existing BBARWA WWTP treatment process.

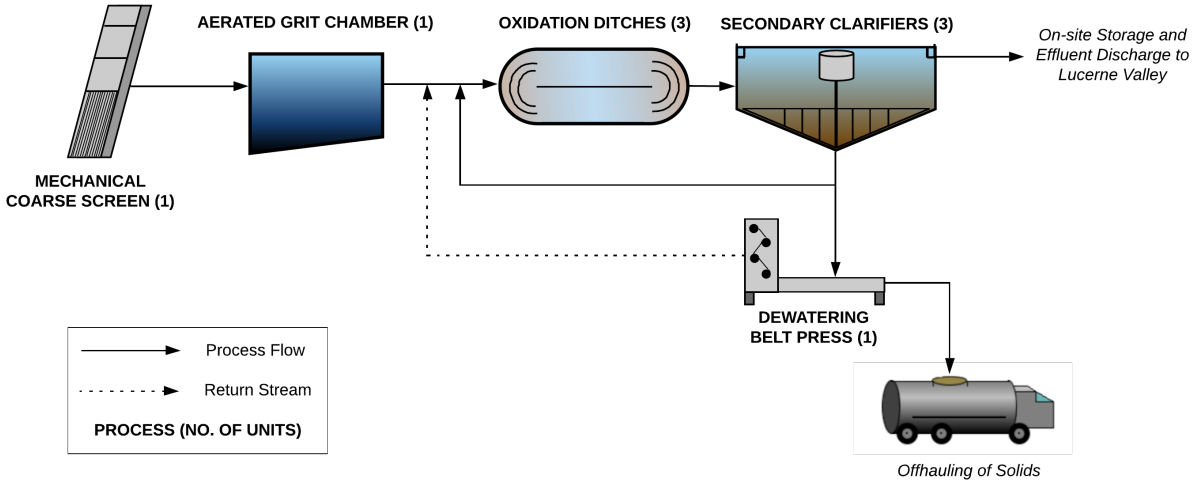


Figure 3. BBARWA Existing WWTP Process Flow Diagram

The existing BBARWA WWTP secondary treatment facility has a capacity of 4.89 MGD and a hydraulic capacity of 9.1 MGD. The WWTP treats commercial and domestic wastewater from the City of Big Bear Lake, BBCCSD, and CSA53 collection systems. The existing treatment process includes the following:

- Preliminary treatment consisting of a mechanical coarse screen and an aerated grit chamber;
- Secondary treatment consisting of extended aeration oxidation ditches and secondary clarifiers; and
- Solids handling through a dewatering belt filter press.

Treated effluent is temporarily stored on-site prior to discharge to Lucerne Valley and dewatered solids are hauled off-site. The undisinfected secondary effluent discharged to Lucerne Valley is currently used to irrigate crops used for livestock feed. This discharge is regulated under Order R7-2021-0023 Waste Discharge Requirements (WDR) permit, issued by the Colorado River Basin Regional Water Quality Control Board (**Appendix A**).

The proposed upgrades, as shown in **Figure 4**, to the BBARWA WWTP to produce disinfected, advanced treated effluent include:

- Biological nutrient removal improvements to the existing oxidation ditches for improved nitrification and denitrification;
- Tertiary filtration and nitrogen and phosphorus removal via denitrification filters;

- Low- and high-pressure filtration with ultrafiltration (UF) membranes and 90% recovery RO membranes;
- Brine pellet reactor for brine minimization to produce a total system recovery of 99%; and
- UV disinfection.

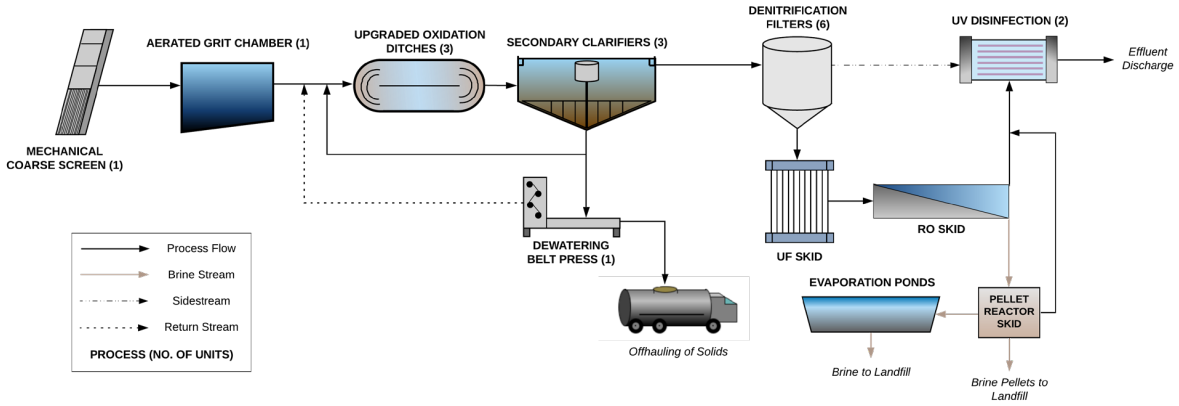


Figure 4. BBARWA Proposed WWTP Treatment Upgrades Flow Diagram

The proposed upgrades (i.e., new advanced treatment train) would be designed for a treatment capacity of 2.2 MGD. By 2040, accounting for expected growth, it is estimated that the WWTP could produce 2,210 AFY of advanced treated effluent, assuming a 99% total recovery rate could be achieved (90% RO recovery and 90% recovery of brine through brine minimization). The WWTP currently produces about 2.0 MGD of undisinfected secondary effluent on an average annual basis.

The RO brine management option included in the preliminary design for Replenish Big Bear is a brine minimization pellet reactor to reduce the volume of brine produced by the RO process. The reduced brine stream from the pellet reactor will be conveyed to evaporation ponds located on BBARWA WWTP property. It is assumed that an RO recovery of 90% at 2.2 MGD influent flow would result in 0.22 MGD of RO brine to be minimized through the pellet reactor and approximately 0.022 MGD of liquid brine to be conveyed to the evaporation pond based on a pellet reactor recovery of 90%. A total evaporation pond area of 23 acres is needed for the brine stream. The RO brine management strategy will be evaluated further as the Project enters the design phase, along with refinements to total system recoveries based on site-specific piloting results.

BBARWA also plans to maintain the existing Lucerne Valley discharge location. All WWTP process water in excess of the new treatment train's 2.2 MGD capacity will continue to be treated to undisinfected secondary levels and conveyed to the existing Lucerne Valley site, consistent with the current, permitted discharge requirements of the existing BBARWA WWTP.

1.3 Purpose of Report

As required by the Clean Water Act (CWA), the discharge of any pollutant or combination of pollutants to surface waters that are deemed waters of the United States (U.S.), as is the Lake discharge and potentially Shay Pond discharge, must be regulated by a National Pollutant Discharge Elimination System (NPDES) permit. Because the two proposed discharge locations are new discharges to surface waters of the U.S., a NPDES permit governing the proposed discharges must be requested from the Regional Water Board.

Under the State and federal antidegradation policies, the Regional Water Board is required to make a finding regarding the satisfaction of the policies as they pertain to surface water discharges for which the Regional Water Board issues a NPDES permit. The State antidegradation policy, which incorporates the federal antidegradation policy, seeks to maintain the existing high quality of water to the maximum extent possible, and only allows a lowering of water quality if:

- Changes in water quality are consistent with maximum benefit to the people of the state, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards, and
- Waste discharge requirements for a proposed discharge will result in the best practicable treatment or control of the discharge necessary to assure:
    - No pollution or nuisance; and
    - Highest water quality consistent with maximum benefit to the people of the State.

The purpose of this report is to provide the Regional Water Board with the information needed to determine whether the proposed discharges are consistent with State and federal antidegradation policies. This antidegradation analysis includes assessments of water quality impacts on the receiving waters and downstream receiving waters estimated to result from the proposed project; an evaluation of how these estimated changes in water quality compare to applicable WQO and relevant water quality criteria; how estimated changes in water quality may affect existing or probable beneficial uses; and a finding of consistency with antidegradation policies.

1.4 Analysis Approach

The following antidegradation analysis is tailored to be consistent with federal and State antidegradation policies and the guidance provided in the Administrative Procedures Update (APU) 90-004. Pursuant to the APU guidelines, this analysis follows the provisions for a "simple analysis" and evaluates whether changes in water quality resulting from the proposed new discharges to the Lake and Shay Pond are "*consistent with maximum benefit to the people of the State, will not unreasonably affect uses and will not cause water quality to be less than water quality objectives and that the discharge provides protection of existing in-stream beneficial uses and water quality necessary to protect those uses.*"

In general, the data available for existing secondary effluent quality, projected disinfected advanced treated effluent quality, and ambient water quality were assessed to determine if the proposed future discharge would result in concentrations that exceed existing ambient water quality and/or relevant WQOs or criteria. For constituents anticipated to lead to a lowering of existing ambient water quality or an exceedance of relevant WQOs or criteria, further analysis was conducted.

Additionally, TDS, TIN, TN, TP, and chlorophyll-a were evaluated using a two dimensional (2D) hydrodynamic-water quality model (CE-QUAL-W2) developed for Big Bear Lake by Dr. Michael A. Anderson (Dr. Anderson), a limnologist who has in-depth knowledge of the Lake. The model evaluation was conducted to help select the preferred treatment alternative and assess the impacts of the proposed Lake discharge on constituents of interest. The water quality impacts with and without the proposed project were assessed for three different treatment alternatives as documented in *Big Bear Lake Analysis: Replenish Big Bear* (2021 Lake Model Analysis; **Appendix B**). Additional model updates were recently completed to incorporate additional discharge volume scenarios and seasonal variability and documented in *Replenish Big Bear: Modeling of Higher Flows and with Zero TP Load* (2022 Lake Model Update; **Appendix C**). The model results from both analyses are discussed in this report.

For constituents not able to be evaluated by the CE-QUAL-W2 model, their potential impacts with regard to a lowering of existing ambient water quality and/or the exceedance of relevant WQOs or criteria were assessed using a simple mass balance equation.

2 REGULATORY REQUIREMENTS

This section summarizes the federal and State antidegradation policies considered in this antidegradation analysis.

2.1 Applicable Laws and Policies

The federal Clean Water Act (CWA) requires states to adopt, with United States Environmental Protection Agency (U.S. EPA) approval, water quality standards applicable to all intrastate waters (33 U.S.C. § 1313). U.S. EPA regulations also require state water quality standard submittals to include an antidegradation policy to protect beneficial uses and prevent further degradation of high-quality waters (33 U.S.C. § 1313(d)(4)(B); 40 C.F.R. § 131.12). The State's antidegradation policy is embodied in State Water Resources Control Board (SWRCB) Resolution 68-16.

BBARWA's requested discharge of disinfected, advanced treated effluent to the Lake and to Shay Pond requires the application of WQOs contained in the Basin Plan, as well as criteria promulgated by the U.S. EPA for California waters. Both the federal and State antidegradation policies apply to the proposed surface water discharges of treated effluent to the Lake and to Shay Pond.

2.2 Federal Policies and Guidance

The federal antidegradation policy is designed to protect existing uses and the level of water quality necessary to protect existing uses and provide protection for higher quality and outstanding national water resources. The federal policy directs states to adopt a statewide policy that includes the following primary provisions (40 C.F.R. § 131.12).

1) *Existing in-stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*

2) *Where the quality of waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after the full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost effective and reasonable best management practices for nonpoint source control*

3) *Where high quality waters constitute an outstanding National resource, such as water of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.*

4) *In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with Section 316 of the Act.*

Based on guidance developed by the U.S. EPA, Region 9 (Guidance on Implementing the Antidegradation Provisions of 40 C.F.R. § 131.12 (U.S. EPA, 1987)) and guidance issued by SWRCB with regard to application of the Federal Antidegradation Policy (Memorandum from William R. Attwater to Regional Board Executive Officers Federal Antidegradation Policy (Attwater, Oct. 1987)), application of the federal antidegradation policy is triggered by a lowering, or potential lowering, of surface water quality. A proposed increase in the volume of an existing discharge or a new discharge to surface water is typically considered a trigger to the application of the federal antidegradation policy. Because the Project is proposing two new discharges to surface waters, the federal antidegradation policy applies.

Both the Lake and Shay Pond are not designated as outstanding natural resource waters and therefore, the receiving waters are not subject to that portion of the federal policy. The application to other portions of the policy is determined on a constituent-by-constituent basis. For a water body where water quality is not significantly better than needed to meet designated uses, either because it does not meet or it just meets applicable water quality objectives or criteria to protect beneficial uses, a new discharge cannot cause further impairment.

For waters with water quality that is better than necessary to support beneficial uses, the new discharge may not lower water quality unless such lowering is necessary to accommodate important economic or social development. In August 2005, the U.S. EPA issued a memorandum discussing antidegradation reviews and significance thresholds (Memorandum from Ephraim S. King, Director, Office of Science and Technology, U.S. EPA, Office of Water to Water Management Division Directors, Regions 1-10 (August 2005). As discussed in the memorandum, an intent of the policy "is to maintain and protect high quality waters and not to allow for any degradation beyond a *de minimis* level without having made a demonstration, with opportunity for public input, that such lowering is necessary and important." (Memorandum at p. 1). U.S. EPA has determined that the significance threshold of a 10% reduction in available assimilative capacity is "workable and protective in identifying those significant lowering of water quality that should receive a full… antidegradation review, including public participation." (U.S. EPA, 2005). This determination by U.S. EPA is helpful in determining the magnitude of water quality change that is determined to be of significant interest in the antidegradation analysis.

2.3 State Policies and Guidance

2.3.1 Resolution 68-16

The State issued its own antidegradation policy in 1968 to protect and maintain existing water quality in California. The State's Resolution 68-16 is interpreted to incorporate the federal antidegradation policy and satisfies the federal regulation requiring states to adopt their own antidegradation policies. Resolution 68-16 states, in part:

1) *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses of such water and will not result in water quality less than that prescribed in the policies.*

2) *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality water will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.*

2.3.2 1987 Policy Memorandum

In 1987, SWRCB issued a policy memorandum to the Regional Water Quality Control Boards (Regional Water Boards) to provide guidance on the application of the federal antidegradation policy for State and Regional Water Board actions, including establishing water quality objectives, issuing NPDES permits, and adopting waivers and exceptions to water quality objectives or control measures (Attwater, 1987). In conducting these actions, the Regional Water Boards must assure protection of existing beneficial uses, that significant lowering of water quality is necessary to accommodate important economic or social development, and that outstanding national resource waters be maintained and protected. The 2005 U.S. EPA guidance referenced in the Federal Policies and Guidance Section above is useful in determining whether changes in water quality that may result from a proposed action are significant.

2.3.3 Administrative Procedures Update (APU) 90-004

SWRCB issued guidance (APU 90-004) to all Regional Water Boards in 1990 regarding the implementation of State and federal antidegradation policies in NPDES permits. By using this guidance, Regional Water Boards are to determine if a proposed discharge is consistent with the intent and purpose of the State and federal antidegradation policies. APU 90-004 provides Regional Water Boards with guidance on the appropriate level of analysis that may be necessary, distinguishing between the need for a "simple" antidegradation analysis and a "complete" antidegradation analysis. If it is determined that a simple analysis is not appropriate based on the estimated level of impact of the new discharge, then a more rigorous analysis – a complete analysis – is appropriate. A primary focus of the complete analysis is the determination of whether and the degree to which water quality is lowered as compared to the socioeconomic costs of maintaining existing water quality. This determination greatly influences the level of analysis required and the level of scrutiny applied to the "balancing test" – that is, whether the discharge is necessary to accommodate important economic and social development, and whether a water quality change is consistent with the maximum benefit to the people of the State.

The antidegradation analysis addresses the following questions stated in SWRCB APU 90-004 to maintain consistency with State and federal antidegradation policies.

- Whether a reduction in water quality will be spatially localized or limited with respect to the water body; e.g., confined to the mixing zone;
- Whether the proposed discharge of treated effluent will produce minor effects which will not result in a significant reduction of water quality;

- Whether the proposed discharge of treated effluent has been approved in a General Plan, or similar growth and development policy document, and has been adequately subjected to the environmental analysis required in an environmental impact report (EIR) required under the California Environmental Quality Act (CEQA); and
- Whether the proposed Project is consistent with maximum benefit to the people of the State.

The Replenish Big Bear Program seeks to discharge highly treated effluent receiving RO treatment and UV disinfection to the Lake and to Shay Pond. BBARWA has reviewed the NPDES guidance issued by SWRCB in APU 90-004 and believes that the proposed project meets the criteria for a simple antidegradation analysis. The following sections provide the rationale for this determination and an associated level of analysis and information for use by the Regional Water Board in its consideration of state and federal antidegradation requirements in accordance with APU 90-004.

3 APPLICABLE WATER QUALITY STANDARDS

This section summarizes the applicable water quality standards for Stanfield Marsh and the Lake. Stanfield Marsh and the Lake are both waters of U.S., which have several designated beneficial uses. Water quality standard applicable to Shay Pond are discussed in **Section 6**. **Figure 5** shows the proposed discharge location in reference to Stanfield Marsh and Lake.

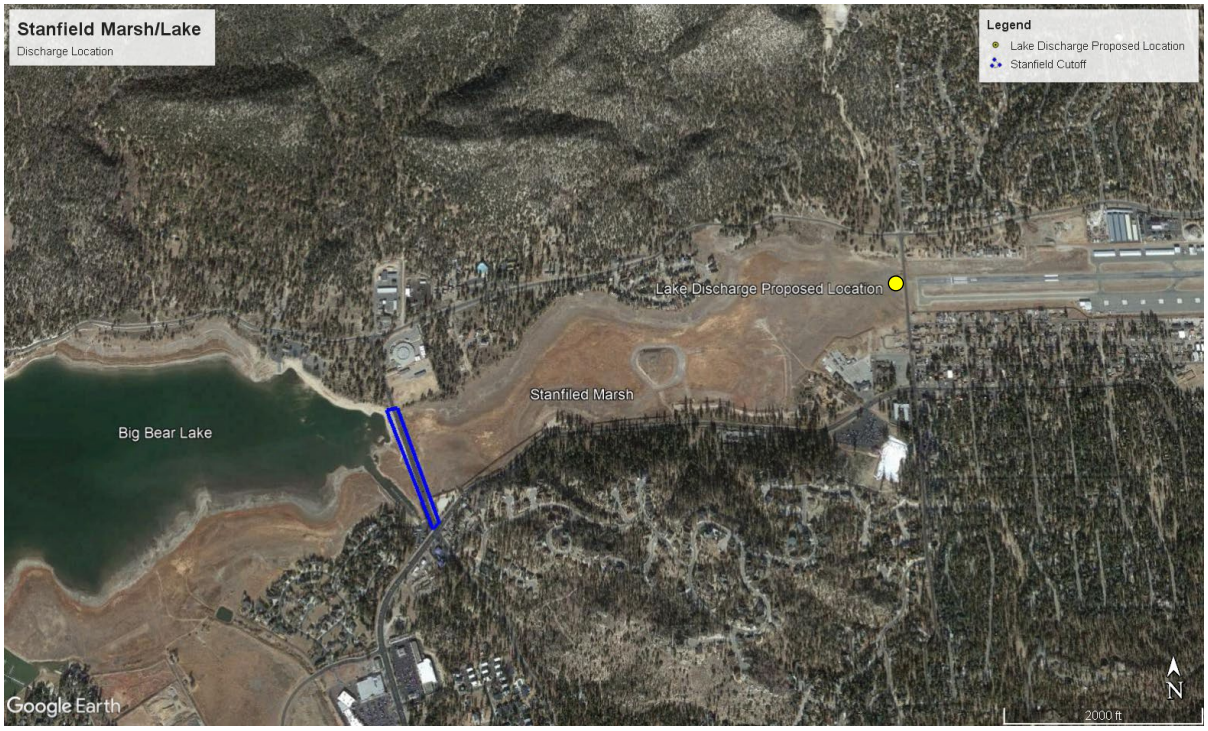


Figure 5. Overview of Lake Discharge Location in Reference to Stanfield Marsh/Lake

3.1 Beneficial Uses

The Basin Plan contains descriptions of the legal, technical, and programmatic bases for water quality regulation in the Santa Ana region. The Basin Plan describes the beneficial uses of major surface waters and their tributaries and the corresponding WQOs put into effect to protect these beneficial uses. **Table 1** shows the designated beneficial uses of the Lake and Stanfield Marsh.

Table 1. Beneficial Uses of Lake and Stanfield Marsh

Beneficial Uses	Big Bear Lake	Stanfield Marsh
AGR - Agricultural Supply	✓	
COLD - Cold Freshwater Habitat	✓	✓
GWR - Groundwater Recharge	✓	
MUN - Municipal and Domestic Supply	✓	✓
RARE - Rare, Threatened, or Endangered Species	✓	✓
REC1 - Water Contact Recreation	✓	✓
REC2 - Non-Contact Water Recreation	✓	✓
SPWN - Spawning, Reproduction, and/or Early Development	✓	
WARM - Warm Freshwater Habitat	✓	
WILD - Wildlife Habitat	✓	✓

3.2 Water Quality Objectives/Water Quality Criteria

To protect the designated beneficial uses, the Regional Water Board applies WQOs contained in the Basin Plan and criteria adopted in the California Toxics Rule (CTR) and the National Toxics Rule (NTR) to the receiving water (i.e., Lake) and downstream receiving waters (i.e., Bear Creek and subsequently Santa Ana River Reach 6). Per the Basin Plan, Stanfield Marsh does not have numeric WQOs. The Lake WQO objectives were used since these are more stringent and the Stanfield Marsh has been mostly dry since 2015.

The Regional Water Board uses these standards to determine if a proposed project will cause or contribute to impairments of the designated beneficial uses. **Table 2** presents the most conservative water quality criteria used to protect the most sensitive beneficial uses that apply to the Lake and downstream receiving waters. The constituents of interest included in **Table 2** are those:

- Included in the Basin Plan;
- Listed in the California 2018 Integrated Report for CWA Section 303(d) list;
- Identified by the Regional Water Board as pollutants of particular concern; and

- Constituents for which a Total Maximum Daily Load (TMDL) exists.

Table 2. Applicable WQOs and/or Criteria for the Lake Discharge

Constituent	Most Stringent WQO or Criterion	Unit	Reference for Most Stringent WQO or Criterion
Ammonia as N	0.46	mg/L	Basin Plan; used Basin Plan Table 4-4 (a)
Boron, Total	0.75	mg/L	Basin Plan(b)
Chloride	10	mg/L	Basin Plan
Fluoride	0.9	mg/L	Basin Plan (c)
Hardness, Total (as CaCO3)	125	mg/L	Basin Plan
Methylene Blue-Activated Substances	0.05	mg/L	Basin Plan (d)
Sodium	20	mg/L	Basin Plan
Sulfate	10	mg/L	Basin Plan
Total Dissolved Solids	**175**	**mg/L**	**Basin Plan**
Total Inorganic Nitrogen	**0.15**	**mg/L-N**	**Basin Plan**
Total Nitrogen	**1**	**mg/L-N**	**Regional Board Input (e)**
Chlorophyll-a	**14**	**µg/L**	**Nutrient TMDL**
Total Phosphorus	**35**	**µg/L-P**	**Nutrient TMDL**
Chlordane	0.00057	µg/L	Lake CWA 303(d) List; CTR
4,4'-DDT	0.00059	µg/L	Lake CWA 303(d) List; CTR
PCBs	0.00017	µg/L	Lake CWA 303(d) List; CTR
Cadmium, Dissolved	2.2	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Copper, Dissolved	8.9	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Lead, Dissolved	2.5	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Mercury	10	ng/L	Lake CWA 303(d) List; Statewide Mercury Provisions
Aluminum	200	µg/L	Title 22 MCL (g)
Specific Conductance	700/1,000	µmhos/cm	AGR Beneficial Use Goal (g)

Notes: Bolded constituents were identified as constituents of interest by the Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C** and discussed in **Section 5.3.1.**

a) The total ammonia was estimated using the equation presented in Table 4-4 of the Basin Plan. The Lake wide average pH is 8.28 based on the 2009-2019 TMDL data collected. The Lake water temperature ranges between 35 °F (1.8°C) and 70°F (20.7°C). The average Lake water temperature used is 53°F (11.8°C).
b) Boron concentrations shall not exceed 0.75 mg/L in inland surface waters of the region as a result of controllable water quality factors.

Constituent	Most Stringent WQO or Criterion	Unit	Reference for Most Stringent WQO or Criterion
c) Annual average concentration determined based on daily air temperature between 17.7-21.4 °C. d) MBAS concentrations shall not exceed 0.05mg/L in inland surface waters designated MUN as a result of controllable water quality factors. It is a secondary drinking water standard. e) Value is being considering by the Regional Water Board, as potential target. f) California Toxics Rule (CTR) hardness-based criterion continuous concentration (CCC) calculated using a median total hardness value of 99 mg/L calculated from measurements made in the Santa Ana River, Reach 6, upstream of Seven Oaks Dam, 2000-2006. g) Constituent added as it was detected in the secondary effluent and Lake.			

The Basin Plan contains both numeric and narrative objectives for inland surface waters, which were used to evaluate the Lake discharge. For this analysis, some of the narrative objectives were not evaluated for the following reasons:

- Algae, floatable, oil and grease, solids (suspended and settleable), sulfides, and surfactants were not evaluated because the Basin Plan does not specify numeric limits so these parameters could not be compared;
- Chlorine residual because chlorine will not be used for disinfection at the BBARWA WWTP;
- Chemical oxygen demand , dissolved oxygen, pathogen indicator bacteria, radioactivity material, color, temperature, and taste and odor because these are assumed to be non-conservative constituents (i.e., presumed to be destroyed, consumed, biodegraded or transformed through the treatment process or through Stanfield Marsh). The treatment process includes low- and high-pressure membrane systems capable of producing effluent that meets or exceeds the objectives for inland surface waters for these constituents, to be confirmed with site-specific piloting of the treatment process;
- Nitrate as N since the TN value being considered by the Regional Board is more stringent than the recommended 10 mg/L in Basin Plan; and
- pH because the treatment process maintains a neutral pH between 7 and 8 upstream of the reverse osmosis process, and then become slightly acidic downstream of reverse osmosis. Reverse osmosis chemical post-treatment will be employed to adjust the pH to a neutral level such that the effluent is within the numerical objectives for pH. In general, the pH of inland surface waters shall not be raised above 8.5 or depressed below 6.5 as a result of controllable water quality factors.

3.3 303 (d) Listings

Section 303(d) of the CWA requires states to develop lists of water bodies (or segments of water bodies) that will not attain water quality standards after implementation of minimum required levels of treatment by point-source dischargers (i.e., municipalities and industries). Section 303(d) requires states to develop a TMDL for each of the listed pollutant and water body combinations for which there is impairment. A TMDL is the amount of loading that the water body can receive and still meet water quality standards for that pollutant. The TMDL must include an allocation of allowable loadings for both point and non-point sources, with consideration of background loadings and a margin of safety. NPDES permit limitations for listed pollutants must be consistent with allocations identified in adopted TMDLs.

The U.S. EPA approved the California's 2018 Integrated Report for CWA Sections 305 (b) and 303(d) on June 9, 2021 (SWRCB, 2021). This list represents the most current listing of impaired water bodies in the project area and downstream areas. The Lake is included in the California's 2018 Section 303(d) list of impaired water bodies for mercury, nutrients, noxious aquatic plants, dichlorodiphenyltrichloroethane (DDT), chlordane, and polychlorinated biphenyls (PCBs). The Santa Ana River (SAR) Reach 6, which is located about 17 miles downstream from the Lake, is also listed for cadmium, lead, and copper. The potential water quality impacts of the proposed Lake discharge are discussed in **Section 5.**

Table 3 lists the constituents identified in the 2018 303(d) list for the Lake and SAR Reach 6, and their potential sources and proposed TMDL completion dates.

Table 3. 2018 CWA Section 303(d) Listed Constituents

Pollutant/Stressor	Potential Sources	Proposed TMDL Adoption
Lake		
Mercury	Source Unknown	2007
Nutrients	Construction/Land Development	Completed
Noxious aquatic plants	Source Unknown	Completed
DDT	Source Unknown	2027
Chlordane	Source Unknown	2027
PCBs	Source Unknown	2019
Santa Ana River Reach 6		
Cadmium	Source Unknown	2021
Lead	Source Unknown	2021
Copper	Source Unknown	2021

3.4 Lake Nutrient TMDL

The Big Bear Lake Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions (Resolution No. R8-2006-0023) was adopted by the Regional Water Board on April 21, 2006 and became effective on September 25, 2007. The Nutrient TMDL includes targets in the Lake for TP, macrophyte coverage, nuisance aquatic vascular plant species, and chlorophyll-a. **Table 4** shows the Nutrient TMDL targets. TP is the only constituent that would be directly discharged and controlled by BBARWA.

Table 4. Nutrient TMDL Numeric Targets for All Hydrologic Conditions

Indicator	Target Value [a][b]
TP Concentration [c]	Annual average no greater than 35 µg/L
Macrophyte Coverage[d]	30-40% on a total lake area basis
Percentage of Nuisance Aquatic Vascular Plant Species[d][e]	95% eradication on a total area basis of Eurasian Water milfoil and any other invasive aquatic plant species
Chlorophyll-a Concentration[e]	Growing season average no greater than 14 µg/L

Source: Basin Plan

Notes:

a) Targets to be attained no later than 2015 (dry hydrological conditions), 2020 (all other conditions)

b) Compliance date for wet and/or average hydrological conditions may change in response to approved TMDLs for wet/average hydrological conditions.

c) Annual average determined by the following methodology: the nutrient data from both the photic composite and discrete bottom samples are averaged by station number and month; a calendar year average is obtained for each sampling location by averaging the average of each month; and finally, the separate annual averages for each location are averaged to determine the lake-wide average.

d) Calculated as a 5-yr running average based on measurements taken at peak macrophyte growth.

e) Growing season is the period from May 1 through October 31 of each year. The chlorophyll-a data from the photic samples are averaged by station number and month; a growing season average is obtained for each sampling location by averaging the average of each month; and finally, the separate growing season averages for each location are averaged to determine the lake-wide average.

An analysis to demonstrate that the proposed Lake discharge is consistent with the Nutrient TMDL assumptions is provided in Attachment B of the ROWD package**.** This technical memorandum (TM) also discusses a TP offset framework to address the lack of wasteload allocation (WLA) for the proposed Lake discharge by proposing a TP net zero load. The TM also discusses the effects of the Lake discharge and TP Offset Program on chlorophyll-a, the response target, as documented in the Lake Analysis (**Appendix B**) and new model updates (**Appendix C**).

3.5 Statewide Mercury Provisions

On May 2, 2017, the California State Water Resources Control Board (State Water Board) adopted Resolution 2017-0027, which approved "*Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Tribal and Subsistence Fishing Beneficial Uses and Mercury Provisions.*" Resolution 2017-0027 established mercury limits to protect the beneficial uses associated with the consumption of fish by both people and wildlife. For lakes and reservoirs, the mercury water column concentration is to be calculated by the permitting authority (i.e., Regional Water Board). The mercury limit for the Lake has not yet been established. However, the State Water Board is also developing a Statewide Mercury Control Program for Reservoirs that are impaired for mercury. The draft "*2017 Amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Mercury TMDL and Implementation Program for Reservoirs,*" proposes to establish WLAs of 10 ng/L for major WWTPs (permitted flow >1 MGD), and a WLA of 20 ng/L for facilities with no "upstream" dischargers. The Statewide Mercury Provisions identified the Lake as one of the 131 impacted reservoirs. For this analysis, the 10 ng/L WLA was considered for evaluation with respect to potential water quality impacts due to the proposed Lake discharge.

3.6 Title 22 Recycled Water Criteria

Per conversations with DDW, the Lake may be designated as a non-restricted recycled water impoundment and the subsequent use of Lake water for snowmaking, landscape irrigation, construction uses, and groundwater recharge would be subject to recycled water regulations. Additional coordination and studies are being conducted to regulate these uses. It is anticipated that a separate WDR permit will be obtained to regulate the Sand Canyon groundwater recharge project. The non-potable recycled water uses for landscape irrigation, construction uses, snowmaking, and nonrestricted impoundment are anticipated to be regulated under the Statewide Water Reclamation Requirements for Recycled Water Use (Oder WQ 2016-0068-DDW).

4 ENVIRONMENTAL SETTING

This section provides additional context to understand the enviromental setting for the Lake discharge.

4.1 Stanfield Marsh

As part of Replenish Big Bear, the proposed project will discharge to the east end of Stanfield Marsh, then flow into the Lake, as shown in **Figure 5**.

Stanfield Marsh in 2016

Stanfield Marsh is a scenic 145-acre nature park that includes a gazebo, walking paths, and two boardwalks that extend out into the marsh, so visitors can observe the wildlife. Stanfield Marsh is home to rare and diverse species of birds, fish, amphibians, and mammals. Rainfall and snowmelt are the only sources of water for Stanfield Marsh, so the water level varies from season to season. During wet periods, Stanfield Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, the boardwalks extend over dry soil, and presence of wildlife becomes scarce. In the last 15 years, Stanfield Marsh has been less than half full nearly 40 percent of the time.

4.2 Big Bear Lake

Stanfield Marsh is hydrologically connected to the Lake through a set of culverts under Stanfield Cutoff. The Lake is located about 6,743 feet (ft; 2,055 meters) above mean sea level (MSL) in the San Bernardino Mountains in San Bernardino County. Together, Stanfield Marsh and the Lake have a surface area of approximately 3,000 acres, a storage capacity of 73,320 AF, and an average depth of 32 ft. The Lake's sole source of water is currently snowmelt and stormwater runoff, which are highly variable. The Lake has several sources of water loss including evaporation, water extraction for snow making, dam releases for flood control, fishery protection, and water rights discharges.

The Lake was formed following construction of the Bear Valley Dam in 1883-1884 to serve as an irrigation supply for the citrus industry in the downstream Redlands-San Bernardino communities. BBMWD was formed in 1964 to manage and help stabilize the water level in the Lake. Historically, the Lake was operated as a storage reservoir by the Bear Valley Mutual Water Company (Mutual). However, due to the drastic fluctuations in Lake levels, legal negotiations arising from disagreement between Mutual, BBMWD, and the community of Big Bear Valley regarding water rights and management of the Lake, a 1977 Judgment was established. Under the terms of this court judgment, Mutual retains a storage right and ownership of all water inflow into the Lake. BBMWD is required to provide Mutual with up to 65,000 AF of water from the Lake in a 10-year rolling period.

In 1996, an In-Lieu Agreement was executed that allows BBMWD to maintain higher Lake levels by delivering water to Mutual from an alternate source of water. This alternate source of water, referred to as In-Lieu Water, comes mainly from the State Water Project (SWP) through the San Bernardino Valley Municipal Water District (SBVMWD), a State Water Contractor. Under the In-Lieu Agreement, when the Lake level falls more than 6 foot below full, and during some months when the Lake is between 4 and 6 feet below full, SBVMWD delivers SWP water to meet Mutual's needs instead of BBMWD releasing water from the Lake. BBMWD pays SBVMWD an annual fee that is adjusted each year based on property tax values.

Due to variable precipitation and extended drought, the Lake has experienced drastic changes in water levels, which impact its water quality. In December 2018, the Lake reached a historic low of 18'1" below full, which is less than 40% full by volume. **Figure 6** shows the fluctuation in Lake levels between 2000 and 2021.

The Lake is an important resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland southern California region. The beneficial uses of the Lake and Marsh are presented in **Table 1**.

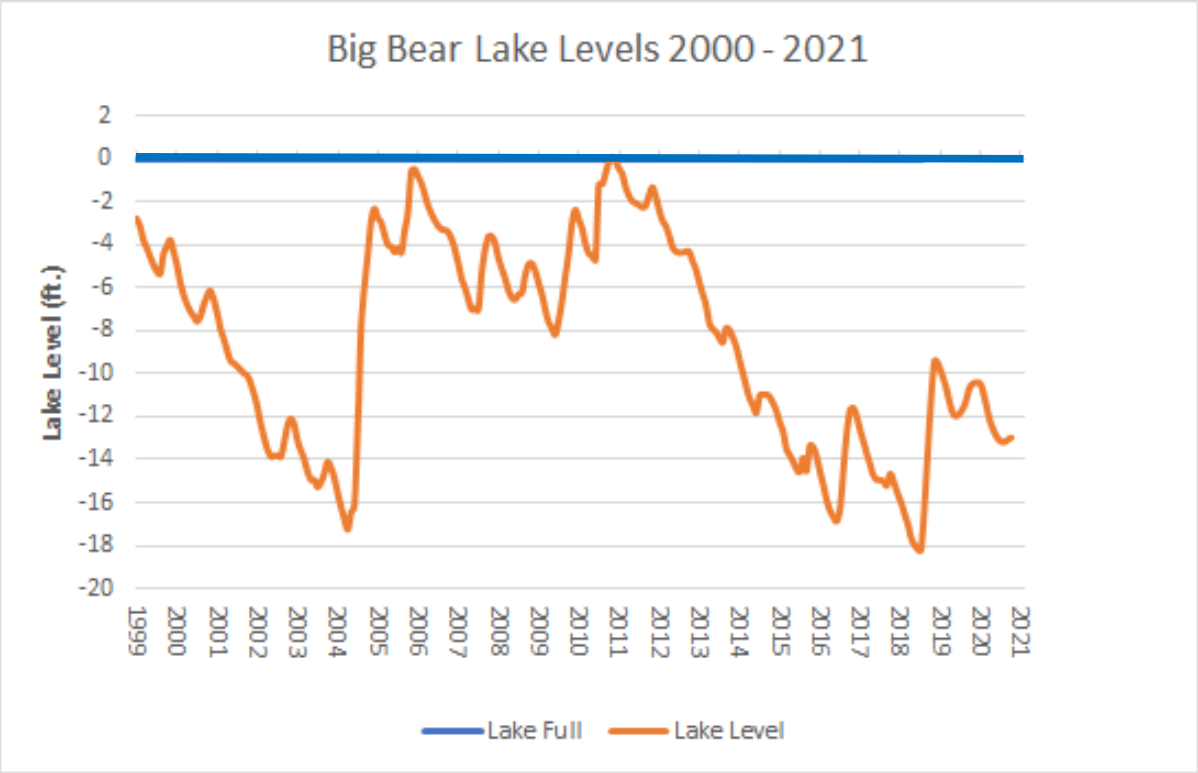


Figure 6. Big Bear Lake Levels: 2000 – 2021

4.3 Santa Ana Watershed

The Lake's dam releases are discharged to Bear Creek, a 17-mile stream, which enters the SAR at Reach 6. The Santa Ana River Watershed comprises portions of San Bernardino, Riverside, Los Angeles, and Orange Counties, covers an area of 2,840 square miles, and is home to over 6 million residents. The Santa Ana River is the major stream draining the watershed—about 100 miles in length from its headwaters near Big Bear to its discharge location in Huntington Beach. **Figure 7** shows the Santa Ana River Watershed, along with the Santa Ana River and its major tributaries.

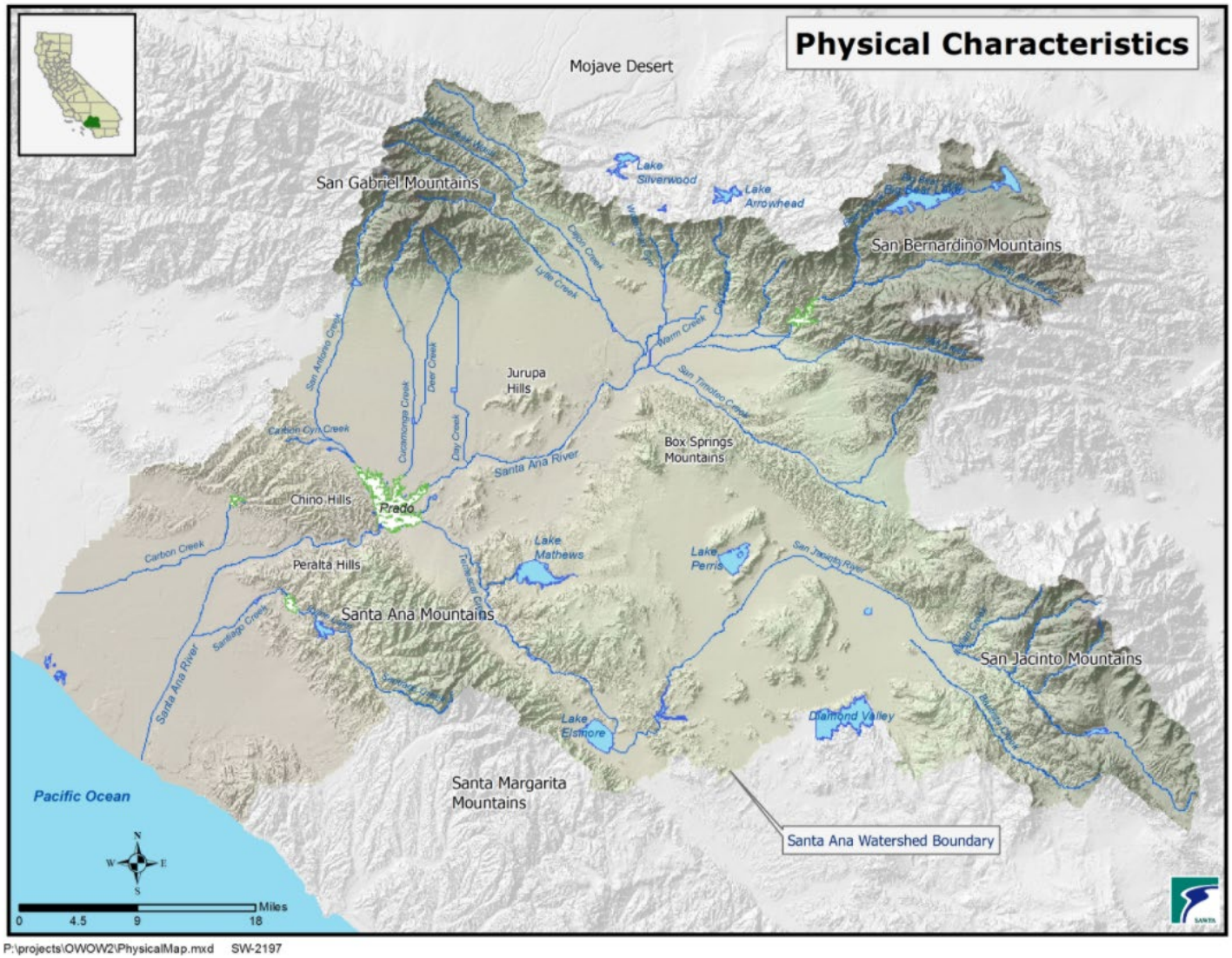


Figure 7. Santa Ana Watershed Map

5 ASSESSMENT OF WATER QUALITY IMPACTS TO BIG BEAR LAKE

This section summarizes the water quality assessment methodology and results for the proposed Lake discharge and potential associated impacts in downstream receiving waters.

5.1 Lake Discharge Project Description

As discussed in **Section 1**, one of the project components of the Replenish Big Bear Program is to discharge to the Lake disinfected, advanced treated effluent that has undergone RO and UV treatment. The Lake discharge is intended to help stabilize Lake levels especially during extended drought periods, assist to maintain the beneficial uses of the Lake, and reduce the in-lieu SWP water demands if higher lake levels allow for additional dam releases. The Lake has experienced record low levels over the last 15 years, forcing BBMWD to close one of their two boat ramps, which reduces the recreational benefit of the Lake.

The projected effluent quality of the proposed discharge is presented in **Table 5** for the constituents of interest in this study (constituents of interest are those listed in **Table 2**). Site-specific pilot testing of the proposed treatment process technologies will be completed in 2023 to establish design criteria and refine final effluent water quality estimates. The values presented in **Table 5** are based on mass balance calculations, vendor provided treatment performance estimates, and industry standard removal rates for RO treatment technology. The secondary effluent data were used as a basis for influent water quality to the advanced treatment train to estimate the projected effluent water quality for the proposed discharge.

Table 5. Projected Effluent Quality of Proposed Discharge and Existing Secondary Effluent Quality

Constituent	BBARWA Secondary Effluent Average Concentrations [a]	Projected Average Effluent Quality of Proposed Discharge	Unit
Ammonia as N	3.15	0.05	mg/L-N
Boron, Total	0.265	0.11	mg/L
Chloride	58	0.60	mg/L
Fluoride	0.41	<0.026[b]	mg/L
Hardness, Total (as CaCO3)	265	3.2	mg/L
Methylene Blue-Activated Substances	0.14	0.0014	mg/L
Sodium	NS	1.9	mg/L
Sulfate	41	0.20	mg/L
Total Dissolved Solids [c]	450	50	mg/L
Total Inorganic Nitrogen [c]	4.40	0.1	mg/L-N
Total Nitrogen [c]	7.80	0.6	mg/L-N
Chlorophyll-a [d]	N/A	N/A	µg/L
Total Phosphorus [c]	2.0	0.03	mg/L-P
Chlordane	<0.17 [e]	<0.17 [b][e]	µg/L
4,4'-DDT	<0.0052 [e]	<0.0052[b] [e]	µg/L
PCBs	<2.5 [e]	<2.5 [b] [e]	µg/L
Cadmium, Total	<0.11	<0.11[b]	µg/L
Copper, Total	14 [f]	0.07	µg/L
Lead, Total	1.3	0.01	µg/L
Mercury, Total	0.76 [g]	<0.5 [b]	ng/L
Aluminum, Total	180	1.3	µg/L
Specific Conductance	755 [e]	18	µmhos/cm

Notes: NS – Not sampled; N/A – Not applicable.

a) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages.
b) The projected effluent quality is anticipated to be below the detection limit. The estimated projected concentration is shows as "<MDL".
c) Values were estimated as part of Draft Treatment Alternatives Analysis TM using BBARWA WWTP average effluent concentrations from weekly and monthly analyses for the 2017 - 2019 calendar years (WSC, 2020).
d) Chlorophyll-a is not a constituent that will be discharged by the BBARWA WWTP.
e) Based on one data point.
f) Values detected below the RL; reported concentration is estimated. Reported as "J-Flag."

Constituent	BBARWA Secondary Effluent Average Concentrations [a]	Projected Average Effluent Quality of Proposed Discharge	Unit
g) On June 18, 2020, BBARWA collected a sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. This result is well below the 10 ng/L target described in the Statewide Mercury Control Program for Reservoirs.			

5.2 Selection of Water Quality Constituents

5.2.1 Selection Criteria

As presented in **Section 3**, water quality constituents assessed in this antidegradation analysis were identified based on one or more of the following conditions being satisfied:

1) Constituent has a WQO or criterion applicable to the Lake and/or downstream receiving waters;
2) Constituent for which an adopted TMDL exists;
3) Constituent identified as a pollutant/stressor on the 2018 CWA Section 303(d) list for the Lake or downstream of the proposed discharge; and
4) Constituent is a known water quality concern of the Regional Water Board.

Based on the conditions listed above, 22 constituents of interest were initially identified for evaluation and are presented in **Table 2**. The data available for the secondary effluent, proposed discharge effluent quality, and ambient water quality were assessed to determine the type of analysis needed for a given constituent. The following approach was used:

- No further analysis was needed for constituents reported as non-detect (ND) in the secondary effluent and the Lake. It is anticipated that RO treatment will achieve additional removal of these constituents and thus, will further reduce any water quality impacts potentially associated with these constituents.
- For constituents with detected concentrations in the secondary effluent, the proposed discharge water quality was compared to the ambient water quality and most stringent WQO or criterion.
- For the proposed discharge water quality constituents exceeding the ambient water quality or most stringent WQO or criterion, a mass balance analysis was completed.

- For constituents of greater interest to the Regional Water Board, such as TIN, TN, TP, and chlorophyll-a, the 2D hydrodynamic-water quality model (CE-QUAL-W2) developed by Dr. Anderson was used to evaluate the potential impacts of the proposed Lake discharge. A summary of the Lake Analysis (**Appendix B**) report along with the model updates recently completed to incorporate additional discharge volume scenarios and seasonal variability are presented in this report and in **Appendix C**.

5.2.2 Data Sources

Table 6 shows the water quality data used for the analysis. Per BBARWA's current WDR Permit, BBARWA is required to monitor for biological oxygen demand (BOD), total suspended solids (TSS), pH, dissolved oxygen (DO), TDS, sulfate, chloride, fluoride, nitrate as N, TN, E.coli, and volatile organic compounds (VOCs) in the secondary effluent on a monthly or annual basis. To support the preparation of the proposed project's Report of Waste Discharge (ROWD) and this analysis, water samples of the secondary effluent and Lake were collected and analyzed for priority pollutants. BBARWA collected its samples on November 18, 2021, and BBMWD collected the Lake samples on December 2, 2021. On June 18, 2020, BBARWA also collected a secondary effluent sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. **Appendix D** contains the BBARWA, Lake, and Shay Pond (discussed in **Section 6**) water quality data.

As part of the Nutrient TMDL, a variety of constituents, including ammonia as N, total hardness, nitrate as N, nitrite as N, total kjeldahl nitrogen (TKN)[2], TP, and chlorophyll-a are collected at the four TMDL monitoring locations (Station 1 Dam, Station 2 Gilner Point, Station 6 Mid Lake Middle, and Station 9 Stanfield Middle. (See **Figure 2** in **Appendix B**). In the Lake Analysis, TIN[3], TN[4], TP, and chlorophyll-a were evaluated using the Nutrient TMDL data from 2009 through 2019. The average results calculated in the Lake Analysis are presented in **Table 6**.

Ammonia and hardness were not modeled in the Lake Analysis because these were not identified as constituents of interest at the time of the model development. For this analysis, the lake-wide annual average was estimated by averaging the four station annual averages consistent with the Nutrient TMDL approach, which consist of averaging the photic and bottom samples for each sampling date. From 2009 through 2019, about 1,280 and 1,180 data points were collected for ammonia and hardness, respectively, at these locations. The calculations are presented in **Appendix E**.

[2] TKN is the sum of organic nitrogen and ammonia.
[3] TIN is the sum of ammonia, nitrate, and nitrite.
[4] TN is defined as the sum of TKN, nitrite, and nitrate.

BBMWD also has manually recorded specific conductance data since 2001 measured at the first 10 to 15 feet below Lake surface. The specific conductance data was used to evaluate TDS in the Lake Analysis as specific conductance can be converted to TDS using a conversion factor that is dependent on the type of minerals and salts dissolved in the Lake. In August 2019, BBMWD collected TDS samples at the four TMDL monitoring locations to compare TDS and specific conductance results and calculated a conversion factor of 1 mg/L of TDS = 0.642 µmhos/cm, which was used in the Lake Analysis model. The Lake TDS average from this report was converted to µmhos/cm using this convention factor.

Table 6. Summary Statistics for Constituents Evaluated in Secondary Effluent and Big Bear Lake

Constituent	Unit	BBARWA Secondary Effluent [a]				Big Bear Lake[a]			
		No. of Samples	% Non-Detected	Avg.[b]	Max.	No. of Samples	% Non-Detected	Avg.[b]	Max.
Ammonia as N	mg/L	24	29%	3.15	22	1,281	33%	0.063 [c]	0.094
Boron, Total	mg/L	2	0%	0.265	0.270	1	0%	0.054 [d]	0.054 [d]
Chloride	mg/L	25	0%	58	63	1	0%	26	26
Fluoride	mg/L	2	0%	0.41	0.52	1	0%	0.41	0.41
Hardness, Total (as CaCO3)	mg/L	2	0%	265	270	1,176	0%	157 [c]	183
MBAS	mg/L	2	50%	0.14	0.14	1	0%	0.058 [d]	0.058 [d]
Sodium	mg/L	0	NS	NS	NS	1	0%	33	33
Sulfate	mg/L	20	0%	41	44	1	0%	18	18
Total Dissolved Solids	mg/L			450 [e]				251 [f]	
Total Inorganic Nitrogen	mg/L			4.40 [e]				0.049 [f]	
Total Nitrogen	mg/L			7.80 [e]				0.948 [f]	
Chlorophyll-a	µg/L			N/A				9.3 [f]	
Total Phosphorus	mg/L			2.00 [d]				0.037 [f]	
Chlordane	µg/L	1	100%	<0.17	<0.17	1	100%	<0.034	<0.034
4,4'-DDT	µg/L	1	100%	<0.0052	<0.0052	1	100%	<0.001	<0.001
PCBs (Aroclors) [g]	µg/L	1	100%	<2.5	<2.5	1	100%	<0.5	<0.5
Cadmium, Total	µg/L	8	100%	<0.11	<0.11	1	100%	<0.11	<0.11
Copper, Total	µg/L	8	88%	14 [d]	14 [d]	1	100%	<6.5	<6.5
Lead, Total	µg/L	8	75%	1.3	1.8 [d]	1	100%	1.8 [d]	1.8 [d]
Mercury, Total	ng/L	8	100%	0.76 [h]	0.76 [h]	2	50%	270	270
Aluminum, Total	µg/L	2	0	180	250	1	0%	58	58
Specific Conductance	µmhos/cm	1	0	755	755			391 [i]	

Notes: Bolded constituents were identified as constituents of interest by the Santa Ana Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C**).

NS – Not sampled; N/A – Not applicable.

a) For constituents with only ND data, the method of detection limit (MDL) is shown as "<MDL."
b) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages. For samples with only one data point, the reported value or "<MDL" is presented.
c) The averages and maximums are for the Lake-wide results and were calculated using Nutrient TMDL 2009-2019 data. See **Appendix E** – for estimates. ND were used and assumed to be "MDL/2".
d) Values detected below the RL; reported concentration is estimated. Reported as "J-Flag."
e) Values were estimated as part of Draft Treatment Alternatives Analysis TM using BBARWA WWTP average effluent concentrations from weekly and monthly analyses for the 2017 - 2019 calendar years (WSC, 2020).
f) TDS average was obtained from the Lake Analysis Table 19, and nutrients and chlorophyll-a from the Lake Analysis Table 22 (**Appendix B**).
g) PCBs are a class of chemicals which include Aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016. The aquatic life criteria apply to the sum of the set of seven Aroclors. All results were non-detect.
h) On June 18, 2020, BBARWA collected a sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. This result is well below the 10 ng/L target described in the Statewide Mercury Control Program for Reservoirs.
i) The Lake TDS average from the Lake Analysis report was converted to µmhos/cm using a 1 mg/L of TDS = 0.642 µmhos/cm conversion factor.

5.2.3 Selection of Constituents

The simple qualitative analysis described in **Section 5.2.1** was applied to the 22 constituents of interest to determine if additional analysis was required. **Table 7** shows the results of the comparison of the secondary effluent quality, projected effluent quality, ambient water quality, and the most stringent WQO or criterion.

Overall, no constituents exceeded their most stringent WQO or criterion and only boron and TIN exceeded existing, ambient water quality concentrations. For the remainder of the constituents—where the projected effluent quality is below the ambient water quality and the most stringent WQO or criterion—no additional analysis was conducted.

The Lake Analysis evaluated TDS, TIN, TN, TP, and chlorophyll-a, so potential TIN water quality impacts were addressed by the Lake Analysis. For boron, a simple mass balance spreadsheet model was used to evaluate the potential impacts of boron on the Lake with the proposed project due to the limited data available.

With respect to the three trace metals – cadmium, copper, and lead – included in the 2018 303(d) list for Reach 6 of the SAR as impairing the water body segment, projected average concentrations of the three trace metals in the proposed discharge are significantly below the hardness-based CTR chronic criterion calculated for each metal using a median total hardness value of 99 mg/L calculated for Reach 6 (see **Table 2**). Cadmium, copper, and lead concentrations contained in the disinfected, advanced treated effluent proposed for discharge to the Lake are not anticipated to lower water quality in Reach 6 for these trace metals, nor are they anticipated to affect future load or WLA included in an adopted TMDL.

Table 7. Comparison of Most Stringent Water Quality Objective or Criterion to Existing Ambient Lake Water Quality and Projected Effluent Quality of Proposed Discharge

Constituent	Unit	Most Stringent WQO or Criterion	Average Lake Concentration [a] [b]	Projected Average Effluent Quality of Proposed Discharge [c]	Comparison of Projected Effluent Quality to Most Stringent WQO (see table Notes)
Ammonia as N	mg/L	0.46	0.063 [d]	0.05	1
Boron, Total	mg/L	0.75	0.054 [e]	0.11	2
Chloride	mg/L	10	26 [e]	0.60	1
Fluoride	mg/L	0.9	0.41 [e]	<0.026	1
Hardness, Total (as CaCO3)	mg/L	125	157 [d]	3.2	1
MBAS	mg/L	0.05	0.058 [e]	0.0014	1
Sodium	mg/L	20	33 [e]	1.9	1
Sulfate	mg/L	10	18 €	0.20	1
Total Dissolved Solids	mg/L	175	251	50	3
Total Inorganic Nitrogen	mg/L	0.15	0.049	0.1	2,3
Total Nitrogen	mg/L	1	0.948	0.6	3
Chlorophyll-a	µg/L	14	9.3	N/A	3
Total Phosphorus	mg/L	0.035	0.037	0.03	3
Chlordane	µg/L	0.00057	<0.034 [e]	<0.17	4
4,4'-DDT	µg/L	0.00059	<0.001 [e]	<0.0052	4
PCBs	µg/L	0.00017	<0.5 [e]	<2.5	4
Cadmium, Total	µg/L	2.2	<0.11 [e]	<0.11	4
Copper, Total	µg/L	8.9	<6.5 [e]	0.07	1
Lead, Total	µg/L	2.5	1.8 [e]	0.01	1
Mercury, Total	ng/L	10	270	<0.5	1
Aluminum, Total	µg/L	200	58 [e]	1.3	1

Constituent	Unit	Most Stringent WQO or Criterion	Average Lake Concentration [a] [b]	Projected Average Effluent Quality of Proposed Discharge [c]	Comparison of Projected Effluent Quality to Most Stringent WQO (see table Notes)
Specific Conductance	µmhos/cm	700/1,000	391	18	1

Notes: Bolded constituents were identified as constituents of interest by the Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C**).
N/A – Not applicable.

a) For constituents with only ND data, the method of detection limit (MDL) is shown as "<MDL."
b) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages. For samples with only one data point, the reported value or "<MDL" is presented.
c) If the projected effluent quality is anticipated to be below the detection limit. The estimated projected concentration is shows as "<MDL".
d) The averages and maximums are for the Lake-wide results and were calculated using Nutrient TMDL 2009-2019 data. See **Appendix E** – for estimates. ND were used and assumed to be "MDL/2".
e) Average is based on one data point.

Blue – Projected effluent quality is below the ambient and most stringent WQO or criterion
Red – Projected effluent quality is above the ambient or most stringent WQO or criterion

1) Projected effluent quality is below the ambient and most stringent WQO or criterion. No degradation anticipated.
2) Projected effluent quality is above the ambient, but below the most stringent WQO or criterion. Further analysis needed to determine impacts on water quality.
3) Impacts evaluated in the Lake Analysis (**Appendix B & C**).
4) Secondary effluent and ambient water quality were ND. No further analysis conducted. It is anticipated that RO will achieve additional removal, resulting in even fewer impacts.

5.3 Water Quality Impacts Assessment

5.3.1 Lake Analysis Model Analysis Results

The Lake Analysis (**Appendix B**) was completed to evaluate the short- and long-term impacts of the Lake discharge on lake level, lake area, TDS, TIN, TN, TP, and chlorophyll-a under three different treatment alternatives:

- Alternative 1: TIN & TP Removal
- Alternative 2: 70% RO (in addition to TIN & TP Removal)
- Alternative 3: 100% RO (in addition to TIN & TP Removal)

These treatment alternatives were evaluated under three hydrologic conditions (i.e., extended drought (5th percentile), median (50th percentile), and prolonged above average rainfall (95th percentile)). The model predicted that Alternative 3 would result in a slight improvement in concentrations of TDS, TIN, TN, TP, and chlorophyll-a as compared to modeled baseline conditions. Informed by the results of this study, the 100% RO treatment alternative was selected as the preferred project and the projected effluent quality of Alternative 3 is the focus of this antidegradation analysis.

Additional refinements to the Lake Analysis were completed in 2022, as documented in **Appendix C**, to investigate the impacts of a higher discharge volume, account for WWTP discharge seasonal variability, and assess the impacts of a TP Offset Program as discussed in **Section 3.4** and Attachment B of the ROWD package. The 50th percentile hydrologic scenario for 2009-2050 was used in the updated analysis (i.e., the median hydrologic condition), as it includes a wide array of runoff conditions. All other hydrologic, meteorological, biological, chemical, and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021).

The Lake Analysis report assumed a steady annual flow of 1,920 AFY of disinfected, advanced treated effluent discharged to the Lake that excludes the 80 AFY that could be discharged to Shay Pond. However, the proposed Lake discharge may be higher than previously modeled as it did not account for a 99% total recovery rate of BBARWA effluent and potentially a lower discharge rate to Shay Pond. **Table 8** presents the Lake discharge flow projections that were considered in the Lake Analysis model and in the 2022 update.

Table 8. Initial and Updated Lake Discharge Flow Rate Projections

Lake Analysis Modeled Scenario	RBB Inflow (AFY)	Daily RBB Inflow (MGD)
Baseline (No Project)	0	0
Alternative 3 [(a)]	1,920	1.71
High Flow (99% recovery) [(b)]	2,210	1.57 – 2.18
Mid Flow (90% recovery) [(b)]	2,009	1.42 – 1.98

Notes:

a) Alternative 3 was assessed in the 2021 Lake Analysis and assumed that of the total Replenish Big Bear effluent contribution considered in the Lake Analysis (i.e., 2,000 AFY), 80 AFY would be delivered to Shay Pond. Therefore, only 1,920 AFY would be discharged to the Lake.

b) In the 2022 Lake Analysis update it was assumed that no discharge to Shay Pond would occur and all disinfected, advanced treated effluent would be discharged to the Lake under two different total recovery rates scenarios.

The Lake discharge is expected to vary seasonally, as shown in **Figure 8**, and thus, differs from the earlier "Alternative 3" scenario that assumed a uniform flow rate of 1.71 MGD throughout the year. Inflows to the WWTP are lower in the summer months due to reduced inflow and fewer visitors relative to the winter season.

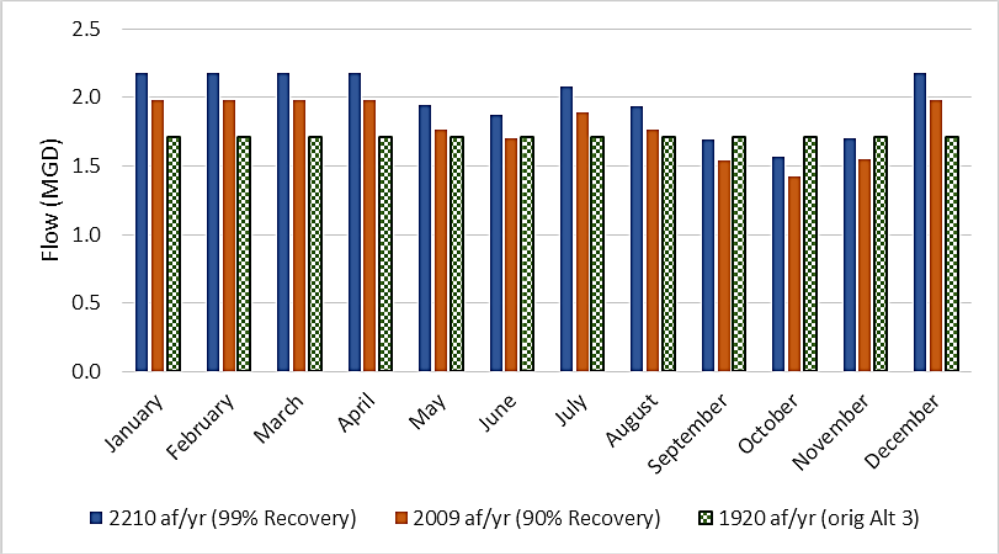


Figure 8. Projected 2040 Monthly BBARWA Discharges to the Lake under Three Inflow Scenarios

Since the Replenish Big Bear Program proposed Lake discharge has not been assigned a WLA for TP in the nutrient TMDL, a TP Offset Program is being proposed to attain a net zero TP contribution to be consistent with the Nutrient TMDL assumptions. A detailed analysis supporting the TP Offset Program is discussed in Attachment B of the ROWD package. In the Lake Analysis model update, the TP offset was modeled as equivalent to a 0 (zero) influent concentration. This approach is a simplification that may hold when considering a whole-lake nutrient budget. However, the Lake dynamics are complex, so projections may not have accounted for these complexities.

5.3.1.1 Lake Discharge Impacts Water Quality

The predicted long-term average water quality in the Lake under the updated modeled operational scenarios (increased and time-varying flows, with and without TP offset) are presented in **Table 9**. For comparison, the previously predicted baseline condition (no project) and Alternative 3 scenario are shown.

Table 9. Predicted Long-term Average Lake Concentrations for TDS, TIN, TN, TP, and Chlorophyll-a Under Different Operational Scenarios

Operational Scenario [a] (All at 50th %tile hydrologic condition)	TDS [b] (mg/L)	TIN [b] (mg/L)	TP [b] (µg/L)	TN [b] (mg/L)	Chlorophyll-a [c] (µg/L)
WQO/(TMDL target)	***175***	***0.15***	***0.15 (35.0)***		***(14.0)***
Baseline (No Project)	195	0.069	47.7	1.15	14.1
Alternative 3 (1920 AFY)	182	0.052	43.3	1.07	14.0
2,210 AFY (99% recovery)	179	0.045	42.3	1.04	13.1
2,009 AFY (90% recovery)	180	0.041	43.4	1.06	12.9
2,210 AFY + TP Offset	179	0.072	39.9	1.00	10.2
2,009 AFY + TP Offset	180	0.040	40.9	1.00	9.5

Notes:

a) The Baseline and Alternative 3 were evaluated in the 2021 Lake Analysis. The other operational scenarios were evaluated in the 2022 Lake Analysis Update and assume no discharge to Shay Pond. The TP Offset scenarios assume a TP Offset Program is implemented.
b) Expressed as annual average concentrations
c) Chlorophyll-a shown as growing season average concentrations

Overall, the predicted long-term average concentrations of TDS, TIN, TN, TP, and chlorophyll-a were lower with the proposed Lake discharge at various rates as compared to the predicted baseline condition, except for TIN under the 2,210 AFY + TP Offset. It is unclear why the model predicted increased TIN under this scenario while all other scenarios showed significantly reduced TIN values relative to the modeled baseline; however, the modeled difference in TIN between the Baseline and 2,210 AFY + TP Offset scenarios is approximately 4%, which is within the range of model variance and is considered statistically insignificant. Therefore, this analysis concludes that projected long-term average concentration of TIN is similar to the modeled baseline condition.

Focusing on chlorophyll-a as the key response target, baseline conditions were predicted to yield a growing season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the Nutrient TMDL target value of 14 µg/L, while Alternative 3 matched the target value, and increased Lake discharges that varied seasonally (**Figure 8**) yielded values below the modeled baseline condition and the Nutrient TMDL target values. The assumption of a TP Offset Program yielded further reductions in chlorophyll-a. The increased Lake discharge volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 to 10.2 µg/L, significantly below predicted baseline and TMDL concentrations.

Cumulative distribution functions (CDFs) were prepared to evaluate the inter-annual differences in water quality, as differences are expected to persist. **Figure 9** shows the CDFs for TP, TN, and chlorophyll-a, which show that increased Lake discharges are predicted to lower the annual average TP and TN concentrations and growing season average chlorophyll-a concentrations. However, wide ranges in predicted concentrations remained in place. **Table 10** shows the predicted frequency of exceedance of the Nutrient TMDL targets or potential targets. Overall, the growing season chlorophyll-a average TMDL target (14 µg/L) was predicted to be exceeded about 53% of the time under baseline conditions and exceeded about 41% and 31% of the time at a 2,210 AFY Lake discharge rate with and without TP offset, respectively.

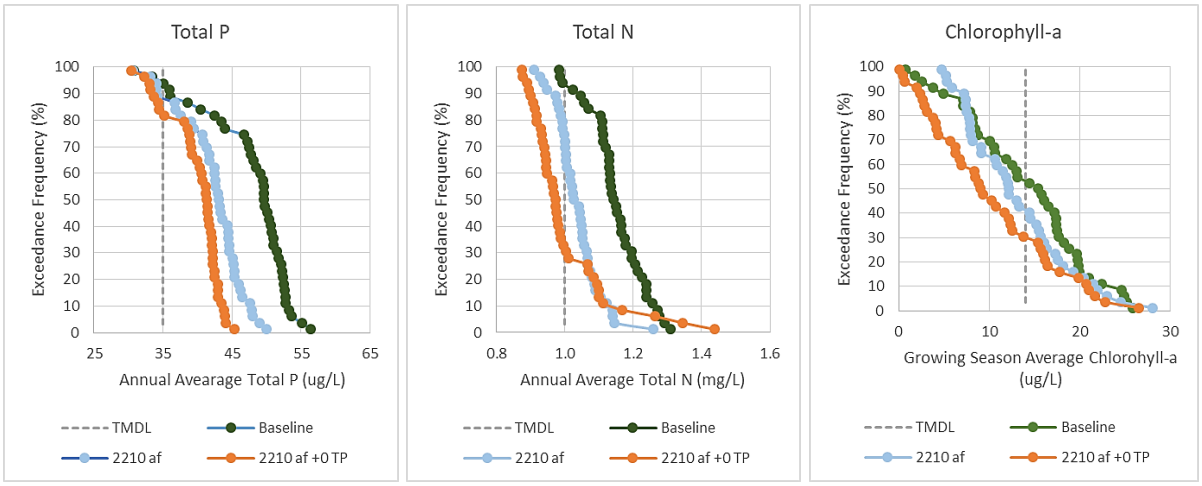


Figure 9. CDFs for Predicted Annual TP and TN Concentrations and Growing Season Average Chlorophyll-a Concentrations for Baseline Condition and at 2,210 AFY Lake Discharge with and without TP Offset

Table 10. Predicted Frequency of Exceeding TMDL Target Under Baseline Conditions and Different Lake Discharge Rates and TP Offset Scenarios (Annual Average or Growing Season Average Basis)

Operational Scenario (All at 50th %tile hydrologic condition)	TP (µg/L)	TN [a] (mg/L)	Chlorophyll-a [b] (µg/L)
WQO/(TMDL target)	***0.15 (35.0)***		***(14.0)***
Baseline (No Project)	94%	91%	53%
Alternative 3 (1920 AFY)	87%	72%	51%
2,210 AFY (99% recovery)	87%	72%	41%
2,009 AFY (90% recovery)	91%	80%	40%
2,210 AFY + TP Offset	82%	30%	31%
2,009 AFY + TP Offset	90%	55%	22%

Notes:
a) Possible target of 1 mg/L, per the Regional Water Board input.
b) Growing season is the period from May 1 through October 31 of each year.

In general, the Lake Analysis demonstrates that the Lake discharge will likely contribute to more frequent attainment of the Nutrient TMDL numeric targets and associated water quality standards, especially when combined with the offset program and actions taken by the TMDL responsible parties to attain the Nutrient TMDL requirements. Additionally, the Lake discharge will increase Lake levels, which will contribute to protection of other beneficial uses and reduce the amount of time critical hydrologic conditions occur in the Lake. A more robust analysis of this Lake discharge on the Nutrient TMDL is provided in Attachment B of the ROWD package.

5.3.1.2 Lake Discharge Impacts on Lake Level, Volume, and Area

The Lake Analysis simulations for the 2009-2019 evaluation period demonstrated that the Replenish Big Bear Program Lake discharge would result in significant increases in predicted lake levels, volumes, and surface areas relative to baseline conditions. Long-term (2009 to 2050) simulations of the proposed Lake discharge under three different hydrologic scenarios indicate that the discharge would be especially beneficial under an "extended drought" scenario where the discharge is predicted to increase the median lake level by more than 10 ft and the median lake area by nearly 600 acres, which in turn would improve recreational access and provide additional Lake habitat as compared to modeled baseline (no project) conditions. The increased lake level and area benefits provided by the Lake discharge would be more modest under the "prolonged above average rainfall" scenario because higher natural inflows would result in higher lake levels. **Table 11** summarizes the projected impacts on Lake level, area, and volume under three hydrologic conditions modeled in the 2021 Lake Analysis.

Table 11. Predicted Lake Level, Area, and Volume under Three Hydrologic Scenarios

Lake Physical Parameter (median values shown)	Scenario	Hydrologic Scenario		
		Extended Drought (5th Percentile)	Median Hydrologic Condition (50th Percentile)	Prolonged Above Average Rainfall (95th Percentile)
Lake Level (ft) (Lake max 6,743 ft)	Baseline	6,722	6,733	6,736
	+Project	6,732 (+10.5)	6,738 (+7.2)	6,740 (+5.2)
Volume (AF)	Baseline	23,400	47,536	54,724
	+Project	45,750 (+22,340)	59,664 (+12,128)	65,204 (+10,480)
Area (acres)	Baseline	1,720	2,328	2,474
	+Project	2,290 (+572)	2,568 (+240)	2,669 (+195)
Notes: Data taken from Table 24 of Lake Analysis report. Assumed a discharge rate of 1,920 AFY. Additional benefit is expected with a higher discharge rate.				

5.3.2 Boron Mass Balance

The projected boron effluent quality of the proposed Lake discharge is anticipated to exceed the Lake ambient water quality (0.054 mg/L – based on one sample collected in December 2021) but remain well below the most stringent criterion of 0.75 mg/L for the protection of sensitive crops. Therefore, the Lake's boron assimilative capacity, defined as the difference between the criterion and the ambient water quality, is 0.694 mg/L (i.e., 0.75 mg/L – 0.054 mg/L).

Due to the limited amount of water quality data available, a simple spreadsheet model was completed to evaluate the contribution of the Lake discharge to boron concentrations in the Lake over time. The calculations are shown in **Appendix F**. The only available data for boron contributions to the Lake from natural inflows is based on boron samples collected in 1972 from several creeks. These data indicated that boron in natural inflows could range between 0.02 and 0.26 mg/L. These results were not used in this analysis due to it high variability, age of the samples, small sample size, and changes in watershed characteristics since the samples were collected.

This analysis did not establish a baseline condition based on ambient water quality; rather, it was assumed that the Lake and natural inflows had a boron concentration of 0 mg/L and the analysis determined the incremental increase of boron in the Lake as result of the Lake discharge.

The 1977-2020 annual inflow and outflow were obtained from the Big Bear Watermaster annual reports and a 43-year simulation was performed based on a repeat of this historic hydrology. The following equations were used to perform the mass balance:

$$Lake\ Storage\ =\ Initial\ Lake\ Storage\ +\ Lake\ Inflows\ -\ Lake\ Outflows$$

$$Lake\ Inflows =\ Lake\ inflows\ from\ precipitation\ and/or\ snowmelt$$

$$Lake\ Outflows\ =\ Spills\ +\ Releases\ +\ Leakage\ +\ Withdrawals\ +\ Evaporation$$

$$Boron\ Mass\ =\ Boron\ in\ Lake\ +\ Boron\ from\ Lake\ Inflow + Boron\ from\ Discharge\ -\ Boron\ from\ Lake\ Outflows$$

$$Boron\ Concentration\ in\ Lake\ (mg/L) = \frac{Boron\ mass\ in\ Lake\ at\ end\ of\ simulation\ year}{Lake\ volume\ at\ end\ \ of\ simulation\ year}$$

Figure 10 shows the projected boron Lake concentrations over the simulation period. The Lake discharge is anticipated to increase boron concentrations over the 44-year simulation, boron is predicted to increase by about 0.065 mg/L. This is less than the 10% assimilative capacity.

The projected incremental increase in boron concentration in the Lake as a result of the project is 0.065 mg/L at the end of the 44-year simulation. The simulation results represent an incremental increase above the current ambient quality, which was 0.054 mg/L based on one sample collected in December 2021. Based on this sample, the estimated total boron concentration in the Lake with the proposed discharge would be below 0.12 mg/L, which is considered safe for agricultural crops like citrus trees that show sensitivity to boron starting at concentrations between 0.5 – 0.75 mg/L (USDA, 1990). The projected boron concentration will remain low compared to the most stringent criterion of 0.75 mg/L which exists in the Basin Plan for the protection of water used to irrigate sensitive crops.

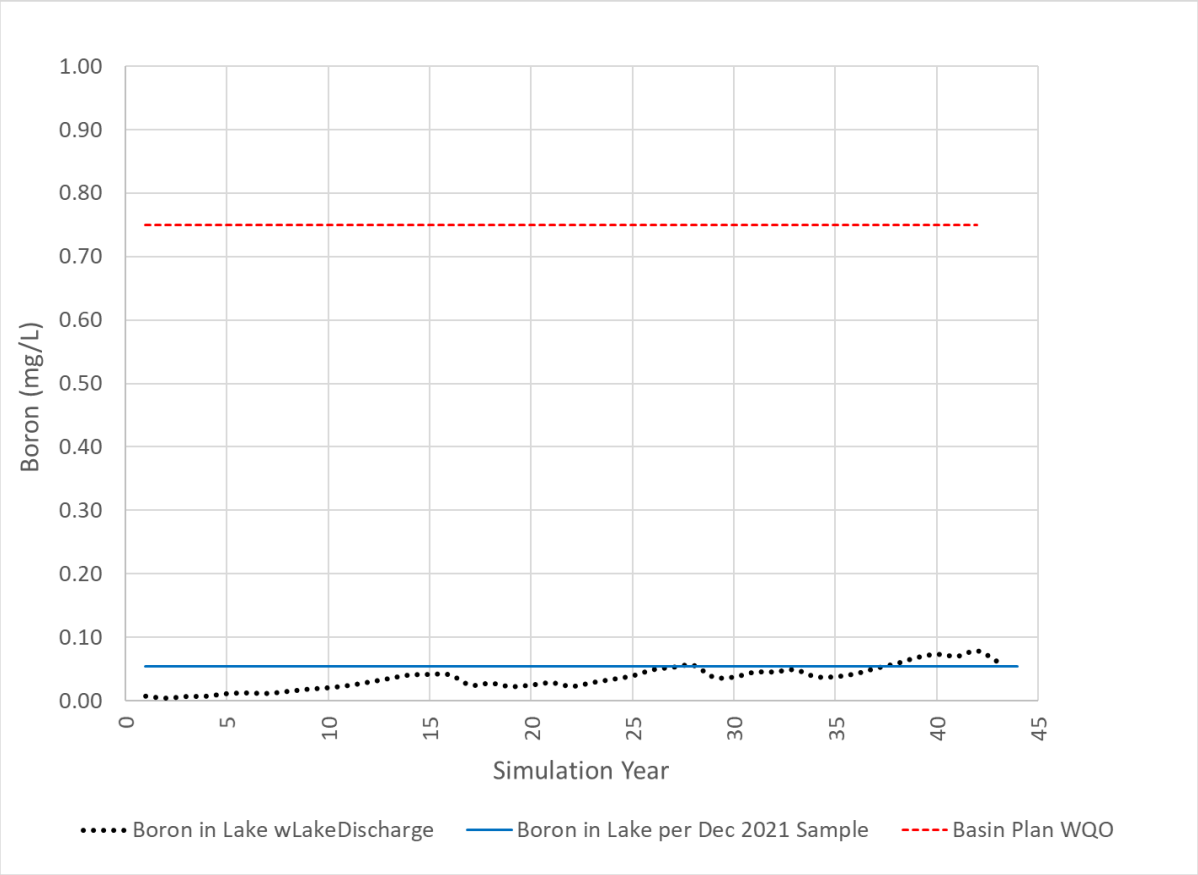


Figure 10. Projected Boron Concentrations with Proposed Lake Discharge

5.4 Summary of Water Quality Impacts

Overall, the Replenish Big Bear Program Lake discharge under most modeled discharge scenarios is anticipated to improve water quality for TDS, TIN, TP, TN, and chlorophyll-a as compared to baseline conditions, and result in similar water quality for total inorganic nitrogen (TIN) as compared to the modeled baseline. In addition, the proposed discharge is projected to contain concentrations of constituents of interest that are similar to or lower than existing ambient water quality and most stringent WQO or criteria for all constituents evaluated except for TIN and boron. For boron, concentrations in the Lake are anticipated to increase compared to baseline conditions but remain well below the most stringent WQO of 0.75 mg/L and the estimated increase is below the U.S. EPA significance threshold of a 10% reduction in available assimilative capacity.

Overall, the Lake Analysis and the 2022 Lake Model Update show that the implementation of the Lake discharge will help improve water quality of the Lake, especially during extended drought and typical (median) conditions. In addition, the proposed Lake discharge will increase lake levels, surface area, and volumes which will help to protect the beneficial uses designated for the Lake.

6 ASSESSMENT OF WATER QUALITY IMPACTS TO SHAY POND

This section describes the proposed Shay Pond discharge component of the Replenish Big Bear Program and presents an antidegradation analysis of the proposed discharge. Currently, it is unknown if Shay Pond and Shay Creek are considered Waters of the U.S. (WOTUS), as the federal regulations that define a WOTUS are currently under review. Regional Water Board input is required to determine the appropriate permitting approach for the proposed discharge to Shay Pond. The necesarry background information to assist the Regional Water Board with this determination is provided in this section.

6.1 Shay Pond Environmental Setting and Project Description

As part of the Replenish Big Bear Program, up to 80 AFY of disinfected, advanced treated effluent is proposed for discharge to Shay Pond. The proposed Shay Pond discharge is intended to replace potable water that is currently discharged to the pond to support the Unarmored Threespine Stickleback (Stickleback) fish, a federal and State listed endangered species.

Shay Pond has a surface area of approximately 10 acres and is located about 1.2 miles southeast of the BBARWA WWTP (**Figure 1**). According to the Bear Valley Basin Groundwater Sustainability Plan (GSP), "*Shay Pond is a natural surface water body at the southern base of an unnamed ridge that separates it from Baldwin Lake (. The nature of this pond is unknown, but it may be fed, in part, from spring flow, surface runoff, and periodically, groundwater intersecting the land surface. Although the pond may have historically been fed from surface water runoff in the ephemeral, upstream segment of Shay Creek, urban development has altered the course of this stream, and it no longer flows into the pond. Surface water exits Shay Pond via the downstream segment of Shay Creek, which flows northwards toward Baldwin Lake and intermittently provides water to Baldwin Lake lake.*" "*Surface water sources to Baldwin Lake are primarily in the form of ephemeral streams with relatively low flow volumes. The only stream where surface water flow periodically has been measured is Shay Creek at its outlet from Shay Pond.*" "*Surface water runoff does not reach Baldwin Lake during most years but percolates into the groundwater system. However, during prolonged precipitation, surface water does flow into Baldwin Lake. All surface water that enters Baldwin Lake is lost to evaporation. The high clay content of the playa sediments prevents vertical migration, and the topographical configuration of the lake prevents outflow from Baldwin Lake*" (TH&Co, 2022). **Figure 11** shows how

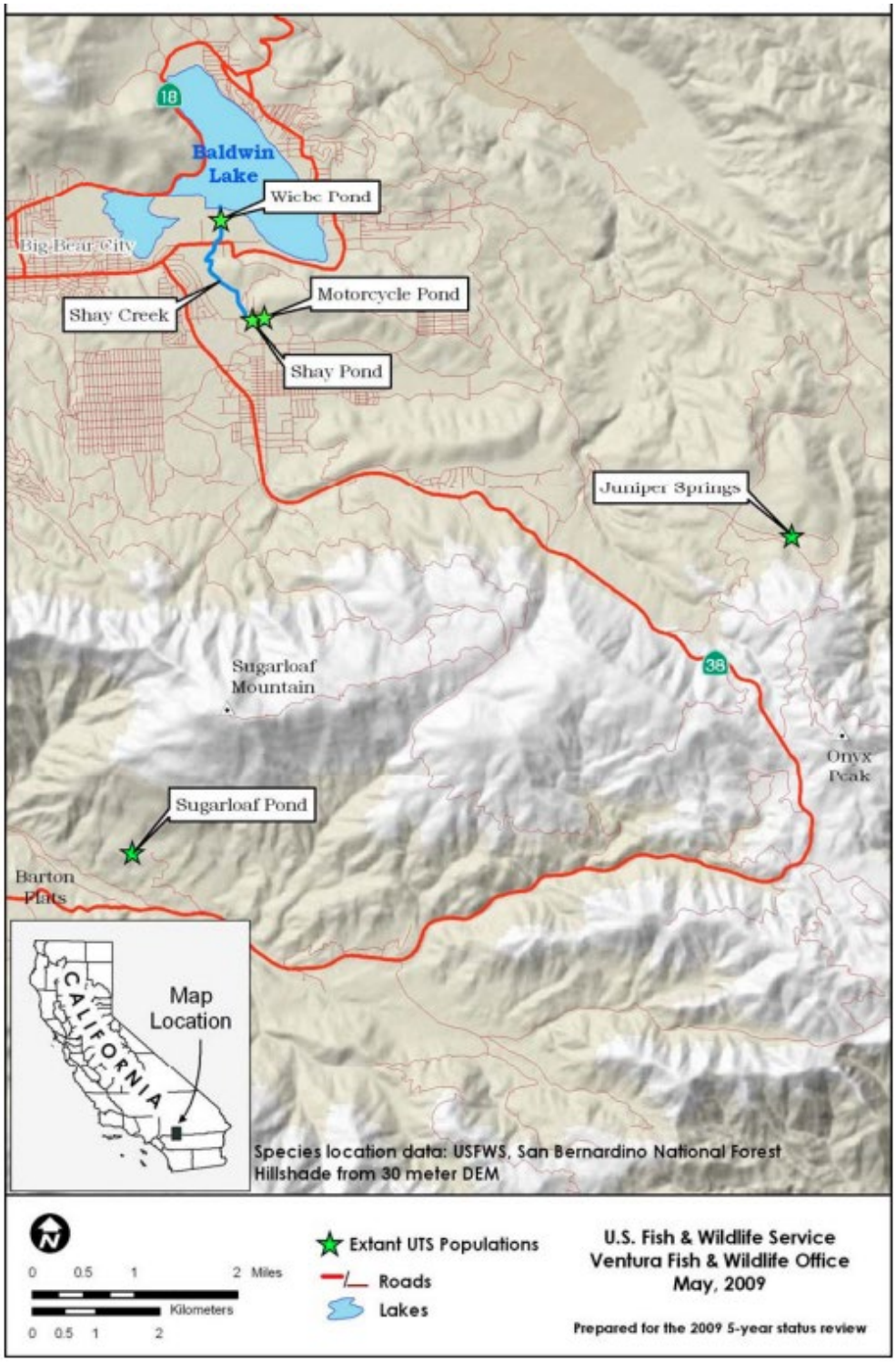
Baldwin Lake, an ephemeral lake, is connected to Shay Pond via Shay Creek. This figure also shows the population of Stickleback fish in the vicinity of Shay Pond.

The population of Stickleback is unique in that it occurs at a high elevation, about 6,700 ft above mean sea level, while all other Stickleback populations inhabit streams below 3,000 ft. In 1985 and 1986, catastrophic mortality of Stickleback in the Valley occurred due to insufficient amounts of water. By the summer of 1990, it was thought that the Stickleback remained in only Shay Pond.

There is a long history of study and group effort regarding the Stickleback in the Shay Creek area. The main stakeholders include the United States Fish and Wildlife Service (USFWS), CDFW, the San Bernardino National Forest (SBNF), BBCCSD, BBLDWP, and BBARWA. Additionally, the Shay Creek Working Group, which includes representatives from the USFWS, CDFW, SBNF, BBCCSD, BBLDWP, and BBARWA, was formed during the process of preparing the USFWS' 2002 Biological Opinion (2002 BO) for the area (Evans, 2002).

The requirements of the 2002 BO state that BBCCSD will provide water to Shay Pond to maintain a minimum 20-gallon-per-minute outflow from Shay Pond. The objective is to maintain a minimum pond water level that will support suitable habitat conditions for the fish. BBCCSD currently meets this requirement by discharging potable water into Shay Pond, but the 2002 BO also states that, should a suitable alternative supply of water be found to be appropriate for the stickleback in the future, BBCCSD may use an 'in-lieu' water supply, which could include the use of tertiary-treated water. The potable water discharged to Shay Pond represents approximately 5% of BBCCSD's customer water demand and could be reserved for potable use instead of discharging to Shay Pond.

The discharge rate needed to maintain the required outflow, accounting for evaoparation and infiltration, has varied from year to year. However, based on the average volume of discharges measured between 2012 and 2020, BBCCSD discharges approximately 50 AFY of potable water to Shay Pond on average. At times, the required discharge has been up to 80 AFY; this maximum volume is used as the basis for the project design and analysis to be conservative. **Figure 12** shows an aerial view of Shay Pond and the proposed discharge location.



(Source: USFWS, 2009)

Figure 11. Population of Stickleback Fish in the Vicinity of Shay Pond

Figure 12. Shay Pond Aerial View

6.2 Applicable Water Quality Standards

Per the Basin Plan, the protection of beneficial uses designated for Shay Creek and Baldwin Lake is primarily provided by narrative water quality objectives. **Table 12** shows the designated beneficial uses of Shay Creek and Baldwin Lake, which are receiving waters for flows from Shay Pond. Baldwin Lake has intermittent beneficial uses as the lake is ephemeral. The water quality objectives used to protect the beneficial uses designated for Shay Creek and, therefore, Shay Pond are presented in **Table 13**, along with ambient Shay Pond water quality, the quality of the current potable water supply to the pond, and the proposed effluent quality of the proposed discharge.

Table 12. Beneficial Uses of Shay Pond Receiving Waters

Beneficial Uses	Shay Creek	Baldwin Lake
COLD – Cold Freshwater Habitat	✓	I
GWR – Groundwater Recharge	✓	
MUN – Municipal and Domestic Supply	✓	I

Beneficial Uses	Shay Creek	Baldwin Lake
RARE – Rare, Threatened, or Endangered Species	✓	I
REC1 – Water Contact Recreation	✓	I
REC2 – Non-Contact Water Recreation	✓	I
SPWN – Spawning, Reproduction, and/or Early Development	✓	
WARM – Warm Freshwater Habitat		I
WILD – Wildlife Habitat	✓	I
Notes: ✓ - Existing or Potential Beneficial Use; I - Intermittent Beneficial Use		

6.3 Assessment of Water Quality Impacts

The water quality data available for Shay Pond are limited, so a detailed water quality assessment using Shay Pond data could not be completed. For this analysis, the existing water quality of potable water supplies near Shay Pond were compared to the projected effluent quality of the proposed Shay Pond discharge to determine if there is a potential for degradation of Shay Pond water quality as a result of the proposed discharge. The water quality collected in Shay Pond as part of the ROWD application is provided as reference. A similar approach as outlined in **Section 5.2.1** was used to determine if the proposed discharge to Shay Pond could contribute to ambient water quality degradation. **Table 13** presents the results of this analysis.

Water quality data for the specific well that discharges to Shay Pond is not available so the data used for this analysis was obtained by compiling and averaging the water quality data from seven drinking water wells near Shay Pond, which is expected to be representative of the quality of groundwater currently discharged to Shay Pond. BBCCSD collected these data in 2020. The projected effluent quality was estimated as described in **Section 5.1** and presented in **Table 5.** As part of the ROWD process, BBCCSD sampled Shay Pond for 156 constituents, of which only 19 analytes were detected.

Overall, the projected effluent quality of the proposed discharge to Shay Pond is better than the current potable water supply for chloride, hardness, sodium, sulfate, TDS, TN, aluminum, and specific conductance. The projected effluent quality of the proposed discharge is expected to be of similar quality as existing potable water supplies for ammonia, fluoride, MBAS, cadmium, copper, and lead. However, additional data may be needed to confirm these findings. Boron may be the only constituent that could be above the existing potable water supply quality. However, the average boron concentration in the disinfected, advanced treated effluent proposed for discharge to the pond is well below the 0.75 mg/L Basin Plan objective for boron for the protection of sensitive agricultural crops, which is not a use of Shay Pond water.

Additional coordination with the CDFW will be conducted to ensure the Stickleback fish are protected.

Table 13. Comparison of Most Stringent Water Quality Objective or Criterion to Current BBCCSD Potable Water Supply Quality and Projected Effluent Quality of Proposed Discharge

Constituent	Units	Reference for Most Stringent WQO or Criterion	Average Quality of Potable Groundwater Supply [a]	Shay Pond Ambient Quality [b]	Projected Effluent Quality of Proposed Discharge	Comparison of Projected Effluent Quality to Most Stringent WQO (See Table Notes)
Ammonia as N	mg/L	1.4 [c]	NS	0.24	0.05	1
Boron	mg/L	0.75	<0.1	0.059	0.11	2
Chloride	mg/L	500	9	7.6	0.60	1
Fluoride	mg/L	0.9	2.1	1.2	<0.026	1
Hardness, Total (as CaCO3)	mg/L	100	209	180	3.2	1
MBAS	mg/L	0.05	<0.1	<0.1	0.0014	1
Sulfate	mg/L	500	39	23	0.20	1
Total Dissolved Solids	mg/L	1000	291	320	50	1
Total Nitrogen	mg/L-N	10	NS	1.2	0.60	1
Cadmium	µg/L	1.5 [d]	<1	<1	<0.11	1
Copper	µg/L	16.6 [d]	<50	<50	0.07	1
Lead	µg/L	3.5 [d]	<5	<5	0.01	1
Aluminum	µg/L	200	<50	120	1.3	1
Specific Conductance	µmhos/cm	700/1000	496	450	18	1

Notes: NS – Not sampled/no data

a) The average groundwater potable water supply was estimated from 7 domestic wells that were tested and are near Shay Pond. NDs were excluded from the average. Constituents with all ND are reported as "<RL." The MDL was not provided.
b) For Shay Pond, only one sample is available. The results are reported. ND are reported as "<MDL."
c) The total ammonia was estimated using the equation presented in Table 4-4 of the Basin Plan. The field temperature on November 17, 2021, was 56 °F (13.3°C) and pH was 7.7.
d) The cadmium, copper, and lead SSO were estimated using a total hardness value of 180 mg/L, based on the sample collected as Shay Pond.

Constituent	Units	Reference for Most Stringent WQO or Criterion	Average Quality of Potable Groundwater Supply [a]	Shay Pond Ambient Quality [b]	Projected Effluent Quality of Proposed Discharge	Comparison of Projected Effluent Quality to Most Stringent WQO (See Table Notes)

Blue – Projected effluent quality is below the ambient and most stringent WQO or criterion
Red – Projected effluent quality is above the ambient or most stringent WQO or criterion

1) Projected effluent quality is below the ambient and most stringent WQO or criterion. No degradation anticipated.
2) Projected effluent quality is above the ambient, but below the most stringent WQO or criterion. Further analysis needed to determine impacts on water quality.

7 EVALUATION OF CONSISTENCY WITH ANTIDEGRADATION POLICY

The guidelines set by the State Water Board for the antidegradation analysis (APU 90-004) provide direction on evaluating the proposed discharges to Stanfield Marsh/ Lake and Shay Pond by focusing on whether and the degree that water quality is lowered, and by considering whether or not the assumed water quality discharge is consistent with the maximum benefit to the people of the State. In developing the antidegradation analysis, the beneficial uses and relevant water quality objectives and commonly used criteria for the Lake and Shay Pond were considered.

7.1 Benefits of Proposed Project

The proposed discharges of disinfected, advanced treated wastewater to Stanfield Marsh and Shay Pond maximize the use of a local sustainable water supply within the Valley region through the surface water discharge of highly treated wastewater produced by BBARWA to directly benefit the community and environment and support the following beneficial uses in the Lake, Stanfield Marsh, and Shay Pond: AGR (Lake only), COLD, GWR (Lake and Pond), MUN, RARE, REC1, REC2, SPWN (Lake and Pond), WARM (Lake and Pond), and WILD (see **Table 1** and **Table 12** for additional details). The proposed Lake and Shay Pond discharges as part of the Replenish Big Bear Program are anticipated to provide the following benefits:

- A new local drought proof water supply will reduce the Valley's vulnerability to drought, both for the community and the environment.
- A new constant source of water supply to Stanfield Marsh that will provide more stable aquatic and riparian habitat for diverse species and more opportunities for the community to realize the educational and recreational benefits of Stanfield Marsh. The marsh has been mostly dry since 2015 but with the project, the 145-acre marsh area will be at least 50% wetted even during dry years.
- Increased Lake levels will provide more wetted shoreline to enhance aquatic and riparian habitat in the Lake.
- Increased lake levels provide increased opportunities and flexibility for BBMWD to conduct lake management activities, such as weed harvesting to control aquatic macrophytes. Such activities are anticipated to enhance the contact and non-contact recreation in the Lake.

- Increased Lake levels will improve Lake access for boats and personal watercraft and allow for continued use of Lake water for snowmaking in the winter, both of which will act to maintain and enhance tourism, the single largest driver of the Big Bear economy.
    - The number of boat permits sold is directly impacted by Lake levels, and it is anticipated that increased levels will result in the sale of additional boat permits and increased rates of associated recreation and tourism, all of which stimulate the local and regional economies.
    - Visitors in the winter are directly tied to weather conditions and the Resorts' ability to facilitate snow activities by extracting Lake water to make snow when Lake levels are high enough.
    - The Transient Occupancy Tax (TOT) is the second largest revenue source for the City of Big Bear Lake, making up approximately 27% of the general-purpose revenues. Revenue from tourists fluctuate depending on the timing and amount of precipitation the region receives and Lake levels.
    - A strengthened tourist economy is expected to provide additional job growth and stability. Project implementation is estimated to create 3 new permanent positions at the WWTP, 242 temporary construction jobs and 480 indirect jobs.
- Higher Lake levels will result in reduced demand on SWP water, which is used in lieu of Lake water to meet Mutual's water needs when Lake levels are low.
- Increased inflow to the Lake will result in the Lake being full more frequently and will provide BBMWD additional flexibility in optimizing Lake releases to provide new downstream benefits to the Santa Ana Watershed, including increased flows in Bear Creek and the Santa Ana River to support habitat and additional downstream capture of surface water for groundwater recharge.
- The Lake discharge provides opportunities to use of a portion of the Lake water for subsequent uses that provide additional potable water supply and recreational benefits through direct and in-lieu groundwater recharge and enhanced snowmaking capabilities (these uses are anticipated to be permitted separately).

- A new source of high-quality water will be discharged to Shay Pond to support 10 acres of habitat for the federally listed Stickleback. The new source of water enables the potable water currently used for this purpose to be stored in the groundwater basin to enhance water supply sustainability.

7.2 Socioeconomic Considerations

As a result of the project benefits described in **Section 7.1**, the proposed project will act to support important economic and social development in the Valley.

The project proponents are voluntarily committing the resources necessary to construct and operate an advanced wastewater treatment facility to discharge disinfected, RO treated effluent of the quality that could be permitted to be discharged to the Lake as a means to achieve the multiple project benefits described above. The commitment of resources by the project proponents to construct, operate, and maintain the proposed treatment facility will result in increased wastewater fees paid by residents and businesses in the Valley. The capital cost of the proposed facilities required for the Lake and Shay Pond discharges is estimated at $56 M (in 2021 dollars) and the annual operations and maintenance (O&M) costs are estimated at $2.4 M (in 2021 dollars). These capital and O&M expenditures are estimated to result in an increase in wastewater fees of approximately $150-$200 per connection per year.

Increased wastewater fees that would be paid by residents and businesses in the Valley with implementation of the proposed project are not without local and regional economic impacts. The estimated increase in wastewater fees would need to be paid by households and businesses out of their existing household incomes or operations budgets, respectively. In effect, additional wastewater fees would be paid out of funds that are currently available for other purposes. With respect to households, future increased wastewater fees would result in less disposable personal income available to a household for the purchase of other goods and services. Similarly, an increase in annual utility costs for a business could result in one or more of the following: increased costs for the goods and/or services it provides and/or decreased reinvestment in the business. With respect to individual households, increases in utility costs have a disproportionate effect on households at the lowest socioeconomic levels.

While the estimated increase in annual wastewater fees with implementation of the proposed project is not estimated to produce substantial and widespread economic impacts in the Valley, a requirement to add additional wastewater treatment beyond the advanced level of treatment included in the proposed project could trigger substantial and widespread socioeconomic impacts. Furthermore, the project proponents believe that the cost of any additional required wastewater treatment would not produce improvements in receiving

water quality that are proportionate with the cost of additional treatment. The benefits of maintaining existing water quality and mass emissions in the Lake and Shay Pond for the constituents analyzed in this antidegradation analysis are not commensurate with the costs of additional wastewater treatment, beyond what is included in the proposed project, should such treatment be recommended. The small decrease in water quality with respect to the constituents considered in this analysis is unlikely to affect beneficial uses of the Lake, Shay Pond, and downstream receiving waters.

7.3 Consistency with Antidegradation Policies

The proposed project, the discharge of disinfected, advanced treated BBARWA effluent to (1) Stanfield Marsh/Big Bear Lake at a discharge rate up to 2,210 AFY and (2) Shay Pond at a discharge rate up to 80 AFY, is determined to comprise best practicable treatment and control and is consistent with federal and State antidegradation policies for the following reasons:

- The proposed discharge to both Stanfield Marsh/Big Bear Lake and Shay Pond will not adversely affect existing or probable beneficial uses of either receiving water or downstream receiving waters, nor will the discharges cause water quality to not meet applicable water quality objectives.
- Overall, the proposed discharge is estimated to improve water quality in the Lake for TDS, TN, TP, and chlorophyll-a, maintain similar water quality for TIN, and have a very minor impact on boron. Future boron concentrations in the Lake are estimated to increase very slightly (i.e., less than 10% of the available assimilative capacity) due to the proposed BBARWA discharge but are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron (see **Table 7** and **Section 5.3.2**). The Lake Analysis shows that projected ambient Lake concentrations of TIN and chlorophyll-a with the proposed discharge will exist below their relevant water quality objective (TIN) or TMDL target (chlorophyll-a). The Lake Analysis also shows that ambient Lake concentration of TDS and TP with the proposed discharge are estimated to exceed the 175 mg/L TDS objective and the 35 µg/L TP TMDL target, respectively. However, the modeled baseline (no project) condition is projected to result in Lake concentrations for TDS, TP, TIN, and chlorophyll-a that exceed those concentrations more often than all modeled BBARWA discharge scenarios. Modeled results for the proposed BBARWA discharge, when combined with a TP Offset Program (see Attachment B of the ROWD package), show the greatest improvements to future, ambient Lake concentrations as compared to the modeled baseline (no project) condition.

- Overall, the proposed BBARWA discharge is estimated to have a very minor impact on Shay Pond water quality and Shay Creek water quality downstream of the pond. The proposed project is estimated to potentially cause a very minor increase in boron concentrations in the pond and downstream in Shay Creek, but concentrations are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron. The disinfected, advanced treated effluent proposed for discharge to the pond is anticipated to lower the concentrations of those constituents listed in **Table 13** as compared to existing ambient concentrations that are largely influenced by the groundwater currently discharged by BBCCSD to the pond to maintain water levels for the endangered Stickleback fish.
- Based on the above, the request to permit a new discharge to both Stanfield Marsh/Big Bear Lake and Shay Pond is consistent with federal and state antidegradation policies in that the minor lowering of water quality for boron in Big Bear Lake (see **Table 7**) and Shay Pond (see **Table 13**) is necessary to accommodate important economic or social development[5], will not unreasonably affect beneficial uses, will not cause further exceedances of applicable water quality objectives, and is consistent with the maximum benefit to the people of the State.
- Based on the above, the request to permit new discharges to Stanfield Marsh/Big Bear Lake and Shay Pond are consistent with the Porter-Cologne Act in that the resulting water quality will constitute the highest water quality that is reasonable, considering all demands placed on the waters, economic and social considerations, and other public interest factors.

The proposed discharge of disinfected, advanced treated BBARWA effluent to Stanfield Marsh/Big Bear Lake and Shay Pond also fully supports California's *Recycled Water Policy* (SWRCB, 2013) in that it would result in an increased use of recycled water from municipal wastewater sources, would incrementally reduce reliance on the vagaries of annual precipitation, and would assist in the sustainable management of surface and groundwater resources.

[5] Maintain and improve recreation and tourism in the Big Bear Lake region which in turn stimulates the local and regional economies.

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Technical Memorandum

To: Ms. Laine Carlson
Water Systems Consulting, Inc.

From: Thomas Harder, P.G., C.HG.
Thomas Harder & Co.

Date: 29-Nov-17

Re: Sand Canyon Recharge Evaluation

This Technical Memorandum (TM) presents an evaluation of groundwater recharge potential within Sand Canyon near the City of Big Bear Lake, California (see Figure 1). The evaluation is being conducted as part of a larger study to assess the feasibility of delivering surface water from Big Bear Lake to Sand Canyon using a combination of existing and new pumps and pipeline infrastructure. The water from Big Bear Lake would include treated water stored in the lake from a Big Bear Area Regional Wastewater Agency (BBARWA) treatment plant. Given the source of water, it will be necessary to consider California Division of Drinking Water (DDW) regulations for indirect potable reuse in evaluating the location of recharge within Sand Canyon.

The specific purpose of this evaluation was to consider the following:

1. Given the surface configuration of the Sand Canyon channel and the hydrogeology of the area, how much water can be recharged in Sand Canyon?
2. Where in Sand Canyon would the recharge facilities need to be located in order to meet DDW regulations for subsurface residence time of recharge water prior to extraction?
3. As there is a diluent requirement for recharge of recycled water in surface basins and given that regulations allow for consideration of subsurface underflow as a diluent source, how much natural underflow can be applied to the diluent requirement in Sand Canyon?

Sources of Data

A number of hydrogeological studies have already been conducted in Sand Canyon. These include:

- Geoscience, 1990. Geohydrologic Characteristics and Artificial Recharge Potential of the Sand Canyon Area. Dated December 1990.
- Geoscience, 2002. Results of Drilling, Construction, Testing and Pump Design for the Sheephorn Well. Dated February 1, 2002.

Analysis Methodology

Geoscience (1990) had previously conducted a travel time analysis for the Sand Canyon area using a numerical groundwater flow model. The downgradient extent of recharge ponds was identified as the point where Teton Road crosses the channel (see Figure 2). Based on this analysis, the travel time to the proposed downgradient extraction wells (proposed to be near TH-5) was more than six months. However, the analysis was based on a range of assumed hydraulic conductivity of 13 ft/day to 40 ft/day. Further, the range of effective porosity was 0.15 to 0.2. These values are relatively high and estimated based on the lithology of sediments encountered during drilling of test boreholes in the area. Subsequent pumping tests from the City of Big Bear Lake Department of Water's (the City's) Sheephorn Well (see Figure 2) indicate that the hydraulic conductivity of the aquifer is less than 1 ft/day. Further, other pumping tests in the area have shown that the effective porosity (which is equivalent to the specific yield in an unconfined aquifer) is on the order of 0.04.

In order to reevaluate the potential travel time and mounding from recharge basins upstream of Teton Road using updated aquifer properties, TH&Co developed a two-dimensional analytical flow model of the Sand Canyon area (see Figure 3 for model area). The analysis was conducted for steady state conditions using the model code WinFlow[1]. All travel time analyses were conducted using the particle tracking feature which allows for the estimation of groundwater travel time between two points from advective groundwater flow. The analysis incorporated the following assumptions:

- The area of the Sand Canyon channel identified for recharge is shown on Figure 3 and is equivalent to approximately 4.2 acres.
- The volume of water applied to the Sand Canyon recharge area was based on an assumed recharge rate of 0.5 ft/day, applied to the recharge basins over a 6-month period. Thus, the total volume of managed recharge for the simulation was 384 acre-ft.

[1] WinFlow Version 3, Environmental Simulations Inc., 2003.

- The analysis was conducted with the Sheephorn Well pumping at a rate of 125 gallons per minute (gpm) for 7 hours per day and the Sand Canyon Well pumping at a rate of 115 gpm for 9 hours per day.
- The initial groundwater levels were conditioned to a groundwater level contour map published by Geoscience (1990)[2] (see Figure 3). This contour map was generated based on data collected during a relatively dry hydrologic period.
- The hydraulic conductivity of the aquifer beneath the basins is assumed to be 1 ft/day.
- The porosity of the aquifer sediments is assumed to be 0.04.
- The sediments in the vadose zone and aquifer are homogeneous.

Findings

Recharge Potential

The primary limit to recharge rates in the Sand Canyon area appears to be available subsurface storage space to accommodate the groundwater mound. The target maximum groundwater level relative to the land surface was 20 ft below ground surface. Previous studies in the Big Bear area have shown that this depth is protective of liquefaction. This groundwater level was achieved at a recharge rate of 2.1 acre-ft/day in the recharge area, with the shallowest groundwater levels occurring beneath the furthest downgradient recharge basins. At a recharge rate of 2.1 acre-ft/day, the maximum predicted recharge for this study was approximately 380 acre-ft/yr, based on a six-month recharge period.

Recharge Water Subsurface Travel Time to the Nearest Downgradient Well

The particle tracking analysis shows that the recharge water will reach the nearest production well (Sheephorn Well) in a little more than approximately 13 months (see Figure 4). Assuming the Sand Canyon recharge project would fall under the definition of a Groundwater Replenishment Reuse Project (GRRP), per DDW regulations, the required subsurface retention time for the recharge water is 2 months. For preliminary recharge siting purposes, a "credit" of 0.25 is applied for travel time calculations using an analytical model, as was done for this analysis. Thus, the credited retention time is interpreted to be 9.75 months (39 x 0.25). This credited retention time is less than the retention time simulated for this analysis (13 months), indicating that the sites simulated are feasible based on the data assumptions in the analysis.

The limiting factors for recharge capacity, as identified by this analysis, were infiltration rate and groundwater mounding in proximity to the land surface. Further data collection will be necessary to determine the total recharge potential of the Sand Canyon area of interest. The most

[2] Geoscience, 1990. Geohydrologic Characteristics and Artificial Recharge Potential of the Sand Canyon Area.

representative infiltration rates can be obtained through a pilot infiltration test. The test would consist of a controlled release of water into a portion of the channel where the water can be dammed up and temporarily ponded. The water level stage in the ponded area can be measured using a staff gage. Once the depth of the ponded area was sufficient (1 to 2 ft deep), the discharge into the channel would be discontinued and the rate of infiltration measured using the staff gage. Optimally, a succession of multiple wetting and drying cycles would be conducted to obtain an average infiltration rate. If possible, the test should also be conducted at multiple locations along the channel, to determine differences in infiltration rate with location.

Native Subsurface Underflow to the Recharge Area

As the aquifer beneath the Sand Canyon area is conceptualized as being unconfined, native subsurface underflow contribution to the portion of the aquifer beneath the recharge area was estimated based on the Dupuit Equation[3], which is expressed as:

$$Q = 0.5K\left(\frac{(h_1 - h_2)^2}{L}\right)$$

Where:

Q	=	Subsurface flow, (acre-ft)
K	=	Hydraulic Conductivity, (ft/day)
h_1	=	Initial Hydraulic head, (ft amsl)
h_2	=	Ending Hydraulic head, (ft amsl)
L	=	Flow Length (ft)

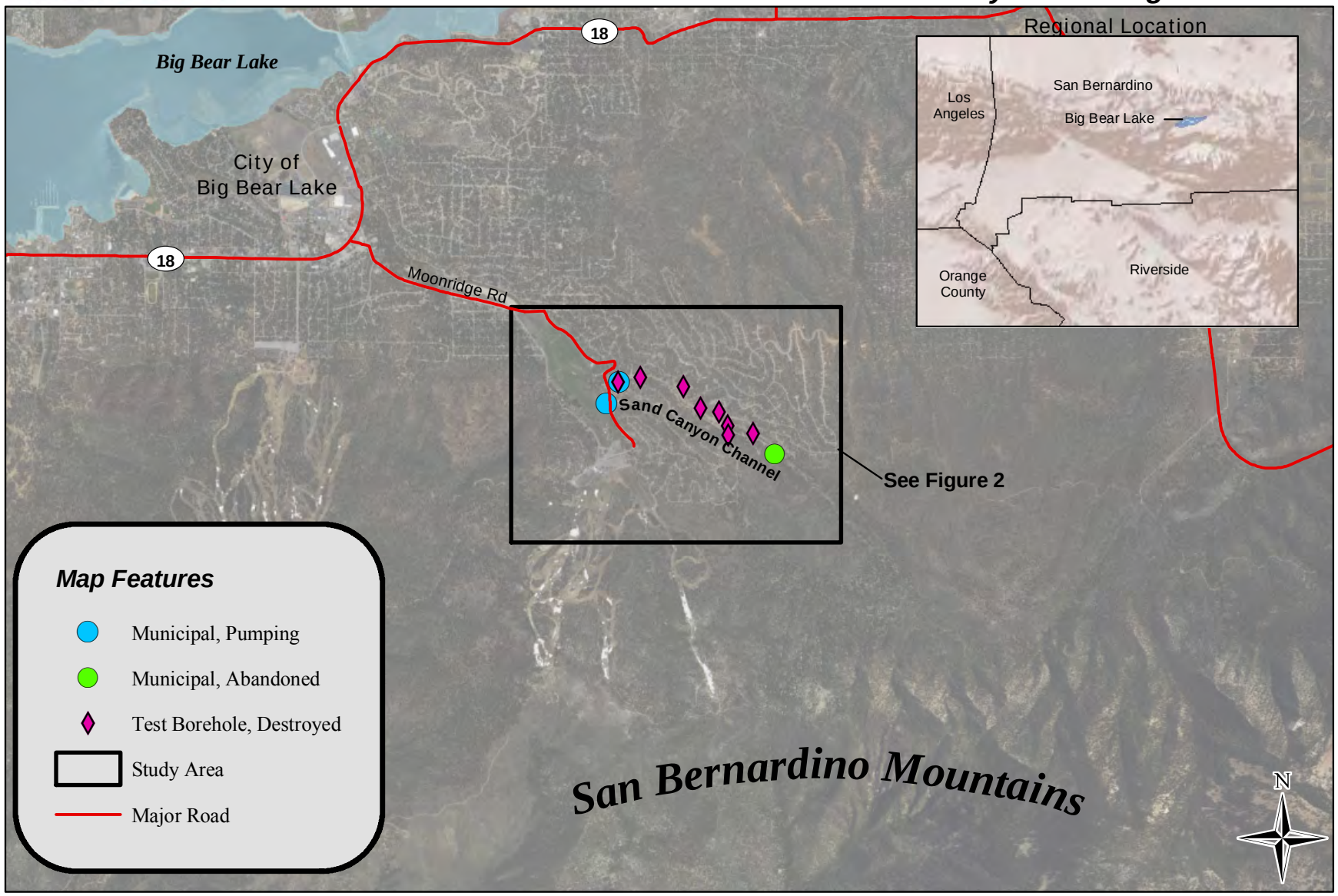
The change in hydraulic head was determined based on the contour map published in Geoscience (1990). The hydraulic conductivity was assumed to be 1 ft/day based on a pumping test conducted in the Sheephorn Well. A summary of the underflow analysis is provided in Table 1. The volume of underflow that may be applied toward the diluent requirement will likely depend on DDW review and interpretation of the data. A range of potential diluent credit was developed such that the low end of the range represents the underflow directly beneath the Sand Canyon channel and the high end of the range represents the entire flow net that ultimately contributes

[3] Fetter, 1994. Applied Hydrogeology, 3rd Edition. MacMillan College Publishing Co.

underflow to the Sand Canyon area, as shown on Figure 1. The range is approximately 58 acre-ft/yr to 247 acre-ft/yr (see Table 1).

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 0.25 0.5 1 Mile

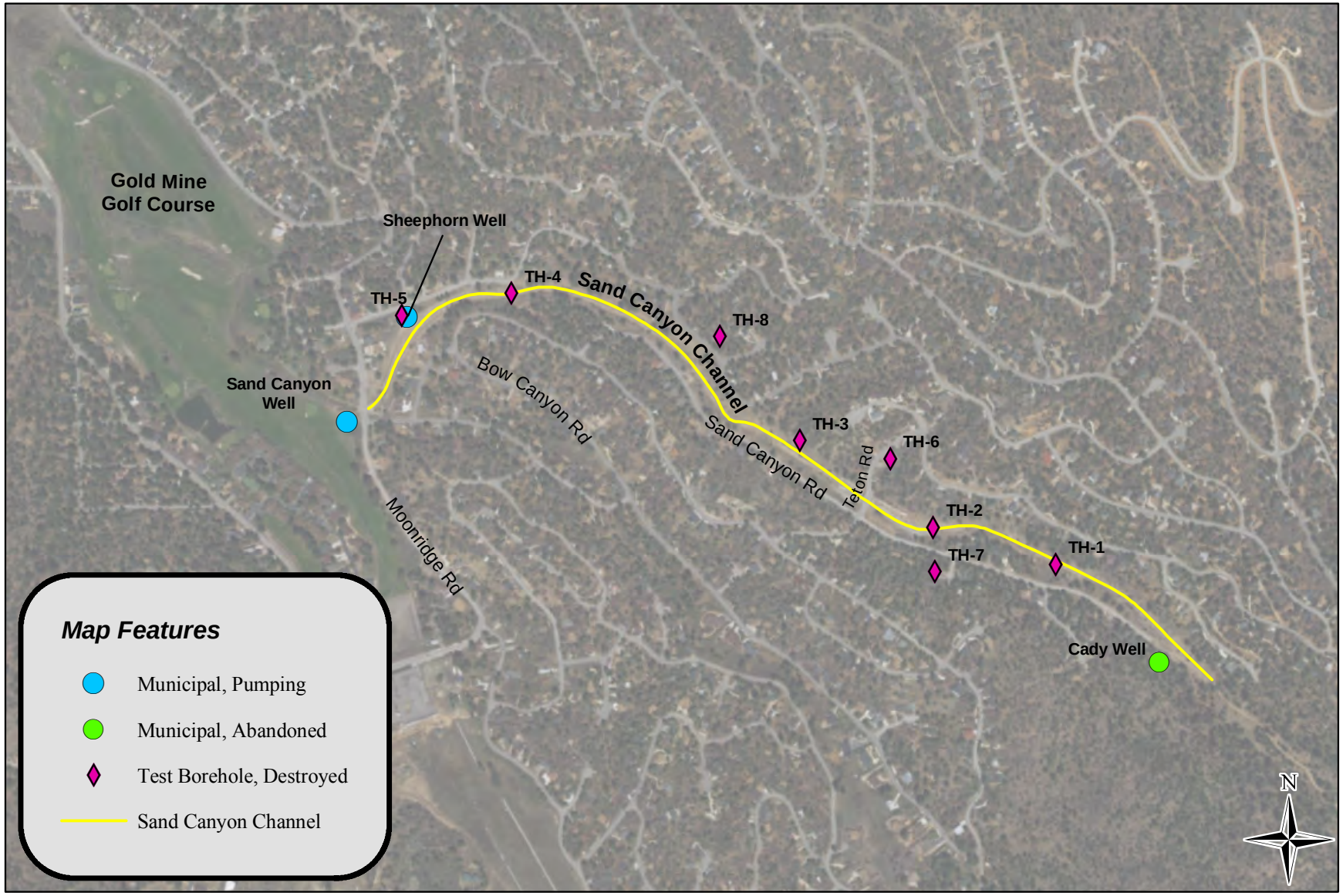
NAD 83 UTM Zone 11

Area Map

Figure 1

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000
Feet

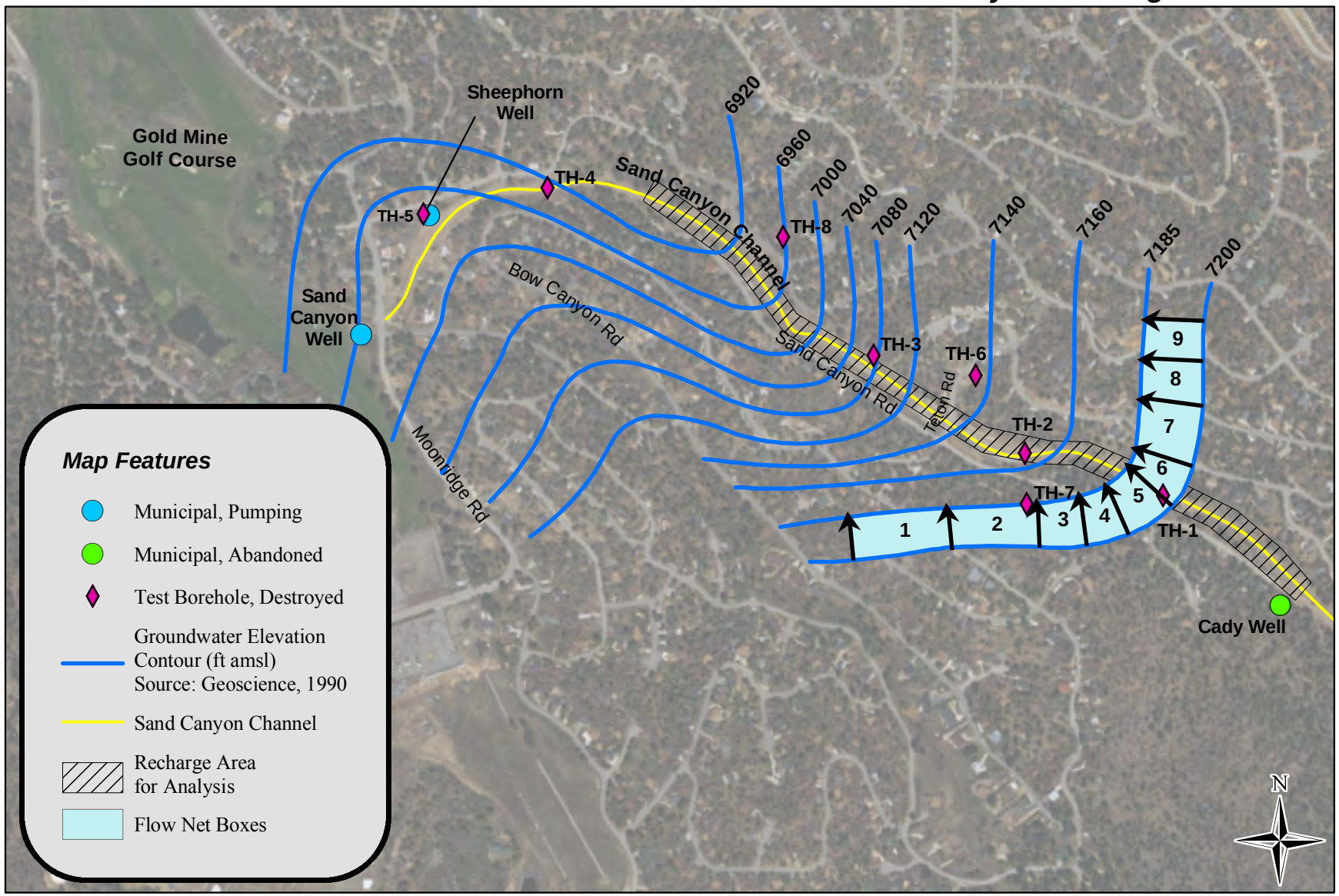
NAD 83 UTM Zone 11

Site Location

Figure 2

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000 Feet

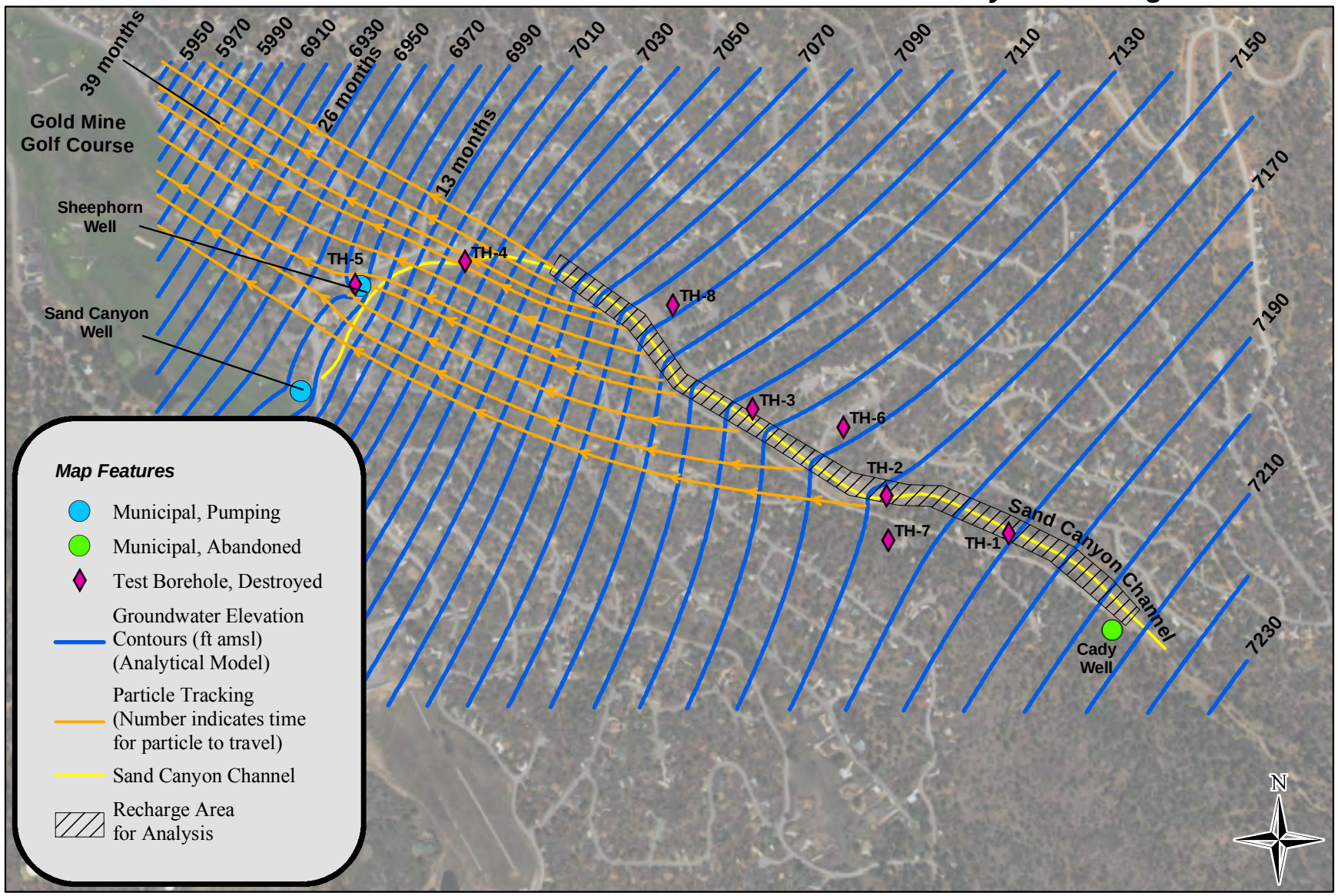
NAD 83 UTM Zone 11

Sand Canyon Underflow Analysis

Figure 3

WSC
Water Systems Consulting, Inc.

Sand Canyon Recharge Evaluation



29-Nov-17

Thomas Harder & Co.
Groundwater Consulting

0 250 500 1,000 Feet

NAD 83 UTM Zone 11

Recharge Travel Time Analysis

Figure 4

Sand Canyon Underflow Analysis

Cell Name	Hydraulic Conductivity [K] (ft/day)	Flow Cell Width (ft)	Initial Hydraulic Head [h_1] (ft)	Ending Hydraulic Head [h_2] (ft)	Length of Flow Cell [L] (ft)	Flow Rate [Q] (ft^3/day)	Flow Rate [Q] (acre-ft/yr)
1	1	490	145	130	213	4,745	40
2	1	439	145	130	205	4,417	37
3	1	296	145	130	223	2,738	23
4	1	307	145	130	177	3,577	30
5	1	305	145	130	200	3,145	26
6	1	296	145	130	161	3,792	32
7	1	281	145	130	275	2,108	18
8	1	254	145	130	210	2,495	21
9	1	235	145	130	197	2,460	21
					Total Flow	**29,476**	**247**

Range in potential diluent credit = 58 - 247 acre-ft/yr

Notes:

Initial and ending hydraulic heads relative to assumed aquifer bottom.

Yellow highlighted values represent underflow directly beneath the Sand Canyon channel.

REPLENISH
— Big Bear —

2/28/2022
Jayne Joy
Executive Officer
Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501
Delivered via Email

Subject: Report of Waste Discharge for Big Bear Area Regional Wastewater Agency Regional Treatment Plant (Replenish Big Bear)

Dear Ms. Joy,

On behalf of Replenish Big Bear project team, please find attached the Report of Waste Discharge (ROWD) for Big Bear Area Regional Wastewater Agency (BBARWA) Regional Treatment Plant. This ROWD is to request a National Pollutant Discharge Elimination System (NPDES) permit for two new discharges locations at 1) to Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), a tributary of Big Bear Lake (Lake) and 2) a separate discharge to Shay Pond, a tributary of Shay Creek.

BBARWA has partnered with Big Bear City Community Service District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), collectively known as the Agency Team, to develop the Replenish Big Bear Program. The Replenish Big Bear Program is intended to help protect the Big Bear Valley (Valley) and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The program is comprised of several elements; the first project includes treatment upgrades at the BBARWA regional wastewater treatment plant (WWTP) to produce disinfected, advanced treated effluent by providing tertiary filtration, reverse osmosis (RO) treatment, and ultraviolet (UV) disinfection for 100% of the water proposed to be discharged at the two new locations.

The proposed project and subject of this ROWD is the discharge of disinfected, advanced treated BBARWA effluent to (1) Stanfield Marsh/Big Bear Lake at a discharge rate up to 2,210 AFY and (2) Shay Pond at a discharge rate up to 80 AFY, is determined to comprise best practicable treatment and control and is consistent with federal and state antidegradation policies. The information supporting this finding is provided in the ROWD submittal package, which consists of the following:

I. ROWD Forms

- California EPA Form 200
- NPDES Form 2A
- NPDES Form 2S
- Location Maps
- Treatment Process Description

II. Supplemental Information
- Attachment A. Secondary Effluent and Receiving Water Characterization Data
- Attachment B. Technical Memo: Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency
- Attachment C. Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/Big Bear Lake and Shay Pond

Note that BBARWA previously held an NPDES permit for discharge to Stanfield Marsh (Order No. 00-12 NPDES No. CA8000344), which was replaced with Waste Discharge Requirements (WDRs) in 2005 because the discharge point was not being used. This expired NPDES number is included in the ROWD forms for reference.

We look forward to further engaging with you and your team on this project and are committed to working cooperatively to implement *Replenish Big Bear* to benefit the Big Bear Valley as well as the greater Santa Ana River Watershed.

Following your review of this ROWD submittal, we would like to request a meeting with key members of your team to discuss any feedback or requests for additional information so that the project team can respond as quickly as possible to keep this critical project moving forward.

We look forward to your review and feedback for next steps. If you have any questions in the meantime, please call or email me at the contact information listed below.

Sincerely,

David Lawrence, PE
General Manager
Big Bear Area Regional Wastewater Agency
dlawrence@bbarwa.org
Mobile: (818) 581-1561

Cc:
SantaAna@waterboards.ca.gov
Julio Lara, Santa Ana Water Board (Julio.Lara@waterboards.ca.gov)
Ryan Harris, Santa Ana Water Board (Ryan.Harris@Waterboards.ca.gov)
Susan Beeson, Santa Ana Water Board (susan.beeson@waterboards.ca.gov)
Lauma Willis, Santa Ana Water Board (Lauma.Willis@waterboards.ca.gov)
John Shimmin, Big Bear Area Regional Wastewater Agency (JShimmin@BBARWA.org)
Mary Reeves, Big Bear City Community Services District (mreeves@bbccsd.org)
Mike Stephenson, Big Bear Municipal Water District (MikeStephenson@bbmwd.net)
Reggie Lamson, Big Bear Lake Department of Water and Power (RLamson@bbldwp.com)
Laine Carlson, Water Systems Consulting (lcarlson@wsc-inc.com)
Antonia Estevez-Olea, Water Systems Consulting (aestevezolea@wsc-inc.com)
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Ashli Desai, Larry Walker Associates (ashlid@lwa.com)
Betsy Elzufon, Larry Walker Associates (betsye@lwa.com)
Mike Trouchon, Larry Walker Associates (michaelt@lwa.com)
Michael A Anderson (michael.anderson@ucr.edu)

Enclosures

REPLENISH
Big Bear

Report of Waste Discharge for Big Bear Area Regional Wastewater Agency Regional Treatment Plant

Prepared by:

Water Systems Consulting, Inc &

Larry Walker Associates

February 2021

WSC

LWA LARRY WALKER ASSOCIATES
science | policy | solutions

Acknowledgement of Credit

This report is financed under the Water Quality, Supply and Infrastructure Improvement Act of 2014, administered by the State of California, Department of Water Resources.

BBARWA SINCE 1974

Service, Quality, Community

Bear Valley Basin

BIG BEAR MUNICIPAL WATER DISTRICT EST. 1953

BIG BEAR CITY CSD Community Services District

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III. NPDES Form 2S

- Part 2, Section 1 – General Information
- Part 2, Section 2 – Generation of Sewage Sludge
- Part 2, Section 3 – Land Application (not applicable)
- Part 2, Section 4 – Surface Disposal (not applicable)
- Part 2, Section 5 – Incineration (not applicable)

IV. Location Maps

V. Treatment Processes

VI. Supplemental Information

Attachment A. Secondary Effluent and Receiving Water Characterization Data

Attachment B. Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency

Attachment C. Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/Big Bear Lake and Shay Pond

I. California EPA Form 200

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE
GENERAL INFORMATION FORM FOR
WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

I. FACILITY INFORMATION

A. FACILITY:

Name: Regional Treatment Plant, Big Bear City

Address: 122 Palomino Drive

City/County/State/Zip Code: Big Bear City, CA 92314

Contact Person: John Shimmin, Plant Manager

Telephone Number: (909) 584-4520 Email: JShimmin@BBARWA.org

B. FACILITY OWNER:

Name: Big Bear Area Regional Wastewater Agency

Address: 121 Palomino Drive, P.O. Box 517

City/State/Zip Code: Big Bear City, CA 92314

Contact Person: David Lawrence, General Manager

Telephone Number: (909) 584-4521 Email: dlawrence@bbarwa.org

Federal Tax ID: 33-0186735

Owner Type (*Mark one*):

☐ Individual ☐ Corporation ☑ Governmental Agency ☐ Partnership

☐ Other:

C. FACILITY OPERATOR (The agency or business, not the person):

Name: Big Bear Area Regional Wastewater Agency

Address: 121 Palomino Drive, P.O. Box 517

City/State/Zip Code: Big Bear City, CA 92314

Contact Person: John Shimmin, Plant Manager

Telephone Number: (909) 584-4520 Email: JShimmin@BBARWA.org

Operator Type (*Mark one*):

☐ Individual ☐ Corporation ☑ Governmental Agency ☐ Partnership

☐ Other:

D. OWNER OF THE LAND

Name Big Bear Area Regional Wastewater Agency

Address 121 Palomino Drive, P.O. Box 517

City/State/Zip Code Big Bear City, CA 92314

Contact Person David Lawrence, General Manager

Telephone Number (909) 584-4521 Email dlawrence@bbarwa.org

Owner Type (*Mark one*):

☐ Individual ☐ Corporation ☑ Governmental Agency ☐ Partnership

☐ Other: _____

E. ADDRESS WHERE LEGAL NOTICE MAY BE SERVED

Address 121 Palomino Drive, P.O. Box 517

City/State/Zip Code Big Bear City, CA 92314

Contact Person David Lawrence, General Manager

Telephone Number (909) 584-4521 Email dlawrence@bbarwa.org

F. BILLING ADDRESS

Address 121 Palomino Drive, P.O. Box 517

City/State/Zip Code Big Bear City, CA 92314

Contact Person Sonja Kawa

Telephone Number (909) 584-4523 Email skawa@bbarwa.org

II. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application:

☐ **Waste Discharge to Land** ☑ **Waste Discharge to Surface Water**

Check all that apply:

☐ Animal or Aquacultural Wastewater
☐ Animal Waste Solids
☑ Biosolids/Residual
☐ Cooling Water
☑ Domestic/ Municipal Wastewater Treatment and Disposal
☐ Dredge Material Disposal
☐ Hazardous Waste (*see instructions*)
☐ Industrial Process Wastewater
☐ Land Treatment Unit
☐ Landfill (*see instructions*)
☐ Mining
☐ Storm Water
☐ Surface Impoundment
☐ Waste Pile
☐ Wastewater Reclamation
☐ Other, *please describe* _____

III. LOCATION OF THE FACILITY

Describe the physical location of the facility:

1. Assessor's Parcel Number(s)
   Facility: 0449-082-040000
   Discharge Point: N/A
2. Latitude
   Facility: 34° 16' 4.2" N
   Discharge Point: 34° 15' 46.5" N (Stanfield Marsh), 34° 15' 14.7"N (Shay Pond)
3. Longitude
   Facility: 116° 48' 55.6" W
   Discharge Point: 116° 51' 58.9" W (Stanfield Marsh), 116° 48' 30.2"W (Shay Pond)

IV. REASON FOR FILING

Check all that apply:

- ☑ New Discharge or Facility
- ☑ Change in Design or Operation
- ☐ Change in Quantity/Type of Discharge
- ☐ Changes in Ownership/Operator (see instructions)
- ☑ Waste Discharge Requirements Update or NPDES Permit Reissuance
- ☐ Other: _____

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency Big Bear Area Regional Wastewater Agency

Has a public agency determined that the proposed project is exempt from CEQA?

☐ Yes ☑ No

If yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below:

_____

_____

Has a "Notice of Determination" been filed under CEQA?

☐ Yes ☑ No

If Yes, enclose a copy of the CEQA document, Environmental Impact Report (EIR), or Negative Declaration. If No, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents: ☑ EIR ☐ Negative Declaration

Expected CEQA Completion Date: June 2023

VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5' USGS Quadrangle) or a street map, if more appropriate.

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

NPDES Forms 2A and 2S, facility maps (January 2022), treatment process narrative and schematics.

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name David Lawrence Title General Manager

Signature [signature] Date 2/28/2022

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

II. NPDES Form 2A

Section 1 – Basic Information

Section 2 – Additional Information

Section 3 – Effluent Discharges

Section 4 – Industrial Discharges (not applicable)

Section 5 – Combined Sewer Overflows (not applicable)

Section 6 – Checklist and Certification Statement

EPA Identification Number	NPDES Permit Number	Facility Name	Form Approved 03/05/19 OMB No. 2040-0004
	CA8000344	Big Bear City RTP	

Form 2A NPDES

U.S. Environmental Protection Agency
Application for NPDES Permit to Discharge Wastewater
NEW AND EXISTING PUBLICLY OWNED TREATMENT WORKS

SECTION 1. BASIC APPLICATION INFORMATION FOR ALL APPLICANTS (40 CFR 122.21(j)(1) and (9))

Facility Information

1.1 Facility name
Regional Treatment Plant, Big Bear City

Mailing address (street or P.O. box)
121 Palomino Drive, P.O. Box 517

City or town	State	ZIP code
Big Bear City	CA	92314

Contact name (first and last)	Title	Phone number	Email address
John Shimmin	Plant Manager	(909) 584-4520	JShimmin@BBARWA.org

Location address (street, route number, or other specific identifier) ☐ Same as mailing address
122 Palomino Drive

City or town	State	ZIP code
Big Bear City	CA	92314

1.2 Is this application for a facility that has yet to commence discharge?
☑ Yes ➔ See instructions on data submission requirements for new dischargers. ☐ No

The existing facility was issued an NPDES permit for discharge to surface water which expired February 1, 2005. The facility is planning upgrades which will entirely change the discharge quality.

Applicant Information

1.3 Is applicant different from entity listed under Item 1.1 above?
☑ Yes ☐ No ➔ SKIP to Item 1.4.

Applicant name
Big Bear Area Regional Wastewater Agency

Applicant address (street or P.O. box)
121 Palomino Drive, P.O. Box 517

City or town	State	ZIP code
Big Bear City	CA	92314

Contact name (first and last)	Title	Phone number	Email address
David Lawrence	General Manager	(909) 584-4521	dlawrence@bbarwa.org

1.4 Is the applicant the facility's owner, operator, or both? (Check only one response.)
☐ Owner ☐ Operator ☑ Both

1.5 To which entity should the NPDES permitting authority send correspondence? (Check only one response.)
☐ Facility ☑ Applicant ☐ Facility and applicant (they are one and the same)

Existing Environmental Permits

1.6 Indicate below any existing environmental permits. (Check all that apply and print or type the corresponding permit number for each.)

Existing Environmental Permits		
☑ NPDES (discharges to surface water) [See note below] CA8000344	☐ RCRA (hazardous waste)	☐ UIC (underground injection control)
☐ PSD (air emissions)	☐ Nonattainment program (CAA)	☐ NESHAPs (CAA)
☐ Ocean dumping (MPRSA)	☐ Dredge or fill (CWA Section 404)	☑ Other (specify) WDR: R8-2005-0044 WDR: R7-2021-0023

Note: This NPDES permit for discharge to surface water expired February 1, 2005.

EPA Identification Number	NPDES Permit Number	Facility Name	Form Approved 03/05/19 OMB No. 2040-0004
	CA8000344	Big Bear City RTP	

Collection System and Population Served

1.7 Provide the collection system information requested below for the treatment works. [USCB 2019, from Google]

Municipality Served	Population Served	Collection System Type (indicate percentage)	Ownership Status
Big Bear City CSD	13,463	100 % separate sanitary sewer 0 % combined storm and sanitary sewer ☐ Unknown	☑ Own ☑ Maintain ☐ Own ☐ Maintain ☐ Own ☐ Maintain
City of Big Bear Lake	5,241	100 % separate sanitary sewer 0 % combined storm and sanitary sewer ☐ Unknown	☑ Own ☑ Maintain ☐ Own ☐ Maintain ☐ Own ☐ Maintain
San Bernardino County SA 53-B	Estimated 650	100 % separate sanitary sewer 0 % combined storm and sanitary sewer ☐ Unknown	☑ Own ☑ Maintain ☐ Own ☐ Maintain ☐ Own ☐ Maintain
BBARWA regional collection facilities	0	____ % separate sanitary sewer ____ % combined storm and sanitary sewer ☐ Unknown	☑ Own ☑ Maintain ☐ Own ☐ Maintain ☐ Own ☐ Maintain
Total Population Served	19,354		

	Separate Sanitary Sewer System	Combined Storm and Sanitary Sewer
Total percentage of each type of sewer line (in miles)	100 %	0 %

Indian Country

1.8 Is the treatment works located in Indian Country?

☐ Yes ☑ No

1.9 Does the facility discharge to a receiving water that flows through Indian Country?

☐ Yes ☑ No

Design and Actual Flow Rates

1.10 Provide design *and* actual flow rates in the designated spaces.

Design Flow Rate
4.89 mgd

Annual Average Flow Rates (Actual)		
Two Years Ago	**Last Year**	**This Year**
2.22 mgd	1.96 mgd	1.84 mgd

Maximum Daily Flow Rates (Actual)		
Two Years Ago	**Last Year**	**This Year**
8.39 mgd	4.56 mgd	3.18 mgd

Discharge Points by Type

1.11 Provide the total number of effluent discharge points to waters of the United States by type.

Total Number of Effluent Discharge Points by Type				
Treated Effluent	**Untreated Effluent**	**Combined Sewer Overflows**	**Bypasses**	**Constructed Emergency Overflows**
2 proposed				

Outfalls and Other Discharge or Disposal Methods

Outfalls Other Than to Waters of the United States

1.12 Does the POTW discharge wastewater to basins, ponds, or other surface impoundments that do not have outlets for discharge to waters of the United States?

☑ Yes ☐ No ➔ SKIP to Item 1.14.

1.13 Provide the location of each surface impoundment and associated discharge information in the table below.

Surface Impoundment Location and Discharge Data

Location	Average Daily Volume Discharged to Surface Impoundment	Continuous or Intermittent (check one)
Lucerne Valley reservoir (Colorado River Basin RWB)	2,120,000 gpd	☑ Continuous ☐ Intermittent See Note below
	gpd	☐ Continuous ☐ Intermittent
	gpd	☐ Continuous ☐ Intermittent

1.14 Is wastewater applied to land?

☑ Yes ☐ No ➔ SKIP to Item 1.16.

1.15 Provide the land application site and discharge data requested below.

Land Application Site and Discharge Data

Location	Size	Average Daily Volume Applied	Continuous or Intermittent (check one)
Lucerne Valley, CA-247 and Camp Rock Rd	340 acres	See Note below 2,120,000 gpd	☑ Continuous ☐ Intermittent
	acres	gpd	☐ Continuous ☐ Intermittent
	acres	gpd	☐ Continuous ☐ Intermittent

1.16 Is effluent transported to another facility for treatment prior to discharge?

☐ Yes ☑ No ➔ SKIP to Item 1.21.

1.17 Describe the means by which the effluent is transported (e.g., tank truck, pipe).

1.18 Is the effluent transported by a party other than the applicant?

☐ Yes ☐ No ➔ SKIP to Item 1.20.

1.19 Provide information on the transporter below.

Transporter Data

Entity name	Mailing address (street or P.O. box)	
City or town	State	ZIP code
Contact name (first and last)	Title	
Phone number	Email address	

Note: After treatment upgrades, up to 2.2 MGD of treated effluent will be sent to outfalls and only any additional flow will be sent to the Lucerne Valley reservoir surface impoundment or land application (permitted under the WDRs).

Outfalls and Other Discharge or Disposal Methods Continued

1.20 In the table below, indicate the name, address, contact information, NPDES number, and average daily flow rate of the receiving facility.

Receiving Facility Data

Facility name	Mailing address (street or P.O. box)	
City or town	State	ZIP code
Contact name (first and last)	Title	
Phone number	Email address	
NPDES number of receiving facility (if any) ☐ None	Average daily flow rate mgd	

1.21 Is the wastewater disposed of in a manner other than those already mentioned in Items 1.14 through 1.21 that do not have outlets to waters of the United States (e.g., underground percolation, underground injection)?

☐ Yes ☑ No ➔ SKIP to Item 1.23.

1.22 Provide information in the table below on these other disposal methods.

Information on Other Disposal Methods

Disposal Method Description	Location of Disposal Site	Size of Disposal Site	Annual Average Daily Discharge Volume	Continuous or Intermittent (check one)
		acres	gpd	☐ Continuous ☐ Intermittent
		acres	gpd	☐ Continuous ☐ Intermittent
		acres	gpd	☐ Continuous ☐ Intermittent

Variance Requests

1.23 Do you intend to request or renew one or more of the variances authorized at 40 CFR 122.21(n)? (Check all that apply. Consult with your NPDES permitting authority to determine what information needs to be submitted and when.)

☐ Discharges into marine waters (CWA Section 301(h))

☐ Water quality related effluent limitation (CWA Section 302(b)(2))

☑ Not applicable

Contractor Information

1.24 Are any operational or maintenance aspects (related to wastewater treatment and effluent quality) of the treatment works the responsibility of a contractor?

☐ Yes ☑ No ➔SKIP to Section 2.

1.25 Provide location and contact information for each contractor in addition to a description of the contractor's operational and maintenance responsibilities.

Contractor Information

	Contractor 1	Contractor 2	Contractor 3
Contractor name (company name)			
Mailing address (street or P.O. box)			
City, state, and ZIP code			
Contact name (first and last)			
Phone number			
Email address			
Operational and maintenance responsibilities of contractor			

SECTION 2. ADDITIONAL INFORMATION (40 CFR 122.21(j)(1) and (2))

Design Flow

Outfalls to Waters of the United States

2.1 Does the treatment works have a design flow greater than or equal to 0.1 mgd?

☑ Yes ☐ No ➔ SKIP to Section 3.

Inflow and Infiltration

2.2 Provide the treatment works' current average daily volume of inflow and infiltration.

Average Daily Volume of Inflow and Infiltration	
(Difference between wet and dry season influent flow between 2016-2021).	598,000 gpd

Indicate the steps the facility is taking to minimize inflow and infiltration.

Only the 18" and 20" trunk lines and force main pump station are the responsibility of the applicant. Video inspection is performed every four years. The most recent inspection identified seven areas that will require maintenance within 5-10 years.

Topographic Map

2.3 Have you attached a topographic map to this application that contains all the required information? (See instructions for specific requirements.)

☑ Yes ☐ No

Flow Diagram

2.4 Have you attached a process flow diagram or schematic to this application that contains all the required information? (See instructions for specific requirements.)

☑ Yes ☐ No

Scheduled Improvements and Schedules of Implementation

2.5 Are improvements to the facility scheduled?

☑ Yes ☐ No ➔ SKIP to Section 3.

Briefly list and describe the scheduled improvements.

1. See the Treatment Process Narrative (Section V).
2.
3.
4.

2.6 Provide scheduled or actual dates of completion for improvements.

Scheduled or Actual Dates of Completion for Improvements

Scheduled Improvement (from above)	Affected Outfalls (list outfall number)	Begin Construction (MM/DD/YYYY)	End Construction (MM/DD/YYYY)	Begin Discharge (MM/DD/YYYY)	Attainment of Operational Level (MM/DD/YYYY)
1.	001, 002		06/30/2026	07/01/2026	
2.					
3.					
4.					

2.7 Have appropriate permits/clearances concerning other federal/state requirements been obtained? Briefly explain your response.

☐ Yes ☑ No ☐ None required or applicable

Explanation:

All required federal permits will be obtained before construction begins.

SECTION 3. INFORMATION ON EFFLUENT DISCHARGES (40 CFR 122.21(j)(3) to (5))

Description of Outfalls

3.1 Provide the following information for each outfall. (Attach additional sheets if you have more than three outfalls.)

	Outfall Number 001	Outfall Number 002	Outfall Number _____
State	CA	CA	
County	San Bernardino	San Bernardino	
City or town	Big Bear City	Big Bear City	
Distance from shore	N/A ft.	N/A ft.	ft.
Depth below surface	N/A ft.	N/A ft.	ft.
Average daily flow rate	2.2 mgd	0.0714 mgd	mgd
Latitude	34° 15′ 46.5″ N	34° 15′ 14.7″ N	° ′ ″
Longitude	116° 51′ 58.9″ W	116° 48′ 30.2″ W	° ′ ″

Seasonal or Periodic Discharge Data

3.2 Do any of the outfalls described under Item 3.1 have seasonal or periodic discharges?

☐ Yes ☑ No ➔ SKIP to Item 3.4.

3.3 If so, provide the following information for each applicable outfall.

	Outfall Number _____	Outfall Number _____	Outfall Number _____
Number of times per year discharge occurs			
Average duration of each discharge (specify units)			
Average flow of each discharge	mgd	mgd	mgd
Months in which discharge occurs			

Diffuser Type

3.4 Are any of the outfalls listed under Item 3.1 equipped with a diffuser?

☐ Yes ☑ No ➔ SKIP to Item 3.6.

3.5 Briefly describe the diffuser type at each applicable outfall.

	Outfall Number _____	Outfall Number _____	Outfall Number _____

Waters of the U.S.

3.6 Does the treatment works discharge or plan to discharge wastewater to waters of the United States from one or more discharge points?

☑ Yes ☐ No ➔SKIP to Section 6.

Receiving Water Description

3.7 Provide the receiving water and related information (if known) for each outfall.

	Outfall Number 001	Outfall Number 002	Outfall Number _____
Receiving water name	Stanfield Marsh	Shay Pond [See Note below]	
Name of watershed, river, or stream system	Big Bear Lake	Shay Creek	
U.S. Soil Conservation Service 14-digit watershed code	341429116583101	N/A	
Name of state management/river basin	N/A	N/A	
U.S. Geological Survey 8-digit hydrologic cataloging unit code	N/A	N/A	
Critical low flow (acute)	N/A cfs	N/A cfs	cfs
Critical low flow (chronic)	N/A cfs	N/A cfs	cfs
Total hardness at critical low flow	157 mg/L of $CaCO_3$	180 (1 value) mg/L of $CaCO_3$	mg/L of $CaCO_3$

Treatment Description

3.8 Provide the following information describing the treatment provided for discharges from each outfall.

	Outfall Number 001	Outfall Number 002	Outfall Number _____
Highest Level of Treatment (check all that apply per outfall)	☑ Primary ☐ Equivalent to secondary ☑ Secondary ☑ Advanced ☑ Other (specify) Tertiary, NDN, RO	☑ Primary ☐ Equivalent to secondary ☑ Secondary ☑ Advanced ☑ Other (specify) Tertiary, NDN, RO	☐ Primary ☐ Equivalent to secondary ☐ Secondary ☐ Advanced ☐ Other (specify) _____
Design Removal Rates by Outfall	Anticipated values for the proposed treatment level:		
BOD_5 or $CBOD_5$	99 %	99 %	%
TSS	99 %	99 %	%
Phosphorus	☐ Not applicable 99 %	☐ Not applicable 99 %	☐ Not applicable %
Nitrogen	☐ Not applicable 98 %	☐ Not applicable 98 %	☐ Not applicable %
Other (specify) Total dissolved solids	☐ Not applicable 88 %	☐ Not applicable 88 %	☐ Not applicable %

Note: The status of Shay Pond as a water of the U.S. has yet to be determined.

Treatment Description Continued

3.9 Describe the type of disinfection used for the effluent from each outfall in the table below. If disinfection varies by season, describe below.

	Outfall Number 001	Outfall Number 002	Outfall Number _____
Disinfection type	Ultraviolet light	Ultraviolet light	
Seasons used	All	All	
Dechlorination used?	☑ Not applicable ☐ Yes ☐ No	☑ Not applicable ☐ Yes ☐ No	☐ Not applicable ☐ Yes ☐ No

Effluent Testing Data

3.10 Have you completed monitoring for all Table A parameters and attached the results to the application package?
☑ Yes [Secondary effluent monitoring] ☐ No

3.11 Have you conducted any WET tests during the 4.5 years prior to the date of the application on any of the facility's discharges or on any receiving water near the discharge points?
☐ Yes ☑ No ➔ SKIP to Item 3.13.

3.12 Indicate the number of acute and chronic WET tests conducted since the last permit reissuance of the facility's discharges by outfall number or of the receiving water near the discharge points.

	Outfall Number _____		Outfall Number _____		Outfall Number _____	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Number of tests of discharge water						
Number of tests of receiving water						

3.13 Does the treatment works have a design flow greater than or equal to 0.1 mgd?
☑ Yes ☐ No ➔ SKIP to Item 3.16.

3.14 Does the POTW use chlorine for disinfection, use chlorine elsewhere in the treatment process, or otherwise have reasonable potential to discharge chlorine in its effluent?
☐ Yes ➔ Complete Table B, including chlorine. ☑ No ➔ Complete Table B, omitting chlorine.

3.15 Have you completed monitoring for all applicable Table B pollutants and attached the results to this application package?
☑ Yes [Secondary effluent monitoring] ☐ No

3.16 Does one or more of the following conditions apply?
- The facility has a design flow greater than or equal to 1 mgd.
- The POTW has an approved pretreatment program or is required to develop such a program.
- The NPDES permitting authority has informed the POTW that it must sample for the parameters in Table C, must sample other additional parameters (Table D), or submit the results of WET tests for acute or chronic toxicity for each of its discharge outfalls (Table E).

☑ Yes ➔ Complete Tables C, D, and E as applicable. ☐ No ➔ SKIP to Section 4.

3.17 Have you completed monitoring for all applicable Table C pollutants and attached the results to this application package?
☑ Yes ☐ No

3.18 Have you completed monitoring for all applicable Table D pollutants required by your NPDES permitting authority and attached the results to this application package?
☑ Yes ☐ No additional sampling required by NPDES permitting authority.

Effluent Testing Data Continued

3.19	Has the POTW conducted either (1) minimum of four quarterly WET tests for one year preceding this permit application or (2) at least four annual WET tests in the past 4.5 years? ☐ Yes ☑ No ➔ Complete tests and Table E and SKIP to Item 3.26.
3.20	Have you previously submitted the results of the above tests to your NPDES permitting authority? ☐ Yes ☑ No ➔ Provide results in Table E and SKIP to Item 3.26.
3.21	Indicate the dates the data were submitted to your NPDES permitting authority and provide a summary of the results.

Date(s) Submitted (MM/DD/YYYY)	Summary of Results
	The existing secondary treatment process would not provide valid results. The required four quarterly WET tests will be performed once the treatment plant upgrades are complete.

3.22	Regardless of how you provided your WET testing data to the NPDES permitting authority, did any of the tests result in toxicity? ☐ Yes ☐ No ➔ SKIP to Item 3.26.
3.23	Describe the cause(s) of the toxicity:
3.24	Has the treatment works conducted a toxicity reduction evaluation? ☐ Yes ☐ No ➔ SKIP to Item 3.26.
3.25	Provide details of any toxicity reduction evaluations conducted.
3.26	Have you completed Table E for all applicable outfalls and attached the results to the application package? ☐ Yes [See note below] ☑ Not applicable because previously submitted information to the NPDES permitting authority.

SECTION 4. INDUSTRIAL DISCHARGES AND HAZARDOUS WASTES (40 CFR 122.21(j)(6) and (7))

Industrial Discharges and Hazardous Wastes

4.1	Does the POTW receive discharges from SIUs or NSCIUs? ☐ Yes ☑ No ➔ SKIP to Item 4.7.
4.2	Indicate the number of SIUs and NSCIUs that discharge to the POTW.

Number of SIUs	Number of NSCIUs

4.3	Does the POTW have an approved pretreatment program? ☐ Yes ☐ No
4.4	Have you submitted either of the following to the NPDES permitting authority that contains information substantially identical to that required in Table F: (1) a pretreatment program annual report submitted within one year of the application or (2) a pretreatment program? ☐ Yes ☐ No ➔ SKIP to Item 4.6.
4.5	Identify the title and date of the annual report or pretreatment program referenced in Item 4.4. SKIP to Item 4.7.
4.6	Have you completed and attached Table F to this application package? ☐ Yes ☐ No

Note: The treatment process will be upgraded prior to commencement of discharge. Toxicity testing will be performed at that time.

Industrial Discharges and Hazardous Wastes Continued

4.7 Does the POTW receive, or has it been notified that it will receive, by truck, rail, or dedicated pipe, any wastes that are regulated as RCRA hazardous wastes pursuant to 40 CFR 261?

☐ Yes ☑ No ➔ SKIP to Item 4.9.

4.8 If yes, provide the following information:

Hazardous Waste Number	Waste Transport Method (check all that apply)	Annual Amount of Waste Received	Units
	☐ Truck ☐ Rail ☐ Dedicated pipe ☐ Other (specify) _____		
	☐ Truck ☐ Rail ☐ Dedicated pipe ☐ Other (specify) _____		
	☐ Truck ☐ Rail ☐ Dedicated pipe ☐ Other (specify) _____		

4.9 Does the POTW receive, or has it been notified that it will receive, wastewaters that originate from remedial activities, including those undertaken pursuant to CERCLA and Sections 3004(7) or 3008(h) of RCRA?

☐ Yes ☑ No ➔ SKIP to Section 5.

4.10 Does the POTW receive (or expect to receive) less than 15 kilograms per month of non-acute hazardous wastes as specified in 40 CFR 261.30(d) and 261.33(e)?

☐ Yes ➔ SKIP to Section 5. ☐ No

4.11 Have you reported the following information in an attachment to this application: identification and description of the site(s) or facility(ies) at which the wastewater originates; the identities of the wastewater's hazardous constituents; and the extent of treatment, if any, the wastewater receives or will receive before entering the POTW?

☐ Yes ☐ No

SECTION 5. COMBINED SEWER OVERFLOWS (40 CFR 122.21(j)(8))

CSO Map and Diagram

5.1 Does the treatment works have a combined sewer system?

☐ Yes ☑ No ➔SKIP to Section 6.

5.2 Have you attached a CSO system map to this application? (See instructions for map requirements.)

☐ Yes ☐ No

5.3 Have you attached a CSO system diagram to this application? (See instructions for diagram requirements.)

☐ Yes ☐ No

CSO Outfall Description

5.4 For each CSO outfall, provide the following information. (Attach additional sheets as necessary.)

	CSO Outfall Number ____	CSO Outfall Number _____	CSO Outfall Number _____
City or town			
State and ZIP code			
County			
Latitude	° ' "	° ' "	° ' "
Longitude	° ' "	° ' "	° ' "
Distance from shore	ft.	ft.	ft.
Depth below surface	ft.	ft.	ft.

CSO Monitoring

5.5 Did the POTW monitor any of the following items in the past year for its CSO outfalls?

	CSO Outfall Number ____	CSO Outfall Number _____	CSO Outfall Number _____
Rainfall	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
CSO flow volume	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
CSO pollutant concentrations	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Receiving water quality	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
CSO frequency	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Number of storm events	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

CSO Events in Past Year

5.6 Provide the following information for each of your CSO outfalls.

	CSO Outfall Number ____	CSO Outfall Number ____	CSO Outfall Number ____
Number of CSO events in the past year	events	events	events
Average duration per event	hours ☐ Actual or ☐ Estimated	hours ☐ Actual or ☐ Estimated	hours ☐ Actual or ☐ Estimated
Average volume per event	million gallons ☐ Actual or ☐ Estimated	million gallons ☐ Actual or ☐ Estimated	million gallons ☐ Actual or ☐ Estimated
Minimum rainfall causing a CSO event in last year	inches of rainfall ☐ Actual or ☐ Estimated	inches of rainfall ☐ Actual or ☐ Estimated	inches of rainfall ☐ Actual or ☐ Estimated

CSO Receiving Waters

5.7 Provide the information in the table below for each of your CSO outfalls.

	CSO Outfall Number ___	CSO Outfall Number ___	CSO Outfall Number ___
Receiving water name			
Name of watershed/ stream system			
U.S. Soil Conservation Service 14-digit watershed code (if known)	☐ Unknown	☐ Unknown	☐ Unknown
Name of state management/river basin			
U.S. Geological Survey 8-Digit Hydrologic Unit Code (if known)	☐ Unknown	☐ Unknown	☐ Unknown
Description of known water quality impacts on receiving stream by CSO (see instructions for examples)			

SECTION 6. CHECKLIST AND CERTIFICATION STATEMENT (40 CFR 122.22(a) and (d))

Checklist and Certification Statement

6.1 In Column 1 below, mark the sections of Form 2A that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing to alert the permitting authority. Note that not all applicants are required to provide attachments.

Column 1	Column 2	
☑ Section 1: Basic Application Information for All Applicants	☐ w/ variance request(s)	☐ w/ additional attachments
☑ Section 2: Additional Information	☑ w/ topographic map ☑ w/ additional attachments	☑ w/ process flow diagram
☑ Section 3: Information on Effluent Discharges	☑ w/ Table A ☑ w/ Table B ☑ w/ Table C	☑ w/ Table D ☐ w/ Table E ☐ w/ additional attachments
☐ Section 4: Industrial Discharges and Hazardous Wastes	☐ w/ SIU and NSCIU attachments ☐ w/ additional attachments	☐ w/ Table F
☐ Section 5: Combined Sewer Overflows	☐ w/ CSO map ☐ w/ CSO system diagram	☐ w/ additional attachments
☑ Section 6: Checklist and Certification Statement	☐ w/ attachments	

6.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name (print or type first and last name)	Official title
David Lawrence	General Manager
Signature	Date signed 2/28/2022

EPA Identification Number	NPDES Permit Number	Facility Name	Outfall Number
	CA8000344	Big Bear City RTP	Current secondary

Form Approved 03/05/19
OMB No. 2040-0004

TABLE A. EFFLUENT PARAMETERS FOR ALL POTWS

Pollutant	Maximum Daily Discharge		Average Daily Discharge			Analytical Method[1]	ML or MDL (include units)
	Value	Units	Value	Units	Number of Samples		
Biochemical oxygen demand ☑ BOD_5 or ☐ $CBOD_5$ (report one)	36	mg/L	8.5	mg/L	301	SM 5210B	2 ☑ ML ☐ MDL
Fecal coliform	24,000	MPN/100mL	ND	MPN/100mL	2	SM 9221	1800 ☑ ML ☐ MDL
Flow rate	8.4	MGD	2.0	MGD	2131		
pH (minimum)	6.9	SU					
pH (maximum)	8.5	SU					
Temperature (winter)	16.0	C	12.2	C	181		
Temperature (summer)	21.5	C	18.1	C	184		
Total suspended solids (TSS)	44	mg/L	7.7	mg/L	298	SM 2540D	5 ☑ ML ☐ MDL

[1] Sampling shall be conducted according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR 136 for the analysis of pollutants or pollutant parameters or required under 40 CFR chapter I, subchapter N or O. See instructions and 40 CFR 122.21(e)(3).

Note: Samples were collected from the currently existing facility which produces undisinfected secondary effluent, currently sent to land application under the WDRs. Future effluent discharged to surface water will be treated to tertiary levels followed by 100% reverse osmosis and UV disinfection after treatment plant upgrades.

EPA Identification Number	NPDES Permit Number	Facility Name	Outfall Number
	CA8000344	Big Bear City RTP	Current secondary

Form Approved 03/05/19
OMB No. 2040-0004

TABLE B. EFFLUENT PARAMETERS FOR ALL POTWS WITH A FLOW EQUAL TO OR GREATER THAN 0.1 MGD

Pollutant	Maximum Daily Discharge		Average Daily Discharge			Analytical Method[1]	ML or MDL (include units)
	Value	Units	Value	Units	Number of Samples		
Ammonia (as N)	22	mg/L	3.2	mg/L	24 (from 2019)	EPA 350.1	0.6 ☑ ML ☐ MDL
Chlorine (total residual, TRC)[2]					0		☐ ML ☐ MDL
Dissolved oxygen	7.3	mg/L	4.8	mg/L	12		☐ ML ☐ MDL
Nitrate/nitrite	9.3	mg/L	1.9	mg/L	25 [from 2019]	EPA 300.0	0.4 ☑ ML ☐ MDL
Kjeldahl nitrogen	23	mg/L	4.4	mg/L	24 (from 2019)	EPA 351.2	1 ☑ ML ☐ MDL
Oil and grease	4.1	mg/L	-	mg/L	1	EPA 1664B	2.1 ☐ ML ☑ MDL
Phosphorus	14.7	mg/L	2.1	mg/L	83	SM 4500 PE	0.013 ☑ ML ☐ MDL
Total dissolved solids	520	mg/L	442	mg/L	70	SM 2540C	5 ☑ ML ☐ MDL

[1] Sampling shall be conducted according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR 136 for the analysis of pollutants or pollutant parameters or required under 40 CFR chapter I, subchapter N or O. See instructions and 40 CFR 122.21(e)(3).

[2] Facilities that do not use chlorine for disinfection, do not use chlorine elsewhere in the treatment process, and have no reasonable potential to discharge chlorine in their effluent are not required to report data for chlorine.

Note: Samples were collected from the currently existing facility which produces undisinfected secondary effluent, currently sent to land application under the WDRs. Future effluent discharged to surface water will be treated to tertiary levels followed by 100% reverse osmosis and UV disinfection after treatment plant upgrades.

Big Bear City Regional Treatment Plant

Form 2A Table C, Secondary Effluent

Pollutant	Maximum Daily Discharge Value	Maximum Daily Discharge Units	Average Daily Discharge Value	Average Daily Discharge Units	Number of samples	Analytical Method	MDL	RL
Metals, Cyanide, and Dioxin								
Antimony, Total	0.23	µg/L	ID	µg/L	8	EPA 200.8	0.14	6
Arsenic, Total	0.73	µg/L	ID	µg/L	8	EPA 200.8	0.4	2
Beryllium, Total	ND	µg/L	ND	µg/L	8	EPA 200.8	0.2	1
Cadmium, Total	ND	µg/L	ND	µg/L	8	EPA 200.8	0.11	1
Chromium (III)	2.6	µg/L	ID	µg/L	6	Calculated		
Chromium (VI)	ND	µg/L	ND	µg/L	8	EPA 218.6	0.14	1
Chromium (total)	0.89	µg/L	ID	µg/L	2	EPA 200.8	0.21	10
Copper, Total	J 14	µg/L	ID	µg/L	8	EPA 200.7	6.5	50
Lead, Total	J 1.8	µg/L	ID	µg/L	8	EPA 200.8	0.51	5
Mercury, Total	0.00076	µg/L	ND	µg/L	8	EPA 245.1/ EPA 1631E	0.15	0.0005-0.2
Nickel, Total	6.3	µg/L	ID	µg/L	8	EPA 200.8	0.52	10
Selenium, Total	J 2.7	µg/L	ID	µg/L	8	EPA 200.8	0.95	5
Silver, Total	0.3	µg/L	ID	µg/L	8	EPA 200.8	0.3	10
Thallium, Total	ND	µg/L	ND	µg/L	8	EPA 200.8	0.18	1
Zinc, Total	120.0	µg/L	80.2	µg/L	8	EPA 200.7	15	50
Cyanide, Total (as CN)	2.7	µg/L	2.4	µg/L	2	SM4500-CN E	1.2	5
Asbestos	2.0	MFL	2.0	MFL	1	EPA 100.2	0.5	50
TCDD Equivalence (TEQ)	ND	pg/L	ND	pg/L	1	EPA 1613B	5	
Volatile Organic Compounds								
Acrolein	ND	µg/L	ND	µg/L	6	EPA 624.1	1.2	2
Acrylonitrile	ND	µg/L	ND	µg/L	6	EPA 624.1	0.6	2
Benzene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.096	0.5
Bromoform	ND	µg/L	ND	µg/L	6	EPA 624.1	0.072	0.5
Carbon Tetrachloride	ND	µg/L	ND	µg/L	6	EPA 624.1	0.1	0.5
Chlorobenzene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.088	0.5
Dibromochloromethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.052	0.5
Chloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.18	0.5
2-Chloroethylvinyl Ether	ND	µg/L	ND	µg/L	6	EPA 624.1	0.72	1
Chloroform	ND	µg/L	ND	µg/L	6	EPA 624.1	0.079	0.5
Bromodichloromethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.058	0.5
1,1-Dichloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.08	0.5
1,2-Dichloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.06	0.5

Big Bear City Regional Treatment Plant

Form 2A Table C, Secondary Effluent

Pollutant	Maximum Daily Discharge Value	Maximum Daily Discharge Units	Average Daily Discharge Value	Average Daily Discharge Units	Number of samples	Analytical Method	MDL	RL
1,1-Dichloroethylene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.12	0.5
1,2-Dichloropropane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.066	0.5
1,3-Dichloropropylene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.11	0.5
Ethylbenzene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.098	2
Bromomethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.19	0.5
Chloromethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.19	2
Methylene Chloride	ND	µg/L	ND	µg/L	6	EPA 624.1	0.076	2
1,1,2,2-Tetrachloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.11	0.5
Tetrachloroethene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.11	0.5
Toluene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.07	2
trans-1,2-Dichloroethene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.11	1
1,1,1-Trichloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.06	0.5
1,1,2-Trichloroethane	ND	µg/L	ND	µg/L	6	EPA 624.1	0.068	0.5
Trichloroethene	ND	µg/L	ND	µg/L	6	EPA 624.1	0.082	2
Vinyl Chloride	ND	µg/L	ND	µg/L	6	EPA 624.1	0.12	0.5
Acid-Extractable Compounds								
2-Chlorophenol	ND	µg/L	ND	µg/L	6	EPA 625	2.7	10
2,4-Dichlorophenol	ND	µg/L	ND	µg/L	6	EPA 625	3.5	5
2,4-Dimethylphenol	ND	µg/L	ND	µg/L	6	EPA 625	3	10
4,6-Dinitro-2-methylphenol	ND	µg/L	ND	µg/L	6	EPA 625	3.7	50
2,4-Dinitrophenol	ND	µg/L	ND	µg/L	6	EPA 625	2.6	25
2-Nitrophenol	ND	µg/L	ND	µg/L	6	EPA 625	2.5	50
4-Nitrophenol	ND	µg/L	ND	µg/L	6	EPA 625	2.8	50
4-Chloro-3-methylphenol	ND	µg/L	ND	µg/L	6	EPA 625	3.4	25
Pentachlorophenol	ND	µg/L	ND	µg/L	6	EPA 625	4.9	25
Phenol, Single Compound	ND	µg/L	ND	µg/L	6	EPA 625	2.5	5
2,4,6-Trichlorophenol	ND	µg/L	ND	µg/L	6	EPA 625	3.6	50
Base-Neutral Compounds								
Acenaphthene	ND	µg/L	ND	µg/L	1	EPA 610	0.27	0.5
Acenaphthylene	ND	µg/L	ND	µg/L	1	EPA 610	0.011	0.2
Anthracene	ND	µg/L	ND	µg/L	1	EPA 610	0.029	0.2
Benzidine	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
Benzo(a)anthracene	ND	µg/L	ND	µg/L	1	EPA 610	0.023	0.2

Big Bear City Regional Treatment Plant

Form 2A Table C, Secondary Effluent

Pollutant	Maximum Daily Discharge Value	Maximum Daily Discharge Units	Average Daily Discharge Value	Average Daily Discharge Units	Number of samples	Analytical Method	MDL	RL
Benzo(a)pyrene	ND	µg/L	ND	µg/L	1	EPA 610	0.03	0.1
Benzo(b)fluoranthene	ND	µg/L	ND	µg/L	1	EPA 610	0.03	0.5
Benzo(ghi)perylene	ND	µg/L	ND	µg/L	1	EPA 610	0.029	0.2
Benzo(k)fluoranthene	ND	µg/L	ND	µg/L	1	EPA 610	0.029	0.2
Bis (2-Chloroethoxy) Methane	ND	µg/L	ND	µg/L	1	EPA 625	2.8	25
Bis (2-Chloroethyl) Ether	ND	µg/L	ND	µg/L	1	EPA 625	2.5	5
Bis (2-Chloroisopropyl) Ether	ND	µg/L	ND	µg/L	1	EPA 625	2.5	50
Bis (2-Ethylhexyl) Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	3.3	7.5
4-Bromophenyl Phenyl Ether	ND	µg/L	ND	µg/L	1	EPA 625	2.5	50
Butylbenzyl Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	6	50
2-Chloronaphthalene	ND	µg/L	ND	µg/L	1	EPA 625	2.5	50
4-Chlorophenyl Phenyl Ether	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
Chrysene	ND	µg/L	ND	µg/L	1	EPA 610	0.028	0.2
Dibenzo(a,h)anthracene	ND	µg/L	ND	µg/L	1	EPA 610	0.027	0.1
1,2-Dichlorobenzene	ND	µg/L	ND	µg/L	1	EPA 624.1	0.059	0.5
1,3-Dichlorobenzene	ND	µg/L	ND	µg/L	1	EPA 624.1	0.077	2
1,4-Dichlorobenzene	ND	µg/L	ND	µg/L	1	EPA 624.1	0.26	0.5
3,3-Dichlorobenzidine	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
Diethyl Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	2.7	10
Dimethyl Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	5.5	10
Di-n-butyl Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	3.7	50
2,4-Dinitrotoluene	ND	µg/L	ND	µg/L	1	EPA 625	3	25
2,6-Dinitrotoluene	ND	µg/L	ND	µg/L	1	EPA 625	3.9	25
Di-n-octyl Phthalate	ND	µg/L	ND	µg/L	1	EPA 625	3.6	50
1,2-Diphenylhydrazine	ND	µg/L	ND	µg/L	1	EPA 625	2.5	5
Fluoranthene	ND	µg/L	ND	µg/L	1	EPA 610	0.033	0.2
Fluorene	ND	µg/L	ND	µg/L	1	EPA 610	0.15	0.2
Hexachlorobenzene	ND	µg/L	ND	µg/L	1	EPA 625	2.5	5
Hexachlorobutadiene	ND	µg/L	ND	µg/L	1	EPA 624.1	0.13	1
Hexachlorocyclopentadiene	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
Hexachloroethane	ND	µg/L	ND	µg/L	1	EPA 625	2.5	5
Indeno (1,2,3-cd) Pyrene	ND	µg/L	ND	µg/L	1	EPA 610	0.035	0.05
Isophorone	ND	µg/L	ND	µg/L	1	EPA 625	2.8	5

Big Bear City Regional Treatment Plant

Form 2A Table C, Secondary Effluent

	Maximum Daily Discharge		Average Daily Discharge		Number of			
Pollutant	Value	Units	Value	Units	samples	Analytical Method	MDL	RL
Naphthalene	ND	µg/L	ND	µg/L	1	EPA 625	0.018	0.2
Nitrobenzene	ND	µg/L	ND	µg/L	1	EPA 625	2.6	50
N-Nitrosodimethylamine	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
N-Nitrosodi-n-Propylamine	ND	µg/L	ND	µg/L	1	EPA 625	2.5	25
N-Nitrosodiphenylamine	ND	µg/L	ND	µg/L	1	EPA 625	3.6	5
Phenanthrene	ND	µg/L	ND	µg/L	1	EPA 610	0.012	0.2
Pyrene	ND	µg/L	ND	µg/L	1	EPA 610	0.04	0.2
1,2,4-Trichlorobenzene	ND	µg/L	ND	µg/L	1	EPA 624.1	0.79	5

Notes:

The secondary effluent dataset extends from June 2017 through November 2021.

Discharge to surface water will not commence until treatment plant upgrades are complete (estimated July 2026). Therefore, these data are not representative of future tertiary quality.

ND = All data were undetected below the MDL.

J = The result is estimated above the MDL and below the RL.

ID = There were insufficient detected data for calculating an average.

Big Bear City Regional Treatment Plant

Form 2A Table D Additional, Secondary Effluent

Pollutant	Maximum Daily Discharge Value	Maximum Daily Discharge Units	Average Daily Discharge Value	Average Daily Discharge Units	Number of samples	Analytical Method	MDL	RL
Aldrin	ND	µg/L	ND	µg/L	1	EPA 608	0.0078	0.025
alpha-BHC	ND	µg/L	ND	µg/L	1	EPA 608	0.0082	0.05
beta-BHC	ND	µg/L	ND	µg/L	1	EPA 608	0.0088	0.025
gamma-BHC	ND	µg/L	ND	µg/L	1	EPA 608	0.0072	0.1
delta-BHC	ND	µg/L	ND	µg/L	1	EPA 608	0.0068	0.025
Chlordane	ND	µg/L	ND	µg/L	1	EPA 608	0.17	0.5
4,4-DDT	ND	µg/L	ND	µg/L	1	EPA 608	0.0052	0.05
4,4-DDE	ND	µg/L	ND	µg/L	1	EPA 608	0.01	0.25
4,4-DDD	ND	µg/L	ND	µg/L	1	EPA 608	0.05	0.25
Dieldrin	ND	µg/L	ND	µg/L	1	EPA 608	0.0092	0.05
Endosulfan I	ND	µg/L	ND	µg/L	1	EPA 608	0.0084	0.1
Endosulfan II	ND	µg/L	ND	µg/L	1	EPA 608	0.0046	0.05
Endosulfan Sulfate	ND	µg/L	ND	µg/L	1	EPA 608	0.012	0.25
Endrin	ND	µg/L	ND	µg/L	1	EPA 608	0.0096	0.05
Endrin Aldehyde	ND	µg/L	ND	µg/L	1	EPA 608	0.01	0.05
Heptachlor	ND	µg/L	ND	µg/L	1	EPA 608	0.0088	0.05
Heptachlor Epoxide	ND	µg/L	ND	µg/L	1	EPA 608	0.0076	0.05
PCB-1016	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1221	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1232	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1242	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1248	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1254	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
PCB-1260	ND	µg/L	ND	µg/L	1	EPA 608	2.5	2.5
Toxaphene	ND	µg/L	ND	µg/L	1	EPA 608	0.26	2.5
Aluminum (Al)	250	µg/L	180	µg/L	2	EPA 200.7	14	50
Barium (Ba)	46	µg/L	46	µg/L	1	EPA 200.7	12	100
Iron (Fe)	150	µg/L	150	µg/L	1	EPA 200.7	14	100
Iron (Fe) Dissolved	J 22	µg/L	22	µg/L	1	EPA 200.7	14	100
Manganese (Mn)	21	µg/L	21	µg/L	1	EPA 200.7	0.8	20
Manganese (Mn) Dissolved	ND	µg/L	ND	µg/L	1	EPA 200.7	0.8	20
Chloride	87	mg/L	56	mg/L	144	EPA 300.0		1
Fluoride (F)	0.52	mg/L	0.41	mg/L	2	EPA 300.0	0.026	0.1
Nitrate as N	1.3	mg/L	0.89	mg/L	2	EPA 300.0	0.12	0.4

Big Bear City Regional Treatment Plant

Form 2A Table D Additional, Secondary Effluent

Pollutant	Maximum Daily Discharge Value	Maximum Daily Discharge Units	Average Daily Discharge Value	Average Daily Discharge Units	Number of samples	Analytical Method	MDL	RL
NO2+NO3 as N	9.3	mg/L	1.9	mg/L	25	Calculation		0.4
Nitrite as N	ND	mg/L	ND	mg/L	1	EPA 300.0	0.17	0.4
Sulfate	48	mg/L	40	mg/L	131	EPA 300.0		0.5
MBAS	0.14	mg/L	0.14	mg/L	2	SM 5540C	0.047	0.1
Methyl tert-Butyl Ether	ND	µg/L	ND	µg/L	1	EPA 624	0.069	3
Styrene	ND	µg/L	ND	µg/L	1	EPA 624	0.059	0.5
Xylenes	ND	µg/L	ND	µg/L	1	EPA 624	0.26	0.5
Total Trihalomethanes (TTHM)	ND	µg/L	ND	µg/L	1	EPA 624	0.22	0.5
Sodium (Na)	89	mg/L	60	mg/L	24	EPA 200.7		1
Boron (B)	270	µg/L	265	µg/L	2	EPA 200.7	32	100

Notes:

The secondary effluent dataset extends from June 2017 through November 2021.

Discharge to surface water will not commence until treatment plant upgrades are complete (estimated July 2026). Therefore, these data are not representative of future tertiary quality.

ND = All data were undetected below the MDL.

J = The result is estimated above the MDL and below the RL.

III. NPDES Form 2S - Biosolids

Part 2, Section 1 – General Information

Part 2, Section 2 – Generation of Sewage Sludge

Part 2, Section 3 – Land Application (not applicable)

Part 2, Section 4 – Surface Disposal (not applicable)

Part 2, Section 5 – Incineration (not applicable)

PART 2 **PERMIT APPLICATION INFORMATION (40 CFR 122.21(q))**

Complete this part if you have an effective NPDES permit or have been directed by the NPDES permitting authority to submit a full permit application. In other words, complete this part if your facility has, or is applying for, an NPDES permit.
Part 2 is divided into five sections. Section 1 pertains to all applicants. The applicability of Sections 2 to 5 depends on your facility's sewage sludge use or disposal practices. See the instructions to determine which sections you are required to complete.

PART 2, SECTION 1. GENERAL INFORMATION (40 CFR 122.21(q)(1 7) AND (q)(13))

General Information

All Part 2 applicants must complete this section.

Facility Information

1.1	Facility name Regional Treatment Plant, Big Bear City			
	Mailing address (street or P.O. box) 121 Palomino Drive, P.O. Box 517			
	City or town Big Bear City	State CA	ZIP code 92314	Phone number (909) 584-4520
	Contact name (first and last) John Shimmin	Title Plant Manager	Email address JShimmin@BBARWA.org	
	Location address (street, route number, or other specific identifier) 122 Palomino Drive		☐ Same as mailing address	
	City or town Big Bear City	State CA	ZIP code 92314	
1.2	Is this facility a Class I sludge management facility? ☐ Yes ☑ No			
1.3	**Facility Design Flow Rate**	4.89 million gallons per day (mgd)		
1.4	**Total Population Served**	19,354		
1.5	**Ownership Status** ☐ Public—federal ☐ Public—state ☑ Other public (specify) Municipal ☐ Private ☐ Other (specify) _____			

Applicant Information

1.6	Is applicant different from entity listed under Item 1.1 above? ☑ Yes ☐ No ➔SKIP to Item 1.8 (Part 2, Section 1).			
1.7	Applicant name Big Bear Area Regional Wastewater Agency			
	Applicant mailing address (street or P.O. box) 121 Palomino Drive, P.O. Box 517			
	City or town Big Bear City		State CA	ZIP code 92314
	Contact name (first and last) David Lawrence	Title General Manager	Phone number (909) 584-4521	Email address dlawrence@bbarwa.org
1.8	Is the applicant the facility's owner, operator, or both? (Check only one response.) ☐ Operator ☐ Owner ☑ Both			
1.9	To which entity should the NPDES permitting authority send correspondence? (Check only one response.) ☐ Facility ☑ Applicant ☐ Facility and applicant (they are one and the same)			

1.10	Facility's NPDES permit number ☐ Check here if you do not have an NPDES permit but are otherwise required to submit Part 2 of Form 2S.	See Note below CA8000344

1.11 Indicate all other federal, state, and local permits or construction approvals received or applied for that regulate this facility's sewage sludge management practices below.

☐ RCRA (hazardous wastes)	☐ Nonattainment program (CAA)	☐ NESHAPs (CAA)
☐ PSD (air emissions)	☐ Dredge or fill (CWA Section 404)	☐ Other (specify)
☐ Ocean dumping (MPRSA)	☐ UIC (underground injection of fluids)	

Indian Country

1.12 Does any generation, treatment, storage, application to land, or disposal of sewage sludge from this facility occur in Indian Country?

☐ Yes ☑ No ➔ SKIP to Item 1.14 (Part 2, Section 1) below.

1.13 Provide a description of the generation, treatment, storage, land application, or disposal of sewage sludge that occurs.

Topographic Map

1.14 Have you attached a topographic map containing all required information to this application? (See instructions for specific requirements.)

☑ Yes ☐ No

Line Drawing

1.15 Have you attached a line drawing and/or a narrative description that identifies all sewage sludge practices that will be employed during the term of the permit containing all the required information to this application? (See instructions for specific requirements.)

☑ Yes ☐ No

Contractor Information

1.16 Do contractors have any operational or maintenance responsibilities related to sewage sludge generation, treatment, use, or disposal at the facility?

☑ Yes ☐ No ➔ SKIP to Item 1.18 (Part 2, Section 1) below.

1.17 Provide the following information for each contractor.

☐ Check here if you have attached additional sheets to the application package.

	Contractor 1	Contractor 2	Contractor 3
Contractor company name	Ag Tech LLC	Synagro West, LLC	
Mailing address (street or P.O. box)	3895 W. County 19th St	14479 Cougar Road	
City, state, and ZIP code	Somerton, AZ 85350	Helendale, CA 92342	
Contact name (first and last)	Cal Mullenix	Jamie Little	
Telephone number	(602) 377-7250	(661) 765-2200	
Email address	cal@westexp.com	jlittle@synagro.com	

Note: This NPDES permit for discharge to surface water expired February 1, 2005.

General Information Continued

1.17 cont.		Contractor 1	Contractor 2	Contractor 3
	Responsibilities of contractor	Sludge hauling through August 2021.	Sludge hauling beginning September 2021.	

Pollutant Concentrations

Using the table below or a separate attachment, provide sewage sludge monitoring data for the pollutants for which limits in sewage sludge have been established in 40 CFR 503 for this facility's expected use or disposal practices. All data must be based on three or more samples taken at least one month apart and must be no more than 4.5 years old.

[Based on 15 samples collected between 2018-2021.]

☐ Check here if you have attached additional sheets to the application package.

1.18

Pollutant	Average Monthly Concentration (mg/kg dry weight)	Analytical Method	Detection Level
Arsenic	ND	EPA 6010	10
Cadmium	ND	EPA 6010	5
Chromium	8.4	EPA 6010	14
Copper	239	EPA 6010	-
Lead	12.2	EPA 6010	17
Mercury	0.55	EPA 7471	0.66
Molybdenum	4.9	EPA 6010	8
Nickel	8.7	EPA 6010	8
Selenium	ND	EPA 6010	1-30
Zinc	524	EPA 6010	-

Checklist and Certification Statement

1.19 In Column 1 below, mark the sections of Form 2S, Part 2, that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing. Note that not all applicants are required to complete all sections or provide attachments. See Exhibit 2S–2 in the Instructions.

Column 1	Column 2
☑ Section 1 (General Information)	☐ w/ attachments
☑ Section 2 (Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge)	☑ w/ attachments
☐ Section 3 (Land Application of Bulk Sewage Sludge)	☐ w/ attachments
☐ Section 4 (Surface Disposal)	☐ w/ attachments
☐ Section 5 (Incineration)	☐ w/ attachments

1.20 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name (print or type first and last name)	Official title
David Lawrence	General Manager
Signature [signature]	Date signed 2/28/2022
Telephone number (909) 584-4521	

Upon the request of the NPDES permitting authority, you must submit any other information the authority deems necessary to assess sewage sludge use or disposal practices at your facility and identify appropriate permitting requirements.

PART 2, SECTION 2. GENERATION OF SEWAGE SLUDGE OR PREPARATION OF A MATERIAL DERIVED FROM SEWAGE SLUDGE (40 CFR 122.21(q)(8) THROUGH (12))

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge

2.1 Does your facility generate sewage sludge or derive a material from sewage sludge?

☑ Yes ☐ No ➔ SKIP to Part 2, Section 3.

Amount Generated Onsite

2.2 Total dry metric tons per 365-day period generated at your facility: 610

Amount Received from Off Site Facility

2.3 Does your facility receive sewage sludge from another facility for treatment use or disposal?

☐ Yes ☑ No ➔SKIP to Item 2.8 (Part 2, Section 2) below.

2.4 Indicate the total number of facilities from which you receive sewage sludge for treatment, use, or disposal:

Provide the following information for each of the facilities from which you receive sewage sludge.

☐ Check here if you have attached additional sheets to the application package.

2.5

Name of facility			
Mailing address (street or P.O. box)			
City or town		State	ZIP code
Contact name (first and last)	Title	Phone number	Email address
Location address (street, route number, or other specific identifier)			☐ Same as mailing address
City or town		State	ZIP code
County		County code	☐ Not available

2.6 Indicate the amount of sewage sludge received, the applicable pathogen class and reduction alternative, and the applicable vector reduction option provided at the offsite facility.

Amount (dry metric tons)	Pathogen Class and Reduction Alternative	Vector Attraction Reduction Option
	☐ Not applicable ☐ Class A, Alternative 1 ☐ Class A, Alternative 2 ☐ Class A, Alternative 3 ☐ Class A, Alternative 4 ☐ Class A, Alternative 5 ☐ Class A, Alternative 6 ☐ Class B, Alternative 1 ☐ Class B, Alternative 2 ☐ Class B, Alternative 3 ☐ Class B, Alternative 4 ☐ Domestic septage, pH adjustment	☐ Not applicable ☐ Option 1 ☐ Option 2 ☐ Option 3 ☐ Option 4 ☐ Option 5 ☐ Option 6 ☐ Option 7 ☐ Option 8 ☐ Option 9 ☐ Option 10 ☐ Option 11

2.7 Identify the treatment process(es) that are known to occur at the offsite facility, including blending activities and treatment to reduce pathogens or vector attraction properties. (Check all that apply.)

☐ Preliminary operations (e.g., sludge grinding and degritting)
☐ Thickening (concentration)
☐ Stabilization
☐ Anaerobic digestion
☐ Composting
☐ Conditioning
☐ Disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization)
☐ Dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons)
☐ Heat drying
☐ Thermal reduction
☐ Methane or biogas capture and recovery
☐ Other (specify) _____

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

Treatment Provided at Your Facility

2.8 For each sewage sludge use or disposal practice, indicate the applicable pathogen class and reduction alternative and the applicable vector attraction reduction option provided at your facility. Attach additional pages, as necessary.

Use or Disposal Practice (check one)	Pathogen Class and Reduction Alternative	Vector Attraction Reduction Option
☐ Land application of bulk sewage	☐ Not applicable	☐ Not applicable
☐ Land application of biosolids (bulk)	☐ Class A, Alternative 1	☐ Option 1
☐ Land application of biosolids (bags)	☐ Class A, Alternative 2	☐ Option 2
☐ Surface disposal in a landfill	☐ Class A, Alternative 3	☐ Option 3
☑ Other surface disposal	☐ Class A, Alternative 4	☐ Option 4
☐ Incineration	☐ Class A, Alternative 5	☐ Option 5
	☐ Class A, Alternative 6	☐ Option 6
	☐ Class B, Alternative 1	☐ Option 7
	☑ Class B, Alternative 2	☐ Option 8
	☐ Class B, Alternative 3	☐ Option 9
	☐ Class B, Alternative 4	☑ Option 10
	☐ Domestic septage, pH adjustment	☐ Option 11

2.9 Identify the treatment process(es) used at your facility to reduce pathogens in sewage sludge or reduce the vector attraction properties of sewage sludge? (Check all that apply.)

- ☑ Preliminary operations (e.g., sludge grinding and degritting)
- ☐ Thickening (concentration)
- ☐ Stabilization
- ☐ Anaerobic digestion
- ☐ Composting
- ☐ Conditioning
- ☐ Disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization)
- ☑ Dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons)
- ☐ Heat drying
- ☐ Thermal reduction
- ☐ Methane or biogas capture and recovery

2.10 Describe any other sewage sludge treatment or blending activities not identified in Items 2.8 and 2.9 (Part 2, Section 2) above.

☐ Check here if you have attached the description to the application package.

Preparation of Sewage Sludge Meeting Ceiling and Pollutant Concentrations, Class A Pathogen Requirements, and One of Vector Attraction Reduction Options 1 to 8

2.11 Does the sewage sludge from your facility meet the ceiling concentrations in Table 1 of 40 CFR 503.13, the pollutant concentrations in Table 3 of 40 CFR 503.13, Class A pathogen reduction requirements at 40 CFR 503.32(a), *and* one of the vector attraction reduction requirements at 40 CFR 503.33(b)(1)–(8) and is it land applied?

☐ Yes ☑ No ➔ SKIP to Item 2.14 (Part 2, Section 2) below.

2.12 Total dry metric tons per 365-day period of sewage sludge subject to this subsection that is applied to the land:

2.13 Is sewage sludge subject to this subsection placed in bags or other containers for sale or give-away for application to the land?

☐ Yes ☐ No

☑ Check here once you have completed Items 2.11 to 2.13, then ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

Sale or Give-Away in a Bag or Other Container for Application to the Land

2.14 Do you place sewage sludge in a bag or other container for sale or give-away for land application?

☐ Yes ☑ No ➔ SKIP to Item 2.17 (Part 2, Section 2) below.

2.15 Total dry metric tons per 365-day period of sewage sludge placed in a bag or other container at your facility for sale or give-away for application to the land:

2.16 Attach a copy of all labels or notices that accompany the sewage sludge being sold or given away in a bag or other container for application to the land.

☐ Check here to indicate that you have attached all labels or notices to this application package.

☑ Check here once you have completed Items 2.14 to 2.16, then ➔ SKIP to Part 2, Section 2, Item 2.32.

Shipment Off Site for Treatment or Blending

2.17 Does another facility provide treatment or blending of your facility's sewage sludge? (This question does not pertain to dewatered sludge sent directly to a land application or surface disposal site.)

☑ Yes ☐ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

2.18 Indicate the total number of facilities that provide treatment or blending of your facility's sewage sludge. Provide the information in Items 2.19 to 2.26 (Part 2, Section 2) below for each facility.

☑ Check here if you have attached additional sheets to the application package.

1 primary, 1 backup

2.19 Name of receiving facility
Nursery Products Hawes Composting Facility

Mailing address (street or P.O. box)
14479 Cougar Rd

City or town	State	ZIP code
Helendale	CA	92342

Contact name (first and last)	Title	Phone number	Email address
Venny Vasquez	Site Manager	(760) 265-5210	vvasquez@synagro.com

Location address (street, route number, or other specific identifier) ☑ Same as mailing address

City or town	State	ZIP code

2.20 Total dry metric tons per 365-day period of sewage sludge provided to receiving facility: 610

2.21 Does the receiving facility provide additional treatment to reduce pathogens in sewage sludge from your facility or reduce the vector attraction properties of sewage sludge from your facility?

☑ Yes ☐ No ➔ SKIP to Item 2.24 (Part 2, Section 2) below.

2.22 Indicate the pathogen class and reduction alternative and the vector attraction reduction option met for the sewage sludge at the receiving facility.

Pathogen Class and Reduction Alternative	Vector Attraction Reduction Option
☐ Not applicable	☐ Not applicable
☐ Class A, Alternative 1	☐ Option 1
☐ Class A, Alternative 2	☐ Option 2
☐ Class A, Alternative 3	☐ Option 3
☐ Class A, Alternative 4	☐ Option 4
☑ Class A, Alternative 5	☑ Option 5
☐ Class A, Alternative 6	☐ Option 6
☐ Class B, Alternative 1	☐ Option 7
☐ Class B, Alternative 2	☐ Option 8
☐ Class B, Alternative 3	☐ Option 9
☐ Class B, Alternative 4	☐ Option 10
☐ Domestic septage, pH adjustment	☐ Option 11

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

2.23 Which treatment process(es) are used at the receiving facility to reduce pathogens in sewage sludge or reduce the vector attraction properties of sewage sludge from your facility? (Check all that apply.)

- ☐ Preliminary operations (e.g., sludge grinding and degritting)
- ☐ Thickening (concentration)
- ☐ Stabilization
- ☐ Anaerobic digestion
- ☑ Composting
- ☐ Conditioning
- ☐ Disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization)
- ☐ Dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons)
- ☐ Heat drying
- ☐ Thermal reduction
- ☐ Methane or biogas capture and recovery
- ☐ Other (specify) _____

2.24 Attach a copy of any information you provide the receiving facility to comply with the "notice and necessary information" requirement of 40 CFR 503.12(g).

☐ Check here to indicate that you have attached material.

2.25 Does the receiving facility place sewage sludge from your facility in a bag or other container for sale or give-away for application to the land?

☐ Yes ☑ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

2.26 Attach a copy of all labels or notices that accompany the product being sold or given away.

☐ Check here to indicate that you have attached material.

☑ Check here once you have completed Items 2.17 to 2.26 (Part 2, Section 2), then ➔ SKIP to Item 2.32 (Part 2, Section 2) below. [See additional pages for backup receiving facility.]

Land Application of Bulk Sewage Sludge

2.27 Is sewage sludge from your facility applied to the land?

☐ Yes ☑ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

2.28 Total dry metric tons per 365-day period of sewage sludge applied to all land application sites: _____

2.29 Did you identify all land application sites in Part 2, Section 3 of this application?

☐ Yes ☐ No ➔ Submit a copy of the land application plan with your application.

2.30 Are any land application sites located in states other than the state where you generate sewage sludge or derive a material from sewage sludge?

☐ Yes ☐ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

2.31 Describe how you notify the NPDES permitting authority for the states where the land application sites are located. Attach a copy of the notification.

☐ Check here if you have attached the explanation to the application package.

☐ Check here if you have attached the notification to the application package.

Surface Disposal

2.32 Is sewage sludge from your facility placed on a surface disposal site?

☐ Yes ☑ No ➔ SKIP to Item 2.39 (Part 2, Section 2) below.

2.33 Total dry metric tons of sewage sludge from your facility placed on all surface disposal sites per 365-day period: _____

2.34 Do you own or operate all surface disposal sites to which you send sewage sludge for disposal?

☐ Yes ➔ SKIP to Item 2.39 (Part 2, Section 2) below. ☐ No

2.35 Indicate the total number of surface disposal sites to which you send your sewage sludge. _____

(Provide the information in Items 2.36 to 2.38 of Part 2, Section 2, for each facility.)

☐ Check here if you have attached additional sheets to the application package.

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

2.36	Site name or number of surface disposal site you do not own or operate			
	Mailing address (street or P.O. box)			
	City or Town		State	ZIP Code
	Contact Name (first and last)	Title	Phone Number	Email Address
2.37	Site Contact (Check all that apply.) ☐ Owner ☐ Operator			
2.38	Total dry metric tons of sewage sludge from your facility placed on this surface disposal site per 365-day period:			

Incineration

2.39	Is sewage sludge from your facility fired in a sewage sludge incinerator? ☐ Yes ☑ No ➔ SKIP to Item 2.46 (Part 2, Section 2) below.			
2.40	Total dry metric tons of sewage sludge from your facility fired in all sewage sludge incinerators per 365-day period:			
2.41	Do you own or operate all sewage sludge incinerators in which sewage sludge from your facility is fired? ☐ Yes ➔ SKIP to Item 2.46 (Part 2, Section 2) below. ☐ No			
2.42	Indicate the total number of sewage sludge incinerators used that you do not own or operate. (Provide the information in Items 2.43 to 2.45 directly below for each facility.) ☐ Check here if you have attached additional sheets to the application package.			
2.43	Incinerator name or number			
	Mailing address (street or P.O. box)			
	City or town		State	ZIP code
	Contact name (first and last)	Title	Phone number	Email address
	Location address (street, route number, or other specific identifier) ☐ Same as mailing address			
	City or town		State	ZIP code
2.44	Contact (check all that apply) ☐ Incinerator owner ☐ Incinerator operator			
2.45	Total dry metric tons of sewage sludge from your facility fired in this sewage sludge incinerator per 365-day period:			

Disposal in a Municipal Solid Waste Landfill

2.46	Is sewage sludge from your facility placed on a municipal solid waste landfill? ☐ Yes ☑ No ➔ SKIP to Part 2, Section 3.	
2.47	Indicate the total number of municipal solid waste landfills used. (Provide the information in Items 2.48 to 2.52 directly below for each facility.) ☐ Check here if you have attached additional sheets to the application package.	

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

2.48	Name of landfill			
	Mailing address (street or P.O. box)			
	City or town		State	ZIP code
	Contact name (first and last)	Title	Phone number	Email address
	Location address (street, route number, or other specific identifier)			☐ Same as mailing address
	County	County code		☐ Not available
	City or town	State		ZIP code
2.49	Total dry metric tons of sewage sludge from your facility placed in this municipal solid waste landfill per 365-day period:			
2.50	List the numbers of all other federal, state, and local permits that regulate the operation of this municipal solid waste landfill.			

Permit Number	Type of Permit

2.51	Attach to the application information to determine whether the sewage sludge meets applicable requirements for disposal of sewage sludge in a municipal solid waste landfill (e.g., results of paint filter liquids test and TCLP test). ☐ Check here to indicate you have attached the requested information.
2.52	Does the municipal solid waste landfill comply with applicable criteria set forth in 40 CFR 258? ☐ Yes ☐ No

PART 2, SECTION 3 LAND APPLICATION OF BULK SEWAGE SLUDGE (40 CFR 122.21(q)(9))

Land Application of Bulk Sewage Sludge

3.1 Does your facility apply sewage sludge to land?

☐ Yes ☑ No ➔ SKIP to Part 2, Section 4.

3.2 Do any of the following conditions apply?

- The sewage sludge meets the ceiling concentrations in Table 1 of 40 CFR 503.12, the pollutant concentrations in Table 3 of 40 CFR 503.13, Class A pathogen reduction requirements at 40 CFR 503.32(a), *and* one of the vector attraction reduction requirements at 40 CFR 503.33(b)(1)–(8);
- The sewage sludge is sold or given away in a bag or other container for application to the land; or
- You provide the sewage sludge to another facility for treatment or blending.

☐ Yes ➔ SKIP to Part 2, Section 4. ☐ No

3.3 Complete Section 3 for every site on which the sewage sludge is applied.

☐ Check here if you have attached sheets to the application package for one or more land application sites.

Identification of Land Application Site

3.4 Site name or number

Location address (street, route number, or other specific identifier) ☐ Same as mailing address

County	County code ☐ Not available

City or town	State	ZIP code

Latitude/Longitude of Land Application Site (see instructions)

Latitude	Longitude
° ′ ″	° ′ ″

Method of Determination

☐ USGS map ☐ Field survey ☐ Other (specify) _____

3.5 Provide a topographic map (or other appropriate map if a topographic map is unavailable) that shows the site location.

☐ Check here to indicate you have attached a topographic map for this site.

Owner Information

3.6 Are you the owner of this land application site?

☐ Yes ➔ SKIP to Item 3.8 (Part 2, Section 3) below. ☐ No

3.7 Owner name

Mailing address (street or P.O. box)

City or town	State	ZIP code

Contact name (first and last)	Title	Phone number	Email address

Applier Information

3.8 Are you the person who applies, or who is responsible for application of, sewage sludge to this land application site?

☐ Yes ➔ SKIP to Item 3.10 (Part 2, Section 3) below. ☐ No

3.9 Applier's name

Mailing address (street or P.O. box)

City or town	State	ZIP code

Contact name (first and last)	Title	Phone number	Email address

Land Application of Bulk Sewage Sludge Continued

Site Type

3.10 Type of land application:

☐ Agricultural land ☐ Forest

☐ Reclamation site ☐ Public contact site

☐ Other (describe)

Crop or Other Vegetation Grown on Site

3.11 What type of crop or other vegetation is grown on this site?

3.12 What is the nitrogen requirement for this crop or vegetation?

Vector Attraction Reduction

3.13 Are the vector attraction reduction requirements at 40 CFR 503.33(b)(9) and (b)(10) met when sewage sludge is applied to the land application site?

☐ Yes ☐ No ➔ SKIP to Item 3.16 (Part 2, Section 3) below.

3.14 Indicate which vector attraction reduction option is met. (Check only one response.)

☐ Option 9 (injection below land surface) ☐ Option 10 (incorporation into soil within 6 hours)

3.15 Describe any treatment processes used at the land application site to reduce vector attraction properties of sewage sludge.

☐ Check here if you have attached your description to the application package.

Cumulative Loadings and Remaining Allotments

3.16 Is the sewage sludge applied to this site since July 20, 1993, subject to the cumulative pollutant loading rates (CPLRs) in 40 CFR 503.13(b)(2)?

☐ Yes ☐ No ➔ SKIP to Part 2, Section 4.

3.17 Have you contacted the NPDES permitting authority in the state where the bulk sewage sludge subject to CPLRs will be applied to ascertain whether bulk sewage sludge subject to CPLRs has been applied to this site on or since July 20, 1993?

☐ Yes ☐ No ➔ Sewage sludge subject to CPLRs may not be applied to this site. SKIP to Part 2, Section 4.

3.18 Provide the following information about your NPDES permitting authority:

NPDES permitting authority name	
Contact person	
Telephone number	
Email address	

3.19 Based on your inquiry, has bulk sewage sludge subject to CPLRs been applied to this site since July 20, 1993?

☐ Yes ☐ No ➔ SKIP to Part 2, Section 4.

3.20 Provide the following information for every facility other than yours that is sending, or has sent, bulk sewage sludge subject to CPLRs to this site since July 20, 1993. If more than one such facility sends sewage sludge to this site, attach additional pages as necessary.

☐ Check here to indicate that additional pages are attached.

Facility name			
Mailing address (street or P.O. box)			
City or town		State	ZIP code
Contact name (first and last)	Title	Phone number	Email address

PART 2, SECTION 4 SURFACE DISPOSAL (40 CFR 122.21(q)(10))

Surface Disposal

4.1 Do you own or operate a surface disposal site?

☐ Yes ☑ No ➔ SKIP to Part 2, Section 5.

4.2 Complete all items in Section 4 for each active sewage sludge unit that you own or operate.

☐ Check here to indicate that you have attached material to the application package for one or more active sewage sludge units.

Information on Active Sewage Sludge Units

4.3

Unit name or number			
Mailing address (street or P.O. box)			
City or town		State	ZIP code
Contact name (first and last)	Title	Phone number	Email address
Location address (street, route number, or other specific identifier)		☐ Same as mailing address	
County		County code ☐ Not available	
City or town		State	ZIP code

Latitude/Longitude of Active Sewage Sludge Unit (see instructions)

Latitude	Longitude
° ′ ″	° ′ ″

Method of Determination

☐ USGS map ☐ Field survey ☐ Other (specify) _____

4.4 Provide a topographic map (or other appropriate map if a topographic map is unavailable) that shows the site location.

☐ Check here to indicate that you have completed and attached a topographic map.

4.5	Total dry metric tons of sewage sludge placed on the active sewage sludge unit per 365-day period:	
4.6	Total dry metric tons of sewage sludge placed on the active sewage sludge unit over the life of the unit:	

4.7 Does the active sewage sludge unit have a liner with a maximum permeability of 1×10^{-7} centimeters per second (cm/sec)?

☐ Yes ☐ No ➔ SKIP to Item 4.9 (Part 2, Section 4) below.

4.8 Describe the liner.

☐ Check here to indicate that you have attached a description to the application package.

4.9 Does the active sewage sludge unit have a leachate collection system?

☐ Yes ☐ No ➔ SKIP to Item 4.11 (Part 2, Section 4) below.

4.10 Describe the leachate collection system and the method used for leachate disposal and provide the numbers of any federal, state, or local permit(s) for leachate disposal.

☐ Check here to indicate that you have attached the description to the application package.

Surface Disposal Continued

4.11	Is the boundary of the active sewage sludge unit less than 150 meters from the property line of the surface disposal site? ☐ Yes ☐ No ➔ SKIP to Item 4.13 (Part 2, Section 4) below.	
4.12	Provide the actual distance in meters:	meters
4.13	Remaining capacity of active sewage sludge unit in dry metric tons:	dry metric tons
4.14	Anticipated closure date for active sewage sludge unit, if known (MM/DD/YYYY):	
4.15	Attach a copy of any closure plan that has been developed for this active sewage sludge unit. ☐ Check here to indicate that you have attached a copy of the closure plan to the application package.	

Sewage Sludge from Other Facilities

4.16	Is sewage sludge sent to this active sewage sludge unit from any facilities other than your facility? ☐ Yes ☐ No ➔ SKIP to Item 4.21 (Part 2, Section 4) below.	
4.17	Indicate the total number of facilities (other than your facility) that send sewage sludge to this active sewage sludge unit. (Complete Items 4.18 to 4.20 directly below for each such facility.) ☐ Check here to indicate that you have attached responses for each facility to the application package.	

4.18 Facility name

Mailing address (street or P.O. box)

City or town		State	ZIP code
Contact name (first and last)	Title	Phone number	Email address

4.19 Indicate the pathogen class and reduction alternative and the vector attraction reduction option met for the sewage sludge before leaving the other facility.

Pathogen Class and Reduction Alternative	Vector Attraction Reduction Option
☐ Not applicable	☐ Not applicable
☐ Class A, Alternative 1	☐ Option 1
☐ Class A, Alternative 2	☐ Option 2
☐ Class A, Alternative 3	☐ Option 3
☐ Class A, Alternative 4	☐ Option 4
☐ Class A, Alternative 5	☐ Option 5
☐ Class A, Alternative 6	☐ Option 6
☐ Class B, Alternative 1	☐ Option 7
☐ Class B, Alternative 2	☐ Option 8
☐ Class B, Alternative 3	☐ Option 9
☐ Class B, Alternative 4	☐ Option 10
☐ Domestic septage, pH adjustment	☐ Option 11

4.20 Which treatment process(es) are used at the other facility to reduce pathogens in sewage sludge or reduce the vector attraction properties of sewage sludge before leaving the other facility? (Check all that apply.)

☐ Preliminary operations (e.g., sludge grinding and degritting)	☐ Thickening (concentration)
☐ Stabilization	☐ Anaerobic digestion
☐ Composting	☐ Conditioning
☐ Disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization)	☐ Dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons)
☐ Heat drying	☐ Thermal reduction
☐ Methane or biogas capture and recovery	☐ Other (specify) _____

Surface Disposal Continued

Vector Attraction Reduction

4.21 Which vector attraction reduction option, if any, is met when sewage sludge is placed on this active sewage sludge unit?

☐ Option 9 (Injection below and surface)

☐ Option 10 (Incorporation into soil within 6 hours)

☐ Option 11 (Covering active sewage sludge unit daily)

☐ None

4.22 Describe any treatment processes used at the active sewage sludge unit to reduce vector attraction properties of sewage sludge.

☐ Check here if you have attached your description to the application package.

Groundwater Monitoring

4.23 Is groundwater monitoring currently conducted at this active sewage sludge unit, or are groundwater monitoring data otherwise available for this active sewage sludge unit?

☐ Yes

☐ No ➔ SKIP to Item 4.26 (Part 2, Section 4) below.

4.24 Provide a copy of available groundwater monitoring data.

☐ Check here to indicate you have attached the monitoring data.

4.25 Describe the well locations, the approximate depth to groundwater, and the groundwater monitoring procedures used to obtain these data.

☐ Check here if you have attached your description to the application package.

4.26 Has a groundwater monitoring program been prepared for this active sewage sludge unit?

☐ Yes

☐ No ➔ SKIP to Item 4.28 (Part 2, Section 4) below.

4.27 Submit a copy of the groundwater monitoring program with this permit application.

☐ Check here to indicate you have attached the monitoring program.

4.28 Have you obtained a certification from a qualified groundwater scientist that the aquifer below the active sewage sludge unit has not been contaminated?

☐ Yes

☐ No ➔ SKIP to Item 4.30 (Part 2, Section 4) below.

4.29 Submit a copy of the certification with this permit application.

☐ Check here to indicate you have attached the certification to the application package.

Site-Specific Limits

4.30 Are you seeking site-specific pollutant limits for the sewage sludge placed on the active sewage sludge unit?

☐ Yes

☐ No ➔ SKIP to Part 2, Section 5.

4.31 Submit information to support the request for site-specific pollutant limits with this application.

☐ Check here to indicate you have attached the requested information.

PART 2, SECTION 5 INCINERATION (40 CFR 122.21(q)(11))

Incineration

Incinerator Information

5.1 Do you fire sewage sludge in a sewage sludge incinerator?

☐ Yes ☑ No ➔ SKIP to END.

5.2 Indicate the total number of incinerators used at your facility. (Complete the remainder of Section 5 for each such incinerator.)

☐ Check here to indicate that you have attached information for one or more incinerators.

5.3 Incinerator name or number

Location address (street, route number, or other specific identifier)

County	County code ☐ Not available	
City or town	State	ZIP code

Latitude/Longitude of Incinerator (see instructions)

Latitude	Longitude
° ' "	° ' "

Method of Determination

☐ USGS map ☐ Field survey ☐ Other (specify) _____

Amount Fired

5.4 Dry metric tons per 365-day period of sewage sludge fired in the sewage sludge incinerator:

Beryllium NESHAP

5.5 Submit information, test data, and a description of measures taken that demonstrate whether the sewage sludge incinerated is beryllium-containing waste and will continue to remain as such.

☐ Check here to indicate that you have attached this material to the application package.

5.6 Is the sewage sludge fired in this incinerator "beryllium-containing waste" as defined at 40 CFR 61.31?

☐ Yes ☐ No ➔ SKIP to Item 5.8 (Part 2, Section 5) below.

5.7 Submit with this application a complete report of the latest beryllium emission rate testing *and* documentation of ongoing incinerator operating parameters indicating that the NESHAP emission rate limit for beryllium has been and will continue to be met.

☐ Check here to indicate that you have attached this information.

Mercury NESHAP

5.8 Is compliance with the mercury NESHAP being demonstrated via stack testing?

☐ Yes ☐ No ➔ SKIP to Item 5.11 (Part 2, Section 5) below.

5.9 Submit a complete report of stack testing and documentation of ongoing incinerator operating parameters indicating that the incinerator has met and will continue to meet the mercury NESHAP emission rate limit.

☐ Check here to indicate that you have attached this information.

5.10 Provide copies of mercury emission rate tests for the two most recent years in which testing was conducted.

☐ Check here to indicate that you have attached this information.

5.11 Do you demonstrate compliance with the mercury NESHAP by sewage sludge sampling?

☐ Yes ☐ No ➔ SKIP to Item 5.13 (Part 2, Section 5) below.

5.12 Submit a complete report of sewage sludge sampling and documentation of ongoing incinerator operating parameters indicating that the incinerator has met and will continue to meet the mercury NESHAP emission rate limit.

☐ Check here to indicate that you have attached this information.

Incineration Continued

Dispersion Factor

5.13	Dispersion factor in micrograms/cubic meter per gram/second:	
5.14	Name and type of dispersion model:	
5.15	Submit a copy of the modeling results and supporting documentation. ☐ Check here to indicate that you have attached this information.	

Control Efficiency

5.16 Provide the control efficiency, in hundredths, for each of the pollutants listed below.

Pollutant	Control Efficiency, in Hundredths
Arsenic	
Cadmium	
Chromium	
Lead	
Nickel	

5.17	Attach a copy of the results or performance testing and supporting documentation (including testing dates). ☐ Check here to indicate that you have attached this information.	

Risk-Specific Concentration for Chromium

5.18	Provide the risk-specific concentration (RSC) used for chromium in micrograms per cubic meter:	
5.19	Was the RSC determined via Table 2 in 40 CFR 503.43? ☐ Yes ☐ No ➔ SKIP to Item 5.21 (Part 2, Section 5) below.	
5.20	Identify the type of incinerator used as the basis. ☐ Fluidized bed with wet scrubber ☐ Other types with wet scrubber ☐ Fluidized bed with wet scrubber and wet electrostatic precipitator ☐ Other types with wet scrubber and wet electrostatic precipitator	
5.21	Was the RSC determined via Table 6 in 40 CFR 503.43 (site-specific determination)? ☐ Yes ☐ No ➔ SKIP to Item 5.23 (Part 2, Section 5) below.	
5.22	Provide the decimal fraction of hexavalent chromium concentration to total chromium concentration in stack exit gas:	
5.23	Attach the results of incinerator stack tests for hexavalent and total chromium concentrations, including the date(s) of any test(s), with this application. ☐ Check here to indicate that you have attached this information. ☐ Not applicable	

Incinerator Parameters

5.24	Do you monitor total hydrocarbons (THC) in the exit gas of the sewage sludge incinerator? ☐ Yes ☐ No	
5.25	Do you monitor carbon monoxide (CO) in the exit gas of the sewage sludge incinerator? ☐ Yes ☐ No	
5.26	Indicate the type of sewage sludge incinerator.	
5.27	Incinerator stack height in meters:	
5.28	Indicate whether the value submitted in Item 5.27 is (check only one response): ☐ Actual stack height ☐ Creditable stack height	

Incineration Continued

Performance Test Operating Parameters

5.29	Maximum performance test combustion temperature:	
5.30	Performance test sewage sludge feed rate, in dry metric tons/day	

5.31 Indicate whether value submitted in Item 5.30 is (check only one response):

☐ Average use ☐ Maximum design

5.32 Attach supporting documents describing how the feed rate was calculated.

☐ Check here to indicate that you have attached this information.

5.33 Submit information documenting the performance test operating parameters for the air pollution control device(s) used for this sewage sludge incinerator.

☐ Check here to indicate that you have attached this information.

Monitoring Equipment

5.34 List the equipment in place to monitor the listed parameters.

Parameter	Equipment in Place for Monitoring
Total hydrocarbons or carbon monoxide	
Percent oxygen	
Percent moisture	
Combustion temperature	
Other (describe)	

Air Pollution Control Equipment

5.35 List all air pollution control equipment used with this sewage sludge incinerator.

☐ Check here if you have attached the list to the application package for the noted incinerator.

END of PART 2

Submit completed application package to your NPDES permitting authority.

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

Additional pages for backup receiving facility:

Shipment Off Site for Treatment or Blending

2.17 Does another facility provide treatment or blending of your facility's sewage sludge? (This question does not pertain to dewatered sludge sent directly to a land application or surface disposal site.)

☑ Yes ☐ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

2.18 Indicate the total number of facilities that provide treatment or blending of your facility's sewage sludge. Provide the information in Items 2.19 to 2.26 (Part 2, Section 2) below for each facility.

☑ Check here if you have attached additional sheets to the application package.

1 primary, 1 backup

2.19

Name of receiving facility Arizona Soils Composting Facility			
Mailing address (street or P.O. box) 41326 McVey Road			
City or town Vicksburg		State AZ	ZIP code 85348
Contact name (first and last) Brian Millage	Title Manager	Phone number (623) 236-0974	Email address bmillage@synagro.com
Location address (street, route number, or other specific identifier)			☑ Same as mailing address
City or town		State	ZIP code

2.20 Total dry metric tons per 365-day period of sewage sludge provided to receiving facility: Contingent

2.21 Does the receiving facility provide additional treatment to reduce pathogens in sewage sludge from your facility or reduce the vector attraction properties of sewage sludge from your facility?

☑ Yes ☐ No ➔ SKIP to Item 2.24 (Part 2, Section 2) below.

2.22 Indicate the pathogen class and reduction alternative and the vector attraction reduction option met for the sewage sludge at the receiving facility.

Pathogen Class and Reduction Alternative	Vector Attraction Reduction Option
☐ Not applicable	☐ Not applicable
☐ Class A, Alternative 1	☐ Option 1
☐ Class A, Alternative 2	☐ Option 2
☐ Class A, Alternative 3	☐ Option 3
☐ Class A, Alternative 4	☐ Option 4
☑ Class A, Alternative 5	☑ Option 5
☐ Class A, Alternative 6	☐ Option 6
☐ Class B, Alternative 1	☐ Option 7
☐ Class B, Alternative 2	☐ Option 8
☐ Class B, Alternative 3	☐ Option 9
☐ Class B, Alternative 4	☐ Option 10
☐ Domestic septage, pH adjustment	☐ Option 11

Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge Continued

2.23 Which treatment process(es) are used at the receiving facility to reduce pathogens in sewage sludge or reduce the vector attraction properties of sewage sludge from your facility? (Check all that apply.)

- ☐ Preliminary operations (e.g., sludge grinding and degritting)
- ☐ Thickening (concentration)
- ☐ Stabilization
- ☐ Anaerobic digestion
- ☑ Composting
- ☐ Conditioning
- ☐ Disinfection (e.g., beta ray irradiation, gamma ray irradiation, pasteurization)
- ☐ Dewatering (e.g., centrifugation, sludge drying beds, sludge lagoons)
- ☐ Heat drying
- ☐ Thermal reduction
- ☐ Methane or biogas capture and recovery
- ☐ Other (specify) _____

2.24 Attach a copy of any information you provide the receiving facility to comply with the "notice and necessary information" requirement of 40 CFR 503.12(g).

☐ Check here to indicate that you have attached material.

2.25 Does the receiving facility place sewage sludge from your facility in a bag or other container for sale or give-away for application to the land?

☐ Yes ☑ No ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

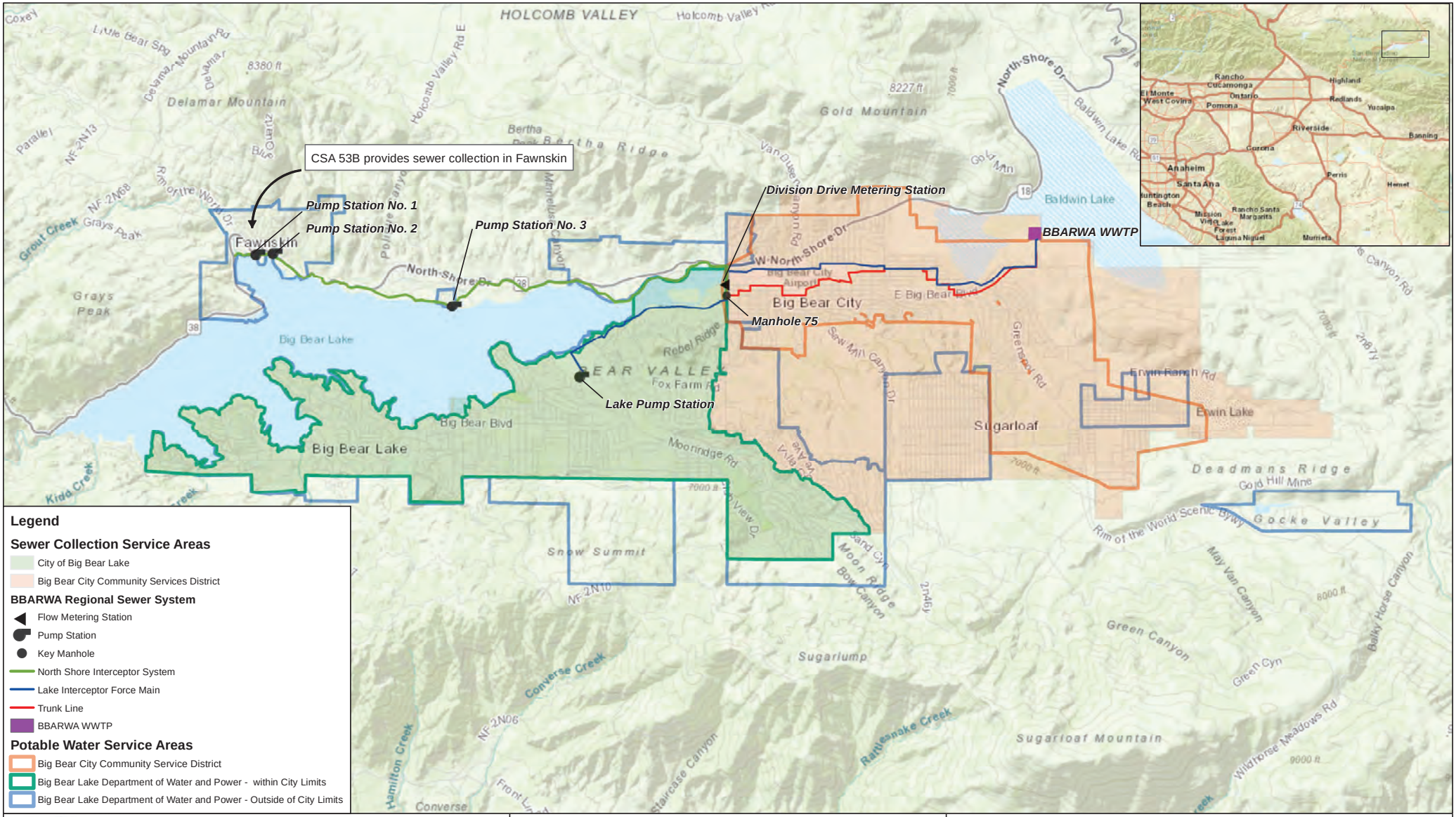
2.26 Attach a copy of all labels or notices that accompany the product being sold or given away.

☐ Check here to indicate that you have attached material.

☑ Check here once you have completed Items 2.17 to 2.26 (Part 2, Section 2), then ➔ SKIP to Item 2.32 (Part 2, Section 2) below.

IV. Location Maps

1. Facility and Service Area Topographic Map
2. Facility and Discharge Points Topographic Map
3. Facility Layout Map
4. Nursery Products Biosolids Receiving Facility Map



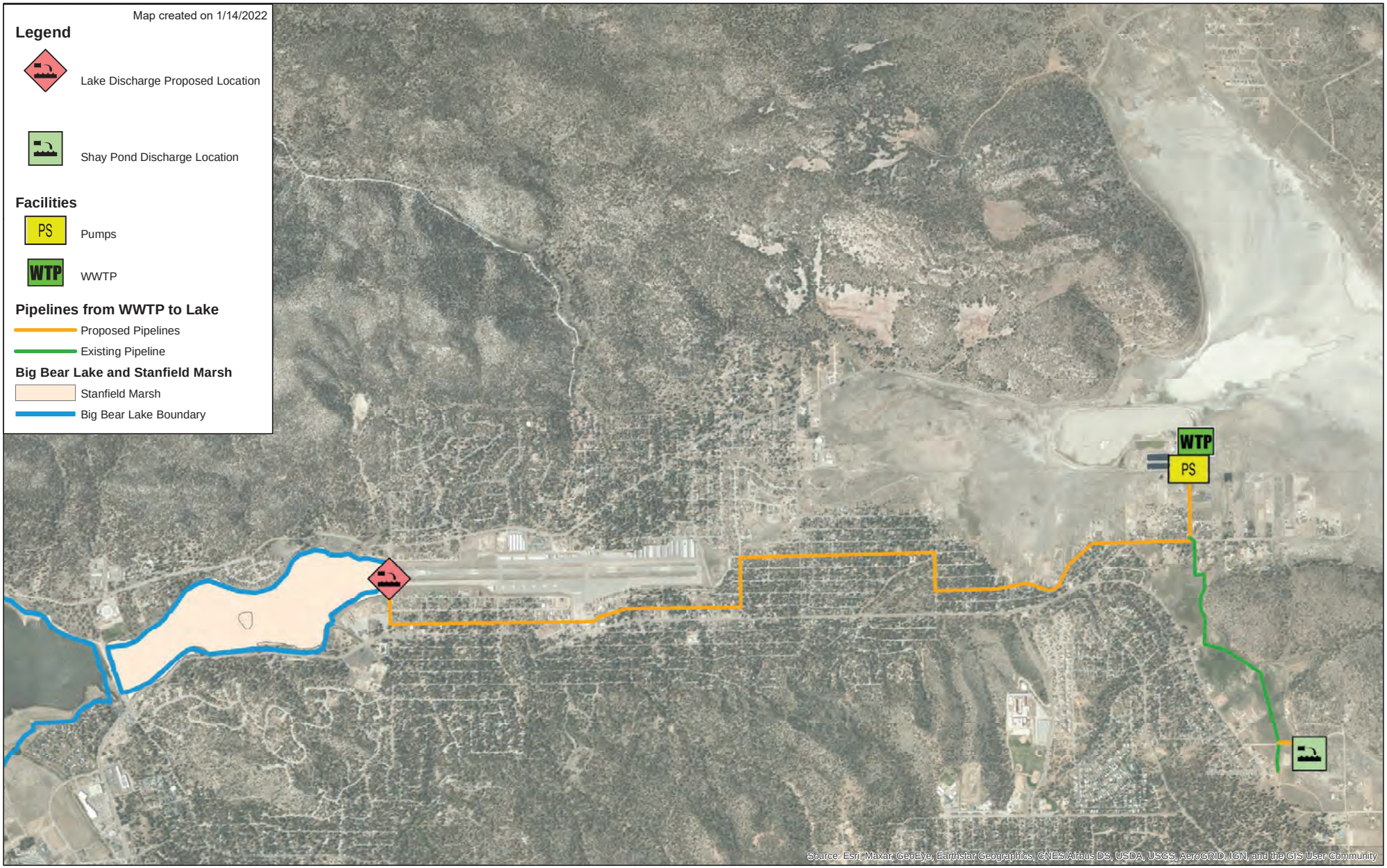
REPLENISH Big Bear

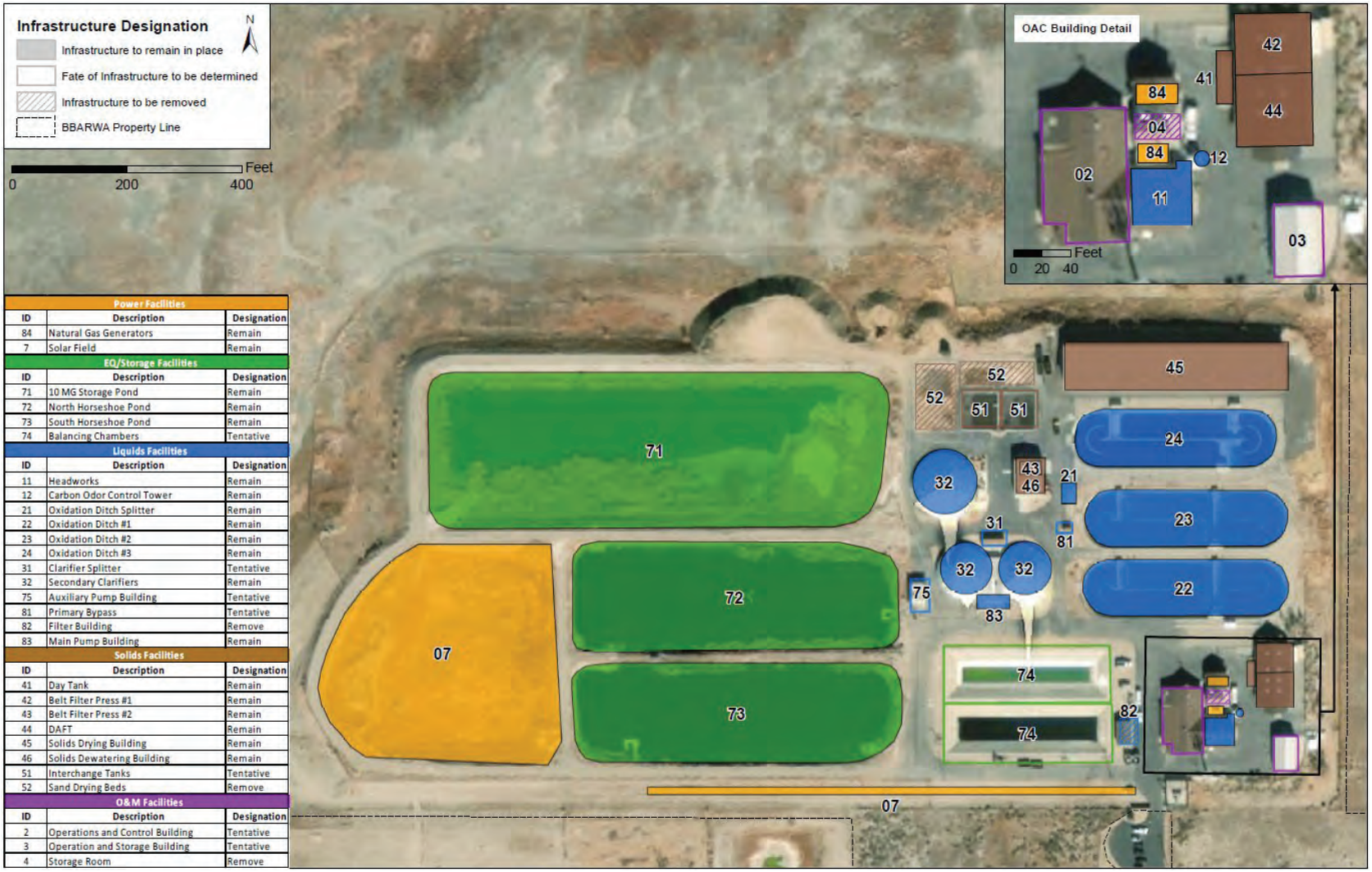
Big Bear Area Regional Wastewater Agency
Sewer Service Area and Big Bear Valley
Potable Water Service Areas
1/28/2022

0 0.5 1 Miles

N

WSC

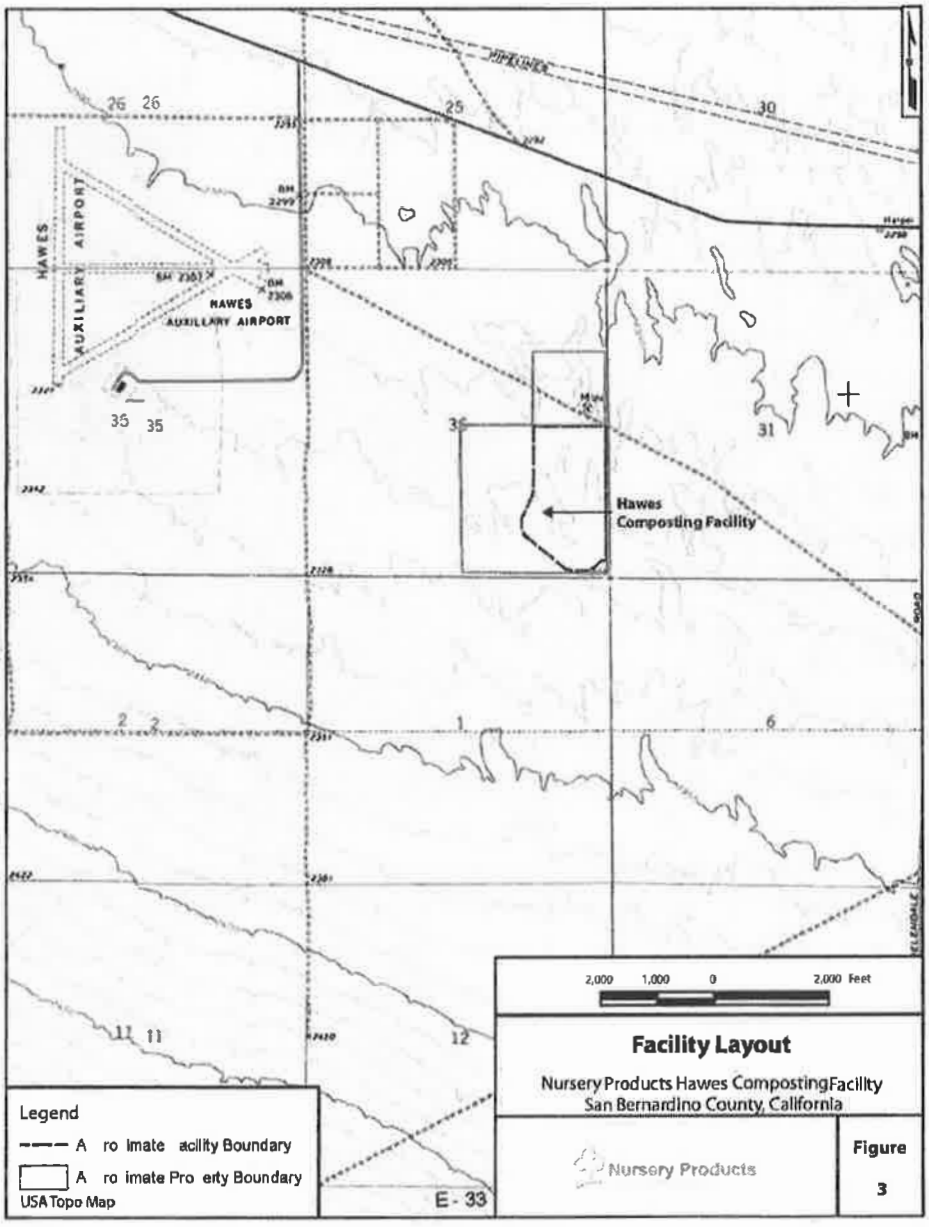

Map created on 1/14/2022
Legend
Lake Discharge Proposed Location
Shay Pond Discharge Location
Facilities
PS
Pumps
WTP
WWTP
Pipelines from WWTP to Lake
Proposed Pipelines
Existing Pipeline
Big Bear Lake and Stanfield Marsh
Stanfield Marsh
Big Bear Lake Boundary
WTP
PS
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Power Facilities		
ID	Description	Designation
84	Natural Gas Generators	Remain
7	Solar Field	Remain
EQ/Storage Facilities		
ID	Description	Designation
71	10 MG Storage Pond	Remain
72	North Horseshoe Pond	Remain
73	South Horseshoe Pond	Remain
74	Balancing Chambers	Tentative
Liquids Facilities		
ID	Description	Designation
11	Headworks	Remain
12	Carbon Odor Control Tower	Remain
21	Oxidation Ditch Splitter	Remain
22	Oxidation Ditch #1	Remain
23	Oxidation Ditch #2	Remain
24	Oxidation Ditch #3	Remain
31	Clarifier Splitter	Tentative
32	Secondary Clarifiers	Remain
75	Auxiliary Pump Building	Tentative
81	Primary Bypass	Tentative
82	Filter Building	Remove
83	Main Pump Building	Remain
Solids Facilities		
ID	Description	Designation
41	Day Tank	Remain
42	Belt Filter Press #1	Remain
43	Belt Filter Press #2	Remain
44	DAFT	Remain
45	Solids Drying Building	Remain
46	Solids Dewatering Building	Remain
51	Interchange Tanks	Tentative
52	Sand Drying Beds	Remove
O&M Facilities		
ID	Description	Designation
2	Operations and Control Building	Tentative
3	Operation and Storage Building	Tentative
4	Storage Room	Remove

Existing Facility Layout (1/28/2022)

Note, this map does not show additional areas designated for solar power facilities near the Administration Building, as these areas do not impact site planning for treatment process upgrades.


HAWES AUXILIARY AIRPORT
HAWES AUXILLARY AIRPORT
Hawes Composting Facility
2,000 1,000 0 2,000 Feet
Facility Layout
Nursery Products Hawes Composting Facility
San Bernardino County, California
Nursery Products
Figure 3
Legend
A ro imate acility Boundary
A ro imate Pro erty Boundary
USA Topo Map
E - 33

V. Treatment Processes

1. Treatment Process Narrative
2. Existing Treatment Process Schematic
3. Future Upgraded Treatment Process Schematic
4. Arizona Soils Biosolids Receiving Facility Schematic

Treatment Process Narrative

Existing Treatment Process

Big Bear Area Regional Wastewater Agency (BBARWA) is a joint powers authority consisting of Big Bear City Community Services District, City of Big Bear Lake, and San Bernardino County Service Area 53-B[1]. BBARWA owns and operates a regional Wastewater Treatment Plant (WWTP). The WWTP treats commercial and domestic wastewater from these three collection systems.

The existing WWTP has a design capacity of 4.89 million gallons per day (MGD). The existing treatment process includes the following:

- Preliminary treatment consisting of a mechanical coarse screen and an aerated grit chamber;
- Secondary treatment consisting of extended aeration oxidation ditches and secondary clarifiers; and
- Solids handling through a dewatering belt filter press.

Treated effluent is temporarily stored on-site prior to discharge to Lucerne Valley. Dewatered solids are hauled off-site.

Future Upgraded Treatment Process

As part of the Replenish Big Bear Program, proposed upgrades to the BBARWA WWTP include:

- Biological nutrient removal added to the existing oxidation ditches;
- Tertiary filtration and nutrient removal via denitrification filters, ultrafiltration (UF), and reverse osmosis (RO) membrane filtration;
- Brine pellet reactor for brine minimization; and
- Ultraviolet (UV) disinfection processes.

The new facilities would be designed for a treatment capacity of 2.2 MGD, with operational capabilities to divert a portion of the denitrification filter effluent directly to ultraviolet disinfection depending on effluent water quality targets and treatment performance. However, it is anticipated that 100% of the water discharged will be treated with RO and UV disinfection. The anticipated completion date is mid-2026.

Solids generated through the brine pellet reactor would be disposed off-site and the liquid stream reject from the brine pellet reactor process would be conveyed to brine evaporation ponds on-site at the BBARWA WWTP for drying and disposal. Treated effluent would be discharged to Shay Pond and Stanfield Marsh, which flows into Big Bear Lake. BBARWA is planning to maintain its current discharge location in Lucerne Valley, where undisinfected secondary effluent is currently used to irrigate fodder crops used for livestock feed. The dewatered solids would continue to be hauled off-site.

[1] BBARWA owns and maintains the trunk lines and force main pump station to convey flows from CSA 53B to the WWTP, but CSA 53B maintains their own collection system.

A detailed summary of the treatment process upgrades is shown in **Table 1**.

Table 1. Summary of Treatment Process Upgrades

Treatment Mode	Processes
Biological Nutrient Removal	**Nitrification-Denitrification**: Retrofit existing oxidation ditches to a Modified Ludzack-Ettinger (MLE) configuration with turbo blowers and diffused aeration for nitrogen removal.
Tertiary Filtration & Nutrient Removal	**Denitrification Filter:** Construct denitrification filters for nitrogen and phosphorus removal. Chemical provisions for supplemental carbon and chemical precipitant addition will be provided for denitrification and phosphorus removal, respectively.
Membrane Filtration	**Ultrafiltration and Reverse Osmosis:** Construct skid-mounted pressurized UF membranes and RO membrane facilities capable of high recovery, high TDS removal, and removal of residual nutrients. Chemical provisions for antiscalant, pH adjustment, and remineralization chemicals will be provided. Brine from the RO system will be conveyed to the Pellet Reactor for brine minimization.
Disinfection	**UV Disinfection:** Construct closed vessel UV disinfection unit process for disinfection of denitrification filter effluent or RO permeate water. UV design criteria such as UV transmittance and UV dose are dependent on the quality of the feed water.
Brine Minimization	**Pellet Reactor:** Construct a skid-mounted pellet reactor system which provides brine minimization through additional RO membrane filtration and precipitation of partially soluble salts through a fluidized bed reactor.

The projected effluent quality of the proposed discharge is presented in **Table 2** for the constituents of interest.

Table 2. Summary of Projected Effluent Quality

Constituent	Projected Effluent Quality	Units
Ammonia as N	0.05	mg/L
Boron	0.11	mg/L
Chloride	0.60	mg/L
Fluoride	<0.026[a]	mg/L
Hardness, Total (as CaCO3)	3.20	mg/L
MBAS	0.0014	mg/L
Sodium	1.9	mg/L
Sulfate	0.20	mg/L
Total Dissolved Solids (TDS)	50	mg/L
Total Inorganic Nitrogen (TIN)	0.10	mg/L-N
Total Nitrogen (TN)	0.60	mg/L-N

Constituent	Projected Effluent Quality	Units
Chlorophyll-a[b]	N/A	µg/L
Total Phosphorus (TP)	0.03	mg/L-P
Chlordane	<0.17[a]	µg/L
4,4'-DDT	<0.0052[a]	µg/L
PCBs	<2.5[a]	µg/L
Cadmium	<0.11[a]	µg/L
Copper	0.07	µg/L
Lead	0.01	µg/L
Mercury	<0.05[a]	ng/L
Aluminum	1.3	µg/L
Specific Conductance	18	µmhos/cm

[a] The projected effluent quality is anticipated to be below the detection limit.
[b] Chlorophyll a is not a constituent that will be discharged by the BBARWA WWTP.

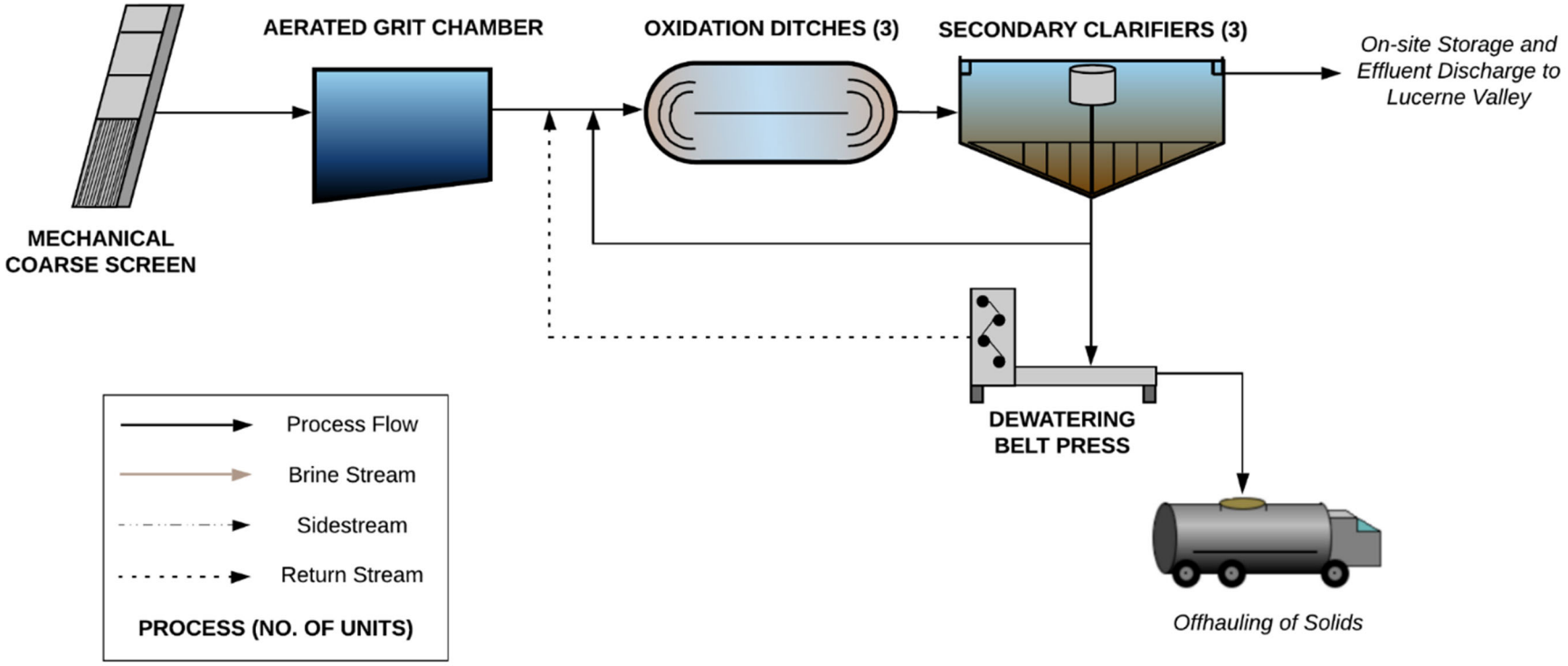


Figure 1. Existing Treatment Process Schematic

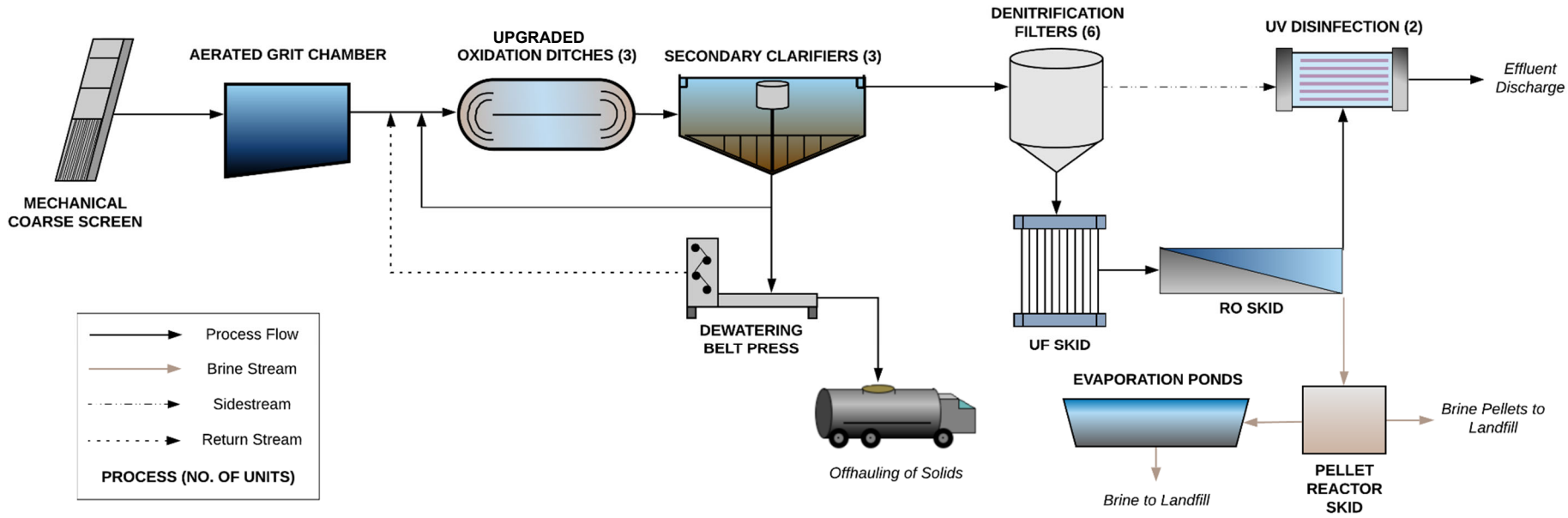
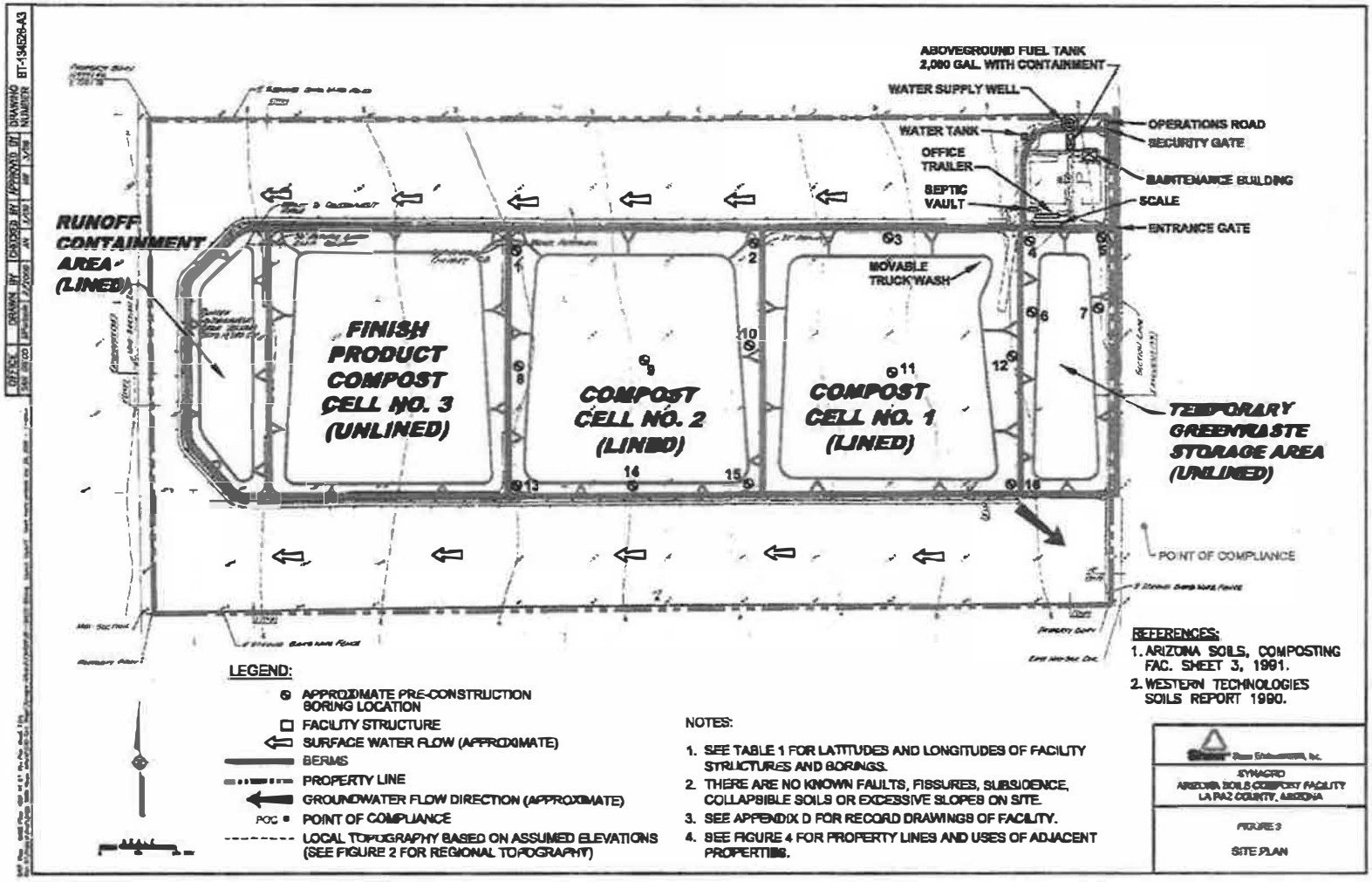


Figure 2. Future Upgraded Treatment Process Schematic

Schematic of Arizona Soils Composting Facility



VI. Supplemental Information

Attachment A. Secondary Effluent and Receiving Water Characterization Data

Attachment B. Big Bear Lake Nutrient Total Maximum Daily Load Analysis for Total Phosphorus Offset Program

Attachment C. Antidegradation Analysis for Proposed Discharges to Big Bear Lake and Shay Pond

Attachment A.

Secondary Effluent and Receiving Water Characterization Data

Big Bear City Regional Treatment Plant

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	12/1/2016	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	11/29/2017	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	12/5/2018	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	12/12/2018	
Secondary Effluent	1	Antimony	=	0.23	µg/L	6	0.14	EPA 200.8	11/20/2019	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	12/18/2019	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	12/2/2020	
Secondary Effluent	1	Antimony	<	ND	µg/L	6	0.14	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	12/1/2016	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	11/29/2017	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	12/5/2018	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	12/12/2018	
Secondary Effluent	2	Arsenic	=	0.73	µg/L	2	0.4	EPA 200.8	11/20/2019	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	12/18/2019	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	12/2/2020	
Secondary Effluent	2	Arsenic	<	ND	µg/L	2	0.4	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	12/1/2016	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	11/29/2017	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	12/5/2018	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	12/12/2018	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	11/20/2019	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	12/18/2019	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	12/2/2020	
Secondary Effluent	3	Beryllium	<	ND	µg/L	1	0.2	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/1/2016	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/29/2017	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/5/2018	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/12/2018	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/20/2019	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/18/2019	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/2/2020	
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	5a	Chromium (III)	<	ND	µg/L			Calculated	12/1/2016	
Secondary Effluent	5a	Chromium (III)	=	2.6	µg/L			Calculated	11/29/2017	
Secondary Effluent	5a	Chromium (III)	=	0.58	µg/L			Calculated	12/5/2018	
Secondary Effluent	5a	Chromium (III)	<	ND	µg/L	10		Calculated	12/18/2019	
Secondary Effluent	5a	Chromium (III)	<	ND	µg/L	10		Calculated	12/2/2020	
Secondary Effluent	5a	Chromium (III)	J	0.72	µg/L			Calculated	11/18/2021	11/24/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	12/1/2016	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	11/29/2017	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	12/5/2018	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	12/12/2018	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	11/20/2019	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	12/18/2019	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	12/2/2020	
Secondary Effluent	5b	Chromium (VI)	<	ND	µg/L	1	0.14	EPA 218.6	11/18/2021	11/24/2021
Secondary Effluent	5	Chromium (Total Cr)	=	0.89	µg/L	10	0.21	EPA 200.8	11/20/2019	
Secondary Effluent	5	Chromium (Total Cr)	J	0.72	µg/L	10	0.21	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/1/2016	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	11/29/2017	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/5/2018	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/12/2018	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	11/20/2019	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/18/2019	
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/2/2020	
Secondary Effluent	6	Copper	J	14	µg/L	50	6.5	EPA 200.7	11/18/2021	11/23/2021
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/1/2016	
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	11/29/2017	
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/5/2018	
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/12/2018	
Secondary Effluent	7	Lead	=	0.76	µg/L	5	0.51	EPA 200.8	11/20/2019	
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/18/2019	
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/2/2020	
Secondary Effluent	7	Lead	J	1.8	µg/L	5	0.51	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.15	EPA 245.1	12/1/2016	
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.15	EPA 245.1	11/29/2017	
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.05	EPA 245.1	12/5/2018	
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.15	EPA 245.1	11/20/2019	
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.15	EPA 245.1	12/18/2019	
Secondary Effluent	8	Mercury, Total	=	0.00076	µg/L	5E-04		EPA 1631E	6/18/2020	6/24/2020
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	0.2	0.15	EPA 245.1	12/2/2020	
Secondary Effluent	8	Mercury, Total	<	ND	µg/L	1	0.15	EPA 245.1	11/18/2021	12/13/2021
Secondary Effluent		Mercury, Dissolved	<	ND	µg/L	5E-04		EPA 1631E filtrate	6/18/2020	6/24/2020
Secondary Effluent		Methylmercury	=	0.18	ng/L	0.05		EPA 1630	6/18/2020	6/25/2020
Secondary Effluent		Methylmercury, Dissolved	=	0.13	ng/L	0.05		EPA 1630 filtrate	6/18/2020	6/25/2020
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	12/1/2016	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	11/29/2017	
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	12/5/2018	
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	12/12/2018	
Secondary Effluent	9	Nickel	=	6.3	µg/L	10	0.52	EPA 200.8	11/20/2019	
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	12/18/2019	
Secondary Effluent	9	Nickel	<	ND	µg/L	10	0.52	EPA 200.8	12/2/2020	
Secondary Effluent	9	Nickel	J	0.96	µg/L	10	0.52	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	12/1/2016	
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	11/29/2017	
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	12/5/2018	
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	12/12/2018	
Secondary Effluent	10	Selenium	=	2.1	µg/L	5	0.95	EPA 200.8	11/20/2019	
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	12/18/2019	
Secondary Effluent	10	Selenium	<	ND	µg/L	5	0.95	EPA 200.8	12/2/2020	
Secondary Effluent	10	Selenium	J	2.7	µg/L	5	0.95	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	12/1/2016	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	11/29/2017	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	12/5/2018	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	12/12/2018	
Secondary Effluent	11	Silver	=	0.3	µg/L	10	0.3	EPA 200.8	11/20/2019	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	12/18/2019	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	12/2/2020	
Secondary Effluent	11	Silver	<	ND	µg/L	10	0.3	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	12/1/2016	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	11/29/2017	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	12/5/2018	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	12/12/2018	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	11/20/2019	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	12/18/2019	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	12/2/2020	
Secondary Effluent	12	Thallium	<	ND	µg/L	1	0.18	EPA 200.8	11/18/2021	11/24/2021
Secondary Effluent	13	Zinc	=	63	µg/L	50	15	EPA 200.7	12/1/2016	
Secondary Effluent	13	Zinc	=	50	µg/L	50	15	EPA 200.7	11/29/2017	
Secondary Effluent	13	Zinc	<	ND	µg/L	50	15	EPA 200.7	12/5/2018	
Secondary Effluent	13	Zinc	<	ND	µg/L	50	15	EPA 200.7	12/12/2018	
Secondary Effluent	13	Zinc	=	120	µg/L	50	15	EPA 200.7	11/20/2019	
Secondary Effluent	13	Zinc	=	110	µg/L	50	15	EPA 200.7	12/18/2019	
Secondary Effluent	13	Zinc	=	51	µg/L	50	15	EPA 200.7	12/2/2020	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	13	Zinc	=	87	µg/L	50	15	EPA 200.7	11/18/2021	11/23/2021
Secondary Effluent	14	Cyanide (total)	=	2.7	µg/L	5	1.2	SM4500-CN E	11/20/2019	
Secondary Effluent	14	Cyanide (total)	J	2	µg/L	5	1.2	SM 4500CN-F	11/18/2021	12/13/2021
Secondary Effluent	15	Asbestos	=	2	MFL	0.5	0.5	EPA 100.2	11/18/2021	12/13/2021
Secondary Effluent	16	2,3,7,8-TCDD	<	ND	pg/L	5	5	EPA 1613B	11/18/2021	12/13/2021
Secondary Effluent	17	Acrolein	<	ND	µg/L	5		EPA 624	12/1/2016	
Secondary Effluent	17	Acrolein	<	ND	µg/L	5		EPA 624	11/29/2017	
Secondary Effluent	17	Acrolein	<	ND	µg/L	5		EPA 624	12/5/2018	
Secondary Effluent	17	Acrolein	<	ND	µg/L	20		EPA 624	12/18/2019	
Secondary Effluent	17	Acrolein	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	17	Acrolein	<	ND	µg/L	2	1.2	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	5		EPA 624	12/1/2016	
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	5		EPA 624	11/29/2017	
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	5		EPA 624	12/5/2018	
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	20		EPA 624	12/18/2019	
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	18	Acrylonitrile	<	ND	µg/L	2	0.6	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	19	Benzene	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	19	Benzene	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	19	Benzene	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	19	Benzene	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	19	Benzene	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	19	Benzene	<	ND	µg/L	0.5	0.096	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	20	Bromoform	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	20	Bromoform	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	20	Bromoform	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	20	Bromoform	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	20	Bromoform	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	20	Bromoform	<	ND	µg/L	0.5	0.072	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	21	Carbon Tetrachloride	<	ND	µg/L	0.5	0.1	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	1		EPA 624	12/5/2018	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	22	Chlorobenzene	<	ND	µg/L	0.5	0.088	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	23	Chlorodibromomethane	<	ND	µg/L	0.5	0.052	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	24	Chloroethane	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	24	Chloroethane	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	24	Chloroethane	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	24	Chloroethane	<	ND	µg/L	10		EPA 624	12/18/2019	
Secondary Effluent	24	Chloroethane	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	24	Chloroethane	<	ND	µg/L	0.5	0.18	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	5		EPA 624	12/1/2016	
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	5		EPA 624	11/29/2017	
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	5		EPA 624	12/5/2018	
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	10		EPA 624	12/18/2019	
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	1		EPA 624	12/2/2020	
Secondary Effluent	25	2-Chloroethyl Vinyl Ether	<	ND	µg/L	1	0.72	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	26	Chloroform	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	26	Chloroform	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	26	Chloroform	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	26	Chloroform	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	26	Chloroform	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	26	Chloroform	<	ND	µg/L	0.5	0.079	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	27	Dichlorobromomethane	<	ND	µg/L	0.5	0.058	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	0.5		EPA 624	12/2/2020	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	28	1,1-Dichloroethane (1,1-DCA)	<	ND	µg/L	0.5	0.08	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	29	1,2-Dichloroethane (1,2-DCA)	<	ND	µg/L	0.5	0.06	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	30	1,1-Dichloroethylene (1,1-DCE)	<	ND	µg/L	0.5	0.12	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	31	1,2-Dichloropropane	<	ND	µg/L	0.5	0.066	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	32	1,3-Dichloropropene	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	32	1,3-Dichloropropene	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	32	1,3-Dichloropropene	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	32	1,3-Dichloropropene	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	32	1,3-Dichloropropene	<	ND	µg/L	0.5	0.11	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	33	Ethylbenzene	<	ND	µg/L	2	0.098	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	10		EPA 624	12/18/2019	
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	34	Methyl Bromide	<	ND	µg/L	0.5	0.19	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	1		EPA 624	11/29/2017	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	10		EPA 624	12/18/2019	
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	35	Methyl Chloride	<	ND	µg/L	2	0.19	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	36	Methylene Chloride	<	ND	µg/L	2	0.076	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	0.5	0.11	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	38	Tetrachloroethylene (PCE)	<	ND	µg/L	0.5	0.11	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	39	Toluene	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	39	Toluene	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	39	Toluene	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	39	Toluene	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	39	Toluene	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	39	Toluene	<	ND	µg/L	2	0.07	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	1		EPA 624	12/2/2020	
Secondary Effluent	40	trans-1,2-Dichloroethylene (t-1,2-DCE	<	ND	µg/L	1	0.11	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	5		EPA 624	12/18/2019	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	41	1,1,1-Trichloroethane (1,1,1-TCA)	<	ND	µg/L	0.5	0.06	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	42	1,1,2-Trichloroethane (1,1,2-TCA)	<	ND	µg/L	0.5	0.068	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	5		EPA 624	12/18/2019	
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	2		EPA 624	12/2/2020	
Secondary Effluent	43	Trichloroethylene (TCE)	<	ND	µg/L	2	0.082	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	1		EPA 624	12/1/2016	
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	1		EPA 624	11/29/2017	
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	1		EPA 624	12/5/2018	
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	10		EPA 624	12/18/2019	
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	0.5		EPA 624	12/2/2020	
Secondary Effluent	44	Vinyl Chloride (VC)	<	ND	µg/L	0.5	0.12	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	9		EPA 625	12/2/2020	
Secondary Effluent	45	2-Chlorophenol	<	ND	µg/L	10	2.7	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	8		EPA 625	12/2/2020	
Secondary Effluent	46	2,4-Dichlorophenol	<	ND	µg/L	5	3.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	8		EPA 625	12/2/2020	
Secondary Effluent	47	2,4-Dimethylphenol	<	ND	µg/L	10	3	EPA 625	11/18/2021	12/13/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	5		EPA 625	12/1/2016	
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	5		EPA 625	11/29/2017	
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/5/2018	
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/18/2019	
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/2/2020	
Secondary Effluent	48	2-Methyl-4,6-Dinitrophenol	<	ND	µg/L	50	3.7	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	10		EPA 625	11/29/2017	
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/5/2018	
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/18/2019	
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	25		EPA 625	12/2/2020	
Secondary Effluent	49	2,4-Dinitrophenol	<	ND	µg/L	25	2.6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	10		EPA 625	12/2/2020	
Secondary Effluent	50	2-Nitrophenol	<	ND	µg/L	50	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	5		EPA 625	12/1/2016	
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	5		EPA 625	11/29/2017	
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	25		EPA 625	12/5/2018	
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	25		EPA 625	12/18/2019	
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	7		EPA 625	12/2/2020	
Secondary Effluent	51	4-Nitrophenol	<	ND	µg/L	50	2.8	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	20		EPA 625	12/5/2018	
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	20		EPA 625	12/18/2019	
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	9		EPA 625	12/2/2020	
Secondary Effluent	52	3-Methyl-4-Chlorophenol	<	ND	µg/L	25	3.4	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	25		EPA 625	12/5/2018	
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	25		EPA 625	12/18/2019	
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	10		EPA 625	12/2/2020	
Secondary Effluent	53	Pentachlorophenol	<	ND	µg/L	25	4.9	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	54	Phenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	54	Phenol	<	ND	µg/L	1		EPA 625	11/29/2017	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	54	Phenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	54	Phenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	54	Phenol	<	ND	µg/L	4		EPA 625	12/2/2020	
Secondary Effluent	54	Phenol	<	ND	µg/L	5	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	1		EPA 625	12/1/2016	
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	1		EPA 625	11/29/2017	
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	10		EPA 625	12/5/2018	
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	10		EPA 625	12/18/2019	
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	8		EPA 625	12/2/2020	
Secondary Effluent	55	2,4,6-Trichlorophenol	<	ND	µg/L	50	3.6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	56	Acenaphthene	<	ND	µg/L	0.5	0.27	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	57	Acenaphthylene	<	ND	µg/L	0.2	0.011	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	58	Anthracene	<	ND	µg/L	0.2	0.029	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	59	Benzidine	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	60	Benzo(a)anthracene	<	ND	µg/L	0.2	0.023	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	61	Benzo(a)pyrene	<	ND	µg/L	0.1	0.03	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	62	Benzo(b)fluoranthene	<	ND	µg/L	0.5	0.03	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	63	Benzo(g,h,i)perylene	<	ND	µg/L	0.2	0.029	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	64	Benzo(k)fluoranthene	<	ND	µg/L	0.2	0.029	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	65	Bis(2-chloroethoxy)methane	<	ND	µg/L	25	2.8	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	66	Bis(2-chloroethyl)ether	<	ND	µg/L	5	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	67	Bis(2-chloroisopropyl)ether	<	ND	µg/L	50	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	68	Bis(2-ethylhexyl)phthalate (DEHP)	<	ND	µg/L	7.5	3.3	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	69	4-Bromophenyl phenyl ether	<	ND	µg/L	50	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	70	Butylbenzyl phthalate	<	ND	µg/L	50	6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	71	2-Chloronaphthalene	<	ND	µg/L	50	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	72	4-Chlorophenyl phenyl ether	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	73	Chrysene	<	ND	µg/L	0.2	0.028	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	74	Dibenzo(a,h)anthracene	<	ND	µg/L	0.1	0.027	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	75	1,2-Dichlorobenzene (o-DCB)	<	ND	µg/L	0.5	0.059	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	76	1,3-Dichlorobenzene (m-DCB)	<	ND	µg/L	2	0.077	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	77	1,4-Dichlorobenzene (p-DCB)	<	ND	µg/L	0.5	0.26	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	78	3,3'-Dichlorobenzidine	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	79	Diethylphthalate	<	ND	µg/L	10	2.7	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	80	Dimethylphthalate	<	ND	µg/L	10	5.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	81	Di-n-butylphthalate	<	ND	µg/L	50	3.7	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	82	2,4-Dinitrotoluene	<	ND	µg/L	25	3	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	83	2,6-Dinitrotoluene	<	ND	µg/L	25	3.9	EPA 625	11/18/2021	12/13/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	84	Di-n-octylphthalate	<	ND	µg/L	50	3.6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	85	1,2-Diphenylhydrazine	<	ND	µg/L	5	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	86	Fluoranthene	<	ND	µg/L	0.2	0.033	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	87	Fluorene	<	ND	µg/L	0.2	0.15	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	88	Hexachlorobenzene	<	ND	µg/L	5	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	89	Hexachlorobutadiene	<	ND	µg/L	1	0.13	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	90	Hexachlorocyclopentadiene	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	91	Hexachloroethane	<	ND	µg/L	5	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	92	Indeno(1,2,3-c,d)pyrene	<	ND	µg/L	0.05	0.035	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	93	Isophorone	<	ND	µg/L	5	2.8	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	94	Naphthalene	<	ND	µg/L	0.2	0.018	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	94	Naphthalene	<	ND	µg/L	10	0.018	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	95	Nitrobenzene	<	ND	µg/L	50	2.6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	96	N-Nitrosodiethylamine	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	97	N-Nitroso-di-n-propylamine	<	ND	µg/L	25	2.5	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	98	N-Nitrosodiphenylamine	<	ND	µg/L	5	3.6	EPA 625	11/18/2021	12/13/2021
Secondary Effluent	99	Phenanthrene	<	ND	µg/L	0.2	0.012	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	100	Pyrene	<	ND	µg/L	0.2	0.04	EPA 610	11/18/2021	12/13/2021
Secondary Effluent	101	1,2,4-Trichlorobenzene	<	ND	µg/L	5	0.79	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent	102	Aldrin	<	ND	µg/L	0.025	0.008	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	103	alpha BHC	<	ND	µg/L	0.05	0.008	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	104	beta BHC	<	ND	µg/L	0.025	0.009	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	105	gamma BHC	<	ND	µg/L	0.1	0.007	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	106	delta-BHC	<	ND	µg/L	0.025	0.007	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	107	Chlordane	<	ND	µg/L	0.5	0.17	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	108	4,4'-DDT	<	ND	µg/L	0.05	0.005	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	109	4,4'-DDE	<	ND	µg/L	0.25	0.01	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	110	4,4'-DDD	<	ND	µg/L	0.25	0.05	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	111	Dieldrin	<	ND	µg/L	0.05	0.009	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	112	Endosulfan I	<	ND	µg/L	0.1	0.008	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	113	Endosulfan II	<	ND	µg/L	0.05	0.005	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	114	Endosulfan sulfate	<	ND	µg/L	0.25	0.012	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	115	Endrin	<	ND	µg/L	0.05	0.01	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	116	Endrin aldehyde	<	ND	µg/L	0.05	0.01	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	117	Heptachlor	<	ND	µg/L	0.05	0.009	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	118	Heptachlor Epoxide	<	ND	µg/L	0.05	0.008	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	119	Aroclor 1016	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	120	Aroclor 1221	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent	121	Aroclor 1232	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	122	Aroclor 1242	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	123	Aroclor 1248	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	124	Aroclor 1254	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	125	Aroclor 1260	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021
Secondary Effluent	126	Toxaphene	<	ND	µg/L	2.5	0.26	EPA 608	11/18/2021	12/13/2021
Secondary Effluent		Aluminum (Al)	=	110	µg/L	50	14	EPA 200.7	11/20/2019	
Secondary Effluent		Aluminum (Al)	=	250	µg/L	50	14	EPA 200.7	11/18/2021	11/23/2021
Secondary Effluent		Barium (Ba)	=	46	µg/L	100	12	EPA 200.7	11/20/2019	
Secondary Effluent		Iron (Fe)	=	150	µg/L	100	14	EPA 200.7	11/20/2019	
Secondary Effluent		Iron (Fe) Dissolved	J	22	µg/L	100	14	EPA 200.7	11/18/2021	11/30/2021
Secondary Effluent		Manganese (Mn)	=	21	µg/L	20	0.8	EPA 200.7	11/20/2019	
Secondary Effluent		Manganese (Mn) Dissolved	<	ND	µg/L	20	0.8	EPA 200.7	11/18/2021	11/30/2021
Secondary Effluent		Chloride (Cl)	=	53	mg/L	1	0.075	EPA 300.0	11/18/2021	11/18/2021
Secondary Effluent		Fluoride (F)	=	0.3	mg/L	0.1	0.026	EPA 300.0	11/20/2019	
Secondary Effluent		Fluoride (F)	=	0.52	mg/L	0.1	0.026	EPA 300.0	11/18/2021	11/18/2021
Secondary Effluent		Nitrate as N (NO3-N)	=	1.3	mg/L	0.4	0.12	EPA 300.0	11/20/2019	
Secondary Effluent		Nitrite as N (NO2-N)	<	ND	mg/L	0.4	0.17	EPA 300.0	11/20/2019	
Secondary Effluent		Sulfate (SO4)	=	35	mg/L	0.5	0.14	EPA 300.0	11/18/2021	11/18/2021
Secondary Effluent		MBAS (LAS Mole. Wt 340.0)	<	ND	mg/L	0.1	0.047	SM 5540C	11/20/2019	
Secondary Effluent		MBAS (LAS Mole. Wt 340.0)	=	0.14	mg/L	0.1	0.047	SM 5540C	11/18/2021	11/18/2021
Secondary Effluent		Methyl tert-Butyl Ether	<	ND	µg/L	3	0.069	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent		Styrene	<	ND	µg/L	0.5	0.059	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent		Xylenes	<	ND	µg/L	0.5	0.26	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent		Total Trihalomethanes (TTHM)	<	ND	µg/L	0.5	0.22	EPA 624.1	11/18/2021	12/13/2021
Secondary Effluent		Boron (B)	=	270	µg/L	100	32	EPA 200.7	11/20/2019	
Secondary Effluent		Boron (B)	=	260	µg/L	100	32	EPA 200.7	11/18/2021	11/23/2021
Secondary Effluent		Hardness, Total (as CaCO3)	=	270	mg/L			Calculated	11/20/2019	
Secondary Effluent		Hardness, Total (as CaCO3)	=	260	mg/L	6.6		Calculated	11/18/2021	11/24/2021
Secondary Effluent		Ammonia-N	<	ND	mg/L				11/28/2018	
Secondary Effluent		Ammonia-N	<	ND	mg/L				12/12/2018	
Secondary Effluent		Ammonia-N	=	22	mg/L				1/2/2019	
Secondary Effluent		Ammonia-N	=	7.5	mg/L				1/16/2019	
Secondary Effluent		Ammonia-N	=	0.45	mg/L				2/6/2019	
Secondary Effluent		Ammonia-N	=	1.1	mg/L				2/13/2019	
Secondary Effluent		Ammonia-N	<	ND	mg/L				3/6/2019	
Secondary Effluent		Ammonia-N	=	0.26	mg/L				3/20/2019	
Secondary Effluent		Ammonia-N	=	0.27	mg/L				4/3/2019	

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Secondary Effluent		Ammonia-N	<	ND	mg/L				4/17/2019	
Secondary Effluent		Ammonia-N	<	ND	mg/L				5/1/2019	
Secondary Effluent		Ammonia-N	=	3.2	mg/L				5/15/2019	
Secondary Effluent		Ammonia-N	=	0.39	mg/L				6/23/2019	
Secondary Effluent		Ammonia-N	=	1.6	mg/L				7/17/2019	
Secondary Effluent		Ammonia-N	=	3.1	mg/L				8/7/2019	
Secondary Effluent		Ammonia-N	=	1.4	mg/L				8/21/2019	
Secondary Effluent		Ammonia-N	=	6.6	mg/L				9/4/2019	
Secondary Effluent		Ammonia-N	<	ND	mg/L				9/18/2019	
Secondary Effluent		Ammonia-N	=	2.3	mg/L				10/23/2019	
Secondary Effluent		Ammonia-N	=	1.3	mg/L				11/6/2019	
Secondary Effluent		Ammonia-N	=	0.55	mg/L				11/20/2019	
Secondary Effluent		Ammonia-N	=	0.26	mg/L				12/4/2019	
Secondary Effluent		Ammonia-N	<	ND	mg/L				12/18/2019	
Secondary Effluent		Ammonia-N	=	1.2	mg/L				11/18/2021	
Shay Pond	1	Antimony (Sb)	<	ND	µg/L	6		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	2	Arsenic (As)	<	ND	µg/L	2		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	3	Beryllium (Be)	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	4	Cadmium (Cd)	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	5a	Chromium (+3)	=	0.76	µg/L			[CALC]	11/17/2021	11/24/2021
Shay Pond	5b	Chromium (+6)	=	1	µg/L	1		EPA 218.6	11/17/2021	11/24/2021
Shay Pond	5	Chromium (Total Cr)	J	1.8	µg/L	10		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	6	Copper (Cu)	J	31	µg/L	50		EPA 200.7	11/17/2021	11/23/2021
Shay Pond	7	Lead (Pb)	J	1.4	µg/L	5		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	8	Mercury	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/30/2021
Shay Pond	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	11/17/2021	11/30/2021
Shay Pond	9	Nickel (Ni)	J	0.52	µg/L	10		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	10	Selenium (Se)	J	1.4	µg/L	5		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	11	Silver (Ag)	<	ND	µg/L	10		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	12	Thallium (Tl)	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/24/2021
Shay Pond	13	Zinc (Zn)	<	ND	µg/L	50		EPA 200.7	11/17/2021	11/23/2021
Shay Pond	14	Cyanide (total)	<	ND	µg/L	50	10	SM4500-CN E	11/17/2021	11/24/2021
Shay Pond	15	Asbestos	<	ND	MFL			EPA 100.2	11/17/2021	11/26/2021
Shay Pond	16	2,3,7,8-TCDD	<	ND	pg/L			EPA 1613B	11/17/2021	12/1/2021
Shay Pond	17	Acrolein	<	ND	µg/L	2	1.2	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	18	Acrylonitrile	<	ND	µg/L	2	0.6	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	19	Benzene	<	ND	µg/L	0.5	0.096	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	20	Bromoform	=	0.58	µg/L	0.5	0.072	EPA 624.1	11/17/2021	11/19/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Shay Pond	21	Carbon tetrachloride	<	ND	µg/L	0.5	0.1	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	22	Chlorobenzene	<	ND	µg/L	0.5	0.088	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	23	Dibromochloromethane	=	0.8	µg/L	0.5	0.052	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	24	Chloroethane	<	ND	µg/L	0.5	0.18	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	25	2-Chloroethylvinyl ether	<	ND	µg/L	1	0.72	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	26	Chloroform	<	ND	µg/L	0.5	0.079	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	27	Bromodichloromethane	J	0.32	µg/L	0.5	0.058	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	28	1,1-Dichloroethane	<	ND	µg/L	0.5	0.08	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	29	1,2-Dichloroethane	<	ND	µg/L	0.5	0.06	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	30	1,1-Dichloroethene	<	ND	µg/L	0.5	0.12	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	31	1,2-Dichloropropane	<	ND	µg/L	0.5	0.066	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	32	1,3-Dichloropropene (total)	<	ND	µg/L	0.5	0.11	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	33	Ethylbenzene	<	ND	µg/L	2	0.098	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	34	Bromomethane	<	ND	µg/L	0.5	0.19	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	35	Chloromethane	<	ND	µg/L	2	0.19	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	36	Methylene chloride	<	ND	µg/L	2	0.076	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	0.5	0.11	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	38	Tetrachloroethene	<	ND	µg/L	0.5	0.11	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	39	Toluene	<	ND	µg/L	2	0.07	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	40	trans-1,2-Dichloroethene	<	ND	µg/L	1	0.11	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	41	1,1,1-Trichloroethane	<	ND	µg/L	0.5	0.06	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	42	1,1,2-Trichloroethane	<	ND	µg/L	0.5	0.068	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	43	Trichloroethene	<	ND	µg/L	2	0.082	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	44	Vinyl chloride	<	ND	µg/L	0.5	0.12	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	45	2-Chlorophenol	<	ND	µg/L	10	2.7	EPA 625	11/17/2021	11/24/2021
Shay Pond	46	2,4-Dichlorophenol	<	ND	µg/L	5	3.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	47	2,4-Dimethylphenol	<	ND	µg/L	10	3	EPA 625	11/17/2021	11/24/2021
Shay Pond	48	4,6-Dinitro-2-methylphenol	<	ND	µg/L	50	3.7	EPA 625	11/17/2021	11/24/2021
Shay Pond	49	2,4-Dinitrophenol	<	ND	µg/L	25	2.6	EPA 625	11/17/2021	11/24/2021
Shay Pond	50	2-Nitrophenol	<	ND	µg/L	50	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	51	4-Nitrophenol	<	ND	µg/L	50	2.8	EPA 625	11/17/2021	11/24/2021
Shay Pond	52	4-Chloro-3-methylphenol	<	ND	µg/L	25	3.4	EPA 625	11/17/2021	11/24/2021
Shay Pond	53	Pentachlorophenol	<	ND	µg/L	25	4.9	EPA 625	11/17/2021	11/24/2021
Shay Pond	54	Phenol	<	ND	µg/L	5	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	55	2,4,6-Trichlorophenol	<	ND	µg/L	50	3.6	EPA 625	11/17/2021	11/24/2021
Shay Pond	56	Acenaphthene	<	ND	µg/L	0.5	0.27	EPA 610	11/17/2021	11/29/2021
Shay Pond	57	Acenaphthylene	<	ND	µg/L	0.2	0.011	EPA 610	11/17/2021	11/29/2021
Shay Pond	58	Anthracene	<	ND	µg/L	0.2	0.029	EPA 610	11/17/2021	11/29/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Shay Pond	59	Benzidine	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	60	Benzo (a) anthracene	<	ND	µg/L	0.2	0.023	EPA 610	11/17/2021	11/29/2021
Shay Pond	61	Benzo (a) pyrene	<	ND	µg/L	0.1	0.03	EPA 610	11/17/2021	11/29/2021
Shay Pond	62	Benzo (b) fluoranthene	<	ND	µg/L	0.5	0.03	EPA 610	11/17/2021	11/29/2021
Shay Pond	63	Benzo (g,h,i) perylene	<	ND	µg/L	0.2	0.029	EPA 610	11/17/2021	11/29/2021
Shay Pond	64	Benzo (k) fluoranthene	<	ND	µg/L	0.2	0.029	EPA 610	11/17/2021	11/29/2021
Shay Pond	65	Bis(2-chloroethoxy)methane	<	ND	µg/L	25	2.8	EPA 625	11/17/2021	11/24/2021
Shay Pond	66	Bis(2-chloroethyl)ether	<	ND	µg/L	5	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	67	Bis(2-chloroisopropyl)ether	<	ND	µg/L	50	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	68	Bis(2-ethylhexyl)phthalate	<	ND	µg/L	7.5	3.3	EPA 625	11/17/2021	11/24/2021
Shay Pond	69	4-Bromophenyl phenyl ether	<	ND	µg/L	50	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	70	Butyl benzyl phthalate	<	ND	µg/L	50	6	EPA 625	11/17/2021	11/24/2021
Shay Pond	71	2-Chloronaphthalene	<	ND	µg/L	50	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	72	4-Chlorophenyl phenyl ether	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	73	Chrysene	<	ND	µg/L	0.2	0.028	EPA 610	11/17/2021	11/29/2021
Shay Pond	74	Dibenz (a,h) anthracene	<	ND	µg/L	0.1	0.027	EPA 610	11/17/2021	11/29/2021
Shay Pond	75	1,2-Dichlorobenzene	<	ND	µg/L	0.5	0.059	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	76	1,3-Dichlorobenzene	<	ND	µg/L	0.5	0.077	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	77	1,4-Dichlorobenzene	<	ND	µg/L	0.5	0.26	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	78	3,3´-Dichlorobenzidine	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	79	Diethyl phthalate	<	ND	µg/L	10	2.7	EPA 625	11/17/2021	11/24/2021
Shay Pond	80	Dimethyl phthalate	<	ND	µg/L	10	5.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	81	Di-n-butyl phthalate	<	ND	µg/L	50	3.7	EPA 625	11/17/2021	11/24/2021
Shay Pond	82	2,4-Dinitrotoluene (2,4-DNT)	<	ND	µg/L	25	3	EPA 625	11/17/2021	11/24/2021
Shay Pond	83	2,6-Dinitrotoluene (2,6-DNT)	<	ND	µg/L	25	3.9	EPA 625	11/17/2021	11/24/2021
Shay Pond	84	Di-n-octyl phthalate	<	ND	µg/L	50	3.6	EPA 625	11/17/2021	11/24/2021
Shay Pond	85	1,2-Diphenylhydrazine	<	ND	µg/L	5	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	86	Fluoranthene	<	ND	µg/L	0.2	0.033	EPA 610	11/17/2021	11/29/2021
Shay Pond	87	Fluorene	<	ND	µg/L	0.2	0.15	EPA 610	11/17/2021	11/29/2021
Shay Pond	88	Hexachlorobenzene	<	ND	µg/L	5	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	89	Hexachlorobutadiene	<	ND	µg/L	1	0.13	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	90	Hexachlorocyclopentadiene	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	91	Hexachloroethane	<	ND	µg/L	5	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	92	Indeno (1,2,3-cd) pyrene	<	ND	µg/L	0.05	0.035	EPA 610	11/17/2021	11/29/2021
Shay Pond	93	Isophorone	<	ND	µg/L	5	2.8	EPA 625	11/17/2021	11/24/2021
Shay Pond	94	Naphthalene	<	ND	µg/L	0.2	0.018	EPA 610	11/17/2021	11/29/2021
Shay Pond	94	Naphthalene	<	ND	µg/L	1	0.11	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	95	Nitrobenzene (NB)	<	ND	µg/L	50	2.6	EPA 625	11/17/2021	11/24/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Shay Pond	96	N-Nitrosodimethylamine	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	97	N-Nitrosodi-n-propylamine	<	ND	µg/L	25	2.5	EPA 625	11/17/2021	11/24/2021
Shay Pond	98	N-Nitrosodiphenylamine	<	ND	µg/L	5	3.6	EPA 625	11/17/2021	11/24/2021
Shay Pond	99	Phenanthrene	<	ND	µg/L	0.2	0.012	EPA 610	11/17/2021	11/29/2021
Shay Pond	100	Pyrene	<	ND	µg/L	0.2	0.04	EPA 610	11/17/2021	11/29/2021
Shay Pond	101	1,2,4-Trichlorobenzene	<	ND	µg/L	1	0.79	EPA 624.1	11/17/2021	11/19/2021
Shay Pond	102	Aldrin	<	ND	µg/L	0.025	0.008	EPA 608M	11/17/2021	11/24/2021
Shay Pond	103	alpha-BHC	<	ND	µg/L	0.05	0.008	EPA 608M	11/17/2021	11/24/2021
Shay Pond	104	beta-BHC	<	ND	µg/L	0.025	0.009	EPA 608M	11/17/2021	11/24/2021
Shay Pond	105	gamma-BHC (Lindane)	<	ND	µg/L	0.1	0.007	EPA 608M	11/17/2021	11/24/2021
Shay Pond	106	delta-BHC	<	ND	µg/L	0.025	0.007	EPA 608M	11/17/2021	11/24/2021
Shay Pond	107	Chlordane	<	ND	µg/L	0.5	0.17	EPA 608M	11/17/2021	11/24/2021
Shay Pond	108	4,4´-DDT	<	ND	µg/L	0.05	0.005	EPA 608M	11/17/2021	11/24/2021
Shay Pond	109	4,4´-DDE	<	ND	µg/L	0.25	0.01	EPA 608M	11/17/2021	11/24/2021
Shay Pond	110	4,4´-DDD	<	ND	µg/L	0.25	0.05	EPA 608M	11/17/2021	11/24/2021
Shay Pond	111	Dieldrin	<	ND	µg/L	0.05	0.009	EPA 608M	11/17/2021	11/24/2021
Shay Pond	112	Endosulfan I	<	ND	µg/L	0.1	0.008	EPA 608M	11/17/2021	11/24/2021
Shay Pond	113	Endosulfan II	<	ND	µg/L	0.05	0.005	EPA 608M	11/17/2021	11/24/2021
Shay Pond	114	Endosulfan sulfate	<	ND	µg/L	0.05	0.012	EPA 608M	11/17/2021	11/24/2021
Shay Pond	115	Endrin	<	ND	µg/L	0.05	0.01	EPA 608M	11/17/2021	11/24/2021
Shay Pond	116	Endrin aldehyde	<	ND	µg/L	0.05	0.01	EPA 608M	11/17/2021	11/24/2021
Shay Pond	117	Heptachlor	<	ND	µg/L	0.05	0.009	EPA 608M	11/17/2021	11/24/2021
Shay Pond	118	Heptachlor epoxide	<	ND	µg/L	0.05	0.008	EPA 608M	11/17/2021	11/24/2021
Shay Pond	119	Aroclor 1016	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	120	Aroclor 1221	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	121	Aroclor 1232	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	122	Aroclor 1242	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	123	Aroclor 1248	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	124	Aroclor 1254	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	125	Aroclor 1260	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021
Shay Pond	126	Toxaphene	<	ND	µg/L	2.5	0.26	EPA 608M	11/17/2021	11/24/2021
Shay Pond		Specific Conductance (E.C.)	=	450	µmhos/cm	2		SM 2510B	11/17/2021	11/18/2021
Shay Pond		Total Filterable Residue/TDS	=	320	mg/L	5		SM 2540C	11/17/2021	11/29/2021
Shay Pond		Aluminum (Al)	=	120	µg/L	50		EPA 200.7	11/17/2021	11/23/2021
Shay Pond		Iron (Fe)	=	120	µg/L	100		EPA 200.7	11/17/2021	11/23/2021
Shay Pond		Manganese (Mn)	J	6.7	µg/L	20		EPA 200.7	11/17/2021	11/23/2021
Shay Pond		Ammonia as N (NH3-N)	J	0.24	mg/L	0.5		EPA 350.1	11/17/2021	11/30/2021
Shay Pond		Chloride (Cl)	=	7.6	mg/L	1		EPA 300.0	11/17/2021	11/18/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Shay Pond		Fluoride (F)	=	1.2	mg/L	0.1		EPA 300.0	11/17/2021	11/18/2021
Shay Pond		Nitrate as N (NO3-N)	=	1.2	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021
Shay Pond		Nitrate + Nitrite (as N)	=	1.3	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021
Shay Pond		Nitrite as N (NO2-N)	<	ND	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021
Shay Pond		Sulfate (SO4)	=	23	mg/L	0.5		EPA 300.0	11/17/2021	11/18/2021
Shay Pond		MBAS (LAS Mole. Wt 340.0)	<	ND	mg/L	0.1		SM 5540C	11/17/2021	11/18/2021
Shay Pond		Methyl tert-butyl ether	<	ND	µg/L	3	0.069	EPA 624.1	11/17/2021	11/19/2021
Shay Pond		Styrene	<	ND	µg/L	0.5	0.059	EPA 624.1	11/17/2021	11/19/2021
Shay Pond		Trichlorofluoromethane	<	ND	µg/L	5	0.13	EPA 624.1	11/17/2021	11/19/2021
Shay Pond		Xylenes (total)	<	ND	µg/L	0.5	0.26	EPA 624.1	11/17/2021	11/19/2021
Shay Pond		Total Trihalomethanes (THM)	=	1.7	µg/L	0.5	0.22	EPA 624.1	11/17/2021	11/19/2021
Shay Pond		Iron (Fe) Dissolved	<	ND	µg/L	100		EPA 200.7	11/17/2021	11/29/2021
Shay Pond		Manganese (Mn) Dissolved	<	ND	µg/L	20		EPA 200.7	11/17/2021	11/29/2021
Shay Pond		Boron (B)	J	59	µg/L	100		EPA 200.7	11/17/2021	11/23/2021
Shay Pond		Hardness, Total (as CaCO3)	=	180	mg/L	6.6		Calculated	11/17/2021	12/1/2021
Shay Pond		pH (Lab)	=	7.7	SU			SM 4500HB	11/17/2021	11/18/2021
Shay Pond		Temperature (Field)	=	56	°F			Field	11/17/2021	11/17/2021
Shay Pond		Total Kjeldahl Nitrogen	<	ND	mg/L	1		EPA 351.2	11/17/2021	11/22/2021
Shay Pond		Total Nitrogen	=	1.2	mg/L			Calculated	11/17/2021	11/22/2021
Big Bear Lake	1	Antimony (Sb)	J	0.22	µg/L	6		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	2	Arsenic (As)	J	1.3	µg/L	2		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	3	Beryllium (Be)	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	4	Cadmium (Cd)	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	5a	Chromium (+3)	J	0.31	µg/L			[CALC]	12/2/2021	12/9/2021
Big Bear Lake	5b	Chromium (+6)	<	ND	µg/L	1		EPA 218.6	12/2/2021	12/3/2021
Big Bear Lake	5	Chromium (Total Cr)	J	0.31	µg/L	10		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	6	Copper (Cu)	<	ND	µg/L	50		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake	7	Lead (Pb)	J	1.8	µg/L	5		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	8	Mercury	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/8/2021
Big Bear Lake	8	Mercury	=	0.27	µg/L	0.2	0.15	EPA 245.1	12/2/2021	12/9/2021
Big Bear Lake	9	Nickel (Ni)	<	ND	µg/L	10		EPA 200.8	12/2/2021	12/10/2021
Big Bear Lake	10	Selenium (Se)	<	ND	µg/L	5		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	11	Silver (Ag)	J	0.53	µg/L	10		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	12	Thallium (Tl)	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/9/2021
Big Bear Lake	13	Zinc (Zn)	<	ND	µg/L	50		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake	14	Cyanide (total)	<	ND	µg/L	5	1	SM4500-CN E	12/2/2021	12/8/2021
Big Bear Lake	15	Asbestos	<	ND	µg/L	1		EPA 100.2	12/2/2021	12/11/2021
Big Bear Lake	16	2,3,7,8-TCDD	<	ND	pg/L	1.7		EPA 1613B	11/17/2021	12/1/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Big Bear Lake	17	Acrolein	<	ND	µg/L	5	1.2	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	18	Acrylonitrile	<	ND	µg/L	2	0.63	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	19	Benzene	<	ND	µg/L	1	0.47	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	20	Bromoform	<	ND	µg/L	1	0.27	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	21	Carbon tetrachloride	<	ND	µg/L	1	0.28	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	22	Chlorobenzene	<	ND	µg/L	1	0.35	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	23	Dibromochloromethane	<	ND	µg/L	1	0.35	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	24	Chloroethane	<	ND	µg/L	1	0.38	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	25	2-Chloroethyl vinyl ether	<	ND	µg/L	5	0.19	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	26	Chloroform	<	ND	µg/L	1	0.29	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	27	Bromodichloromethane	<	ND	µg/L	1	0.44	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	28	1,1-Dichloroethane	<	ND	µg/L	1	0.32	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	29	1,2-Dichloroethane	<	ND	µg/L	1	0.54	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	30	1,1-Dichloroethene	<	ND	µg/L	1	0.32	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	31	1,2-Dichloropropane	<	ND	µg/L	1	0.42	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	32	1,3-Dichloropropene, Total	<	ND	µg/L	1		EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	33	Ethylbenzene	<	ND	µg/L	1	0.41	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	34	Bromomethane	<	ND	µg/L	1	0.5	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	35	Chloromethane	<	ND	µg/L	1	0.29	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	36	Methylene chloride	<	ND	µg/L	1	0.39	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	37	1,1,2,2-Tetrachloroethane	<	ND	µg/L	1	0.38	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	38	Tetrachloroethene	<	ND	µg/L	1	0.34	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	39	Toluene	<	ND	µg/L	1	0.36	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	40	trans-1,2-Dichloroethene	<	ND	µg/L	1	0.27	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	41	1,1,1-Trichloroethane	<	ND	µg/L	1	0.31	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	42	1,1,2-Trichloroethane	<	ND	µg/L	1	0.42	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	43	Trichloroethene	<	ND	µg/L	1	0.34	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	44	Vinyl chloride	<	ND	µg/L	1	0.31	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	45	2-Chlorophenol	<	ND	µg/L	2	0.53	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	46	2,4-Dichlorophenol	<	ND	µg/L	1	0.7	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	47	2,4-Dimethylphenol	<	ND	µg/L	2	0.59	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	48	4,6-Dinitro-2-methylphenol	<	ND	µg/L	10	0.74	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	49	2,4-Dinitrophenol	<	ND	µg/L	5	0.51	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	50	2-Nitrophenol	<	ND	µg/L	10	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	51	4-Nitrophenol	<	ND	µg/L	10	0.55	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	52	4-Chloro-3-methylphenol	<	ND	µg/L	5	0.67	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	53	Pentachlorophenol	<	ND	µg/L	5	0.97	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	54	Phenol	<	ND	µg/L	1	0.5	EPA 625	12/2/2021	12/9/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Big Bear Lake	55	2,4,6-Trichlorophenol	<	ND	µg/L	10	0.71	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	56	Acenaphthene	<	ND	µg/L	0.5	0.27	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	57	Acenaphthylene	<	ND	µg/L	0.2	0.011	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	58	Anthracene	<	ND	µg/L	0.2	0.029	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	59	Benzidine	<	ND	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	60	Benzo (a) anthracene	<	ND	µg/L	0.2	0.023	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	61	Benzo (a) pyrene	<	ND	µg/L	0.1	0.03	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	62	Benzo (b) fluoranthene	<	ND	µg/L	0.5	0.03	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	63	Benzo (g,h,i) perylene	<	ND	µg/L	0.2	0.029	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	64	Benzo (k) fluoranthene	<	ND	µg/L	0.2	0.029	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	65	Bis(2-chloroethoxy)methane	<	ND	µg/L	5	0.55	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	66	Bis(2-chloroethyl)ether	<	ND	µg/L	1	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	67	Bis(2-chloroisopropyl)ether	<	ND	µg/L	10	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	68	Bis(2-ethylhexyl)phthalate	=	2.6	µg/L	1.5	0.65	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	69	4-Bromophenyl phenyl ether	<	ND	µg/L	10	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	70	Butyl benzyl phthalate	<	ND	µg/L	10	1.2	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	71	2-Chloronaphthalene	<	ND	µg/L	10	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	72	4-Chlorophenyl phenyl ether	<	ND	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	73	Chrysene	<	ND	µg/L	0.2	0.028	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	74	Dibenz (a,h) anthracene	<	ND	µg/L	0.1	0.027	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	75	o-Dichlorobenzene	<	ND	µg/L	1	0.35	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	76	m-Dichlorobenzene	<	ND	µg/L	1	0.39	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	77	p-Dichlorobenzene	<	ND	µg/L	1	0.42	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake	78	3,3´-Dichlorobenzidine	J	2.87	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	79	Diethyl phthalate	<	ND	µg/L	2	0.54	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	80	Dimethyl phthalate	<	ND	µg/L	2	1.1	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	81	Di-n-butyl phthalate	<	ND	µg/L	10	0.73	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	82	2,4-Dinitrotoluene (2,4-DNT)	<	ND	µg/L	5	0.59	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	83	2,6-Dinitrotoluene (2,6-DNT)	<	ND	µg/L	5	0.77	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	84	Di-n-octyl phthalate	<	ND	µg/L	10	0.72	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	85	1,2-Diphenylhydrazine	<	ND	µg/L	1	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	86	Fluoranthene	<	ND	µg/L	0.2	0.033	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	87	Fluorene	<	ND	µg/L	0.2	0.15	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	88	Hexachlorobenzene	<	ND	µg/L	1	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	90	Hexachlorocyclopentadiene	<	ND	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	91	Hexachloroethane	<	ND	µg/L	1	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	92	Indeno (1,2,3-cd) pyrene	<	ND	µg/L	0.05	0.035	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	93	Isophorone	<	ND	µg/L	1	0.55	EPA 625	12/2/2021	12/9/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Big Bear Lake	94	Naphthalene	<	ND	µg/L	0.2	0.018	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	95	Nitrobenzene (NB)	<	ND	µg/L	10	0.52	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	96	N-Nitrosodimethylamine	<	ND	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	97	N-Nitrosodi-n-propylamine	<	ND	µg/L	5	0.5	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	98	N-Nitrosodiphenylamine	<	ND	µg/L	1	0.71	EPA 625	12/2/2021	12/9/2021
Big Bear Lake	99	Phenanthrene	<	ND	µg/L	0.2	0.012	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	100	Pyrene	<	ND	µg/L	0.2	0.04	EPA 610	12/2/2021	12/13/2021
Big Bear Lake	102	Aldrin	<	ND	µg/L	0.005	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	103	alpha-BHC	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	104	beta-BHC	<	ND	µg/L	0.005	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	105	gamma-BHC (Lindane)	<	ND	µg/L	0.02	0.001	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	106	delta-BHC	<	ND	µg/L	0.005	0.001	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	107	Chlordane	<	ND	µg/L	0.1	0.034	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	108	4,4´-DDT	<	ND	µg/L	0.01	0.001	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	109	4,4´-DDE	<	ND	µg/L	0.05	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	110	4,4´-DDD	<	ND	µg/L	0.05	0.01	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	111	Dieldrin	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	112	Endosulfan I	<	ND	µg/L	0.02	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	113	Endosulfan II	<	ND	µg/L	0.01	9E-04	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	114	Endosulfan sulfate	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	115	Endrin	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	116	Endrin aldehyde	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	117	Heptachlor	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	118	Heptachlor epoxide	<	ND	µg/L	0.01	0.002	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	119	Aroclor 1016	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	120	Aroclor 1221	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	121	Aroclor 1232	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	122	Aroclor 1242	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	123	Aroclor 1248	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	124	Aroclor 1254	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	125	Aroclor 1260	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake	126	Toxaphene	<	ND	µg/L	0.5	0.052	EPA 608M	12/2/2021	12/10/2021
Big Bear Lake		Specific Conductance (E.C.)	=	470	µmhos/cm	2		SM 2510B	12/2/2021	12/3/2021
Big Bear Lake		Total Filterable Residue/TDS	=	320	mg/L	5		SM 2540C	12/2/2021	12/10/2021
Big Bear Lake		Aluminum (Al)	=	58	µg/L	50		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		Iron (Fe)	J	66	µg/L	100		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		Manganese (Mn)	=	29	µg/L	20		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		Ammonia as N (NH3-N)	J	0.29	mg/L	0.5		EPA 350.1	12/2/2021	12/16/2021

Secondary Effluent and Receiving Water Characterization Data

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date
Big Bear Lake		Chloride (Cl)	=	26	mg/L	1		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		Fluoride (F)	=	0.41	mg/L	0.1		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		Nitrate as N (NO3-N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		Nitrate + Nitrite (as N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		Nitrite as N (NO2-N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		Sulfate (SO4)	=	18	mg/L	0.5		EPA 300.0	12/2/2021	12/2/2021
Big Bear Lake		MBAS (LAS Mole. Wt 340.0)	J	0.058	mg/L	0.1		SM 5540C	12/2/2021	12/2/2021
Big Bear Lake		Methyl tert-butyl ether (MTBE)	<	ND	µg/L	1	0.4	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		Trichlorofluoromethane	<	ND	µg/L	1	0.43	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		m,p-Xylene	<	ND	µg/L	1	0.29	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		o-Xylene	<	ND	µg/L	1	0.29	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		Iron (Fe) Dissolved	<	ND	µg/L	100		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		Manganese (Mn) Dissolved	<	ND	µg/L	20		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		cis-1,3-Dichloropropene	<	ND	µg/L	1	0.36	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		trans-1,3-Dichloropropene	<	ND	µg/L	1	0.33	EPA 624.1	12/15/2021	12/17/2021
Big Bear Lake		Boron (B)	J	54	µg/L	100		EPA 200.7	12/2/2021	12/10/2021
Big Bear Lake		Hardness, Total (as CaCO3)	=	180	mg/L	6.6		Calculated	12/2/2021	12/9/2021
Big Bear Lake		pH (Lab)	=	8.2	SU			SM 4500HB	12/2/2021	12/3/2021
Big Bear Lake		Total Kjeldahl Nitrogen	J	0.87	mg/L	1		EPA 351.2	12/2/2021	12/3/2021
Big Bear Lake		Total Nitrogen	J	0.87	mg/L			Calculated	12/2/2021	12/3/2021

ND = All data were undetected below the MDL.

J = The result is estimated above the MDL and below the RL.

Attachment B.

Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency

TECH MEMO

REPLENISH
Big Bear

Date:	2/28/2022
To:	Jayne Joy – Santa Ana Regional Water Quality Control Board, Executive Officer
CC:	David Lawrence – Big Bear Area Regional Wastewater Agency; Mary Reeves, Big Bear City Community Services District; Mike Stephenson, Big Bear Municipal Water District; Reggie Lamson, Big Bear Lake Department of Water and Power
Prepared by:	Ashli Desai – Larry Walker Associates (LWA); Antonia Estevez-Olea, PE - Water Systems Consulting, Inc. (WSC)
Reviewed by:	Laine Carlson – WSC; Rob Morrow – WSC
Project:	Replenish Big Bear Program
Subject:	Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency

Acknowledgment of Credit

This technical memorandum is financed under the Water Quality, Supply and Infrastructure Improvement Act of 2014, administered by the State of California, Department of Water Resources.

Service, Quality, Community

Executive Summary

The Big Bear Area Regional Wastewater Agency (BBARWA) operates an existing regional wastewater treatment plant (WWTP) and related facilities in the Big Bear Valley (Valley). BBARWA has partnered with Big Bear City Community Service District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), collectively known as the Agency Team, to develop the Replenish Big Bear Program. The Replenish Big Bear Program is intended to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The program is comprised of several elements; the first project includes treatment upgrades at the BBARWA WWTP to produce disinfected advanced treated effluent by providing tertiary filtration, reverse osmosis (RO) treatment and ultraviolet (UV) disinfection for 100% of the water discharged to Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), a tributary of Big Bear Lake (Lake) and a separate discharge to Shay Pond, a tributary of Shay Creek. These discharges are referred to as the "Lake Discharge" and the "Shay Pond Discharge."

The purpose of this technical memorandum (TM) is to provide a structure for issuing a National Pollutant Discharge Elimination System (NPDES) permit for the BBARWA WWTP to Stanfield Marsh and subsequently to the Lake in the context of the Big Bear Lake Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions (Resolution No. R8-2006-0023).

The proposed approach to providing the rationale for permitting the Lake Discharge includes:

1) Demonstrating how the Lake Discharge, in conjunction with requirements for other responsible parties in the Nutrient TMDL, will support attaining the numeric targets in the Nutrient TMDL and, by extension, the applicable water quality standards addressed by the TMDL; and

2) Identifying total phosphorus (TP) water quality based effluent limitations (WQBELs) that can be assigned to be consistent with the assumptions of the Nutrient TMDL.

To evaluate how the Lake Discharge impacts the attainment of numeric targets in the Lake, the impacts were simulated using a two-dimensional hydrodynamic-water quality model (CE-QUAL-W2) of Big Bear Lake developed by Dr. Michael A. Anderson (2021 Lake Model Analysis) and updated in 2022. The 2021 Lake Model Analysis and 2022 Lake Model Update demonstrated that the Lake Discharge will likely result in lower concentrations of TP and chlorophyll-a as compared to the baseline conditions without the project and will increase Lake levels, reducing the amount of time critical conditions occur in the Lake.

To develop an NPDES permit for the Lake Discharge, TP WQBELs must be developed that are consistent with the assumptions of the Nutrient TMDL. The Nutrient TMDL does not include a TP allocation for the Lake Discharge for dry hydrologic conditions. As a result, to be consistent with the Nutrient TMDL assumptions, the Lake Discharge, in essence, needs to have a zero TP wasteload allocation (WLA) during dry hydrologic conditions and not contribute to exceedances of the numeric targets year-round.

To be consistent with the Nutrient TMDL assumptions, TP WQBELs could be established as a combination of a WQBEL derived from the TP numeric targets and an offset framework that would result in a net zero TP loading (or zero TP WLA) to the Lake. The TP loads added to the Lake by the Lake Discharge will be offset through triennial alum applications to attain net zero TP loadings for the upcoming three years. In the event of extreme runoff (defined here as exceeding about 25,000 acre-feet per year (AFY)[1]), which has the potential to bury the reactive alum cap on the sediments and reduce its effectiveness, an alum treatment will be conducted that following spring-summer and the triennial treatment schedule will be reset.

Should the Nutrient TMDL be modified in the future by the Santa Ana Regional Water Quality Control Board (Regional Water Board), allocations for the Lake Discharge could be included and the TP offset program could potentially be discontinued. However, the approach outlined in this TM will provide the justification for issuing an NPDES permit without the need for a TMDL modification.

[1] Approximately the 80th percentile annual inflow based on WaterMaster data for 1977-2018.

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1 Background

The purpose of this TM is to provide a structure for issuing an NPDES permit for the BBARWA WWTP discharge to Stanfield Marsh, and subsequently to the Lake in the context of the Nutrient TMDL for Dry Hydrologic Conditions (Resolution No. R8-2006-0023).

1.1 TMDL Summary

The Nutrient TMDL was adopted by the Regional Water Board on April 21, 2006 and became effective on September 25, 2007. Upon adoption, the Nutrient TMDL was incorporated into Section 6 of the Water Quality Control Plan for the Santa Ana Region (Basin Plan). The Nutrient TMDL includes targets for TP, macrophyte coverage, nuisance aquatic vascular plant species, and chlorophyll-a in the Lake (see **Table 1**). The targets are designated as numeric interpretations of Basin Plan water quality objectives. Because the targets are TMDL equivalents of water quality objectives that apply at all times, the targets apply to all hydrologic conditions. However, the loads necessary to meet those numeric targets were only calculated under dry hydrologic conditions, as discussed further below.

Table 1. Nutrient TMDL Numeric Targets

Indicator	Target Value [a][b]
TP Concentration [c]	Annual average no greater than 35 µg/L
Macrophyte Coverage[d]	30-40% on a total lake area basis
Percentage of Nuisance Aquatic Vascular Plant Species[d][e]	95% eradication on a total area basis of Eurasian Water milfoil and any other invasive aquatic plant species
Chlorophyll-a Concentration[e]	Growing season average no greater than 14 µg/L

Source: Basin Plan

Notes:

a) Targets to be attained no later than 2015 (dry hydrological conditions), 2020 (all other conditions)

b) Compliance date for wet and/or average hydrological conditions may change in response to approved TMDLs for wet/average hydrological conditions.

c) Annual average determined by the following methodology: the nutrient data from both the photic composite and discrete bottom samples are averaged by station number and month; a calendar year average is obtained for each sampling location by averaging the average of each month; and finally, the separate annual averages for each location are averaged to determine the lake-wide average.

d) Calculated as a 5-yr running average based on measurements taken at peak macrophyte growth.

e) Growing season is the period from May 1 through October 31 of each year. The chlorophyll-a data from the photic samples are averaged by station number and month; a growing season average is obtained for each sampling location by averaging the average of each month; and finally, the separate growing season averages for each location are averaged to determine the lake-wide average.

As discussed in the Nutrient TMDL, a "*weight of evidence*" approach will be used to assess attainment of the numeric targets. This means that data pertaining to all targets will be assessed and not attaining one target will not automatically imply that the Lake is not attaining the TMDL (Basin Plan page 6-119).

The Nutrient TMDL also assigns TP WLA to point sources (urban runoff) and load allocations (LA) to non-point sources that were identified as contributing TP loads to the Lake at the time the TMDL was developed. Per the Resolution adopting the Basin Plan Amendment (BPA) that incorporated the Nutrient TMDL into the Basin Plan,

> "*The TMDL for Dry Hydrological Conditions specifies a reduction in phosphorus from internal nutrient sources, which are lake sediment and macrophytes…. The TMDL for Dry Hydrological Conditions does not specify nutrient reductions from external watershed sources, which include resorts, urban discharges and open space/forested lands.*"

Therefore, one of the primary assumptions of the Nutrient TMDL is that the largest sources of TP to the Lake are lake sediment and macrophytes, and external watershed source contributions are minimal compared to those sources. External watershed sources are not required to reduce loads during the dry hydrologic condition (**Table 2**).

The Nutrient TMDL allocations only apply during dry hydrologic conditions, defined as average tributary inflow to the Lake ranging from 0 to 3,049 acre feet (AF), average lake levels ranging from 2,033 to 2,052 meters, and annual precipitation ranging from 0 to 23 inches. The baseline loads, allocations, and responsible parties for achieving the allocations during dry hydrologic conditions are summarized in **Table 2.**

Table 2. Nutrient TMDL WLA and LA for Dry Hydrological Conditions

Source	Baseline Load TP (lbs/yr)	TP Allocation (lbs/yr)	Percent Load Reduction	TMDL Assigned Responsible Parties
WLAs				
Urban	475	475	0%	Department of Transportation (Caltrans), the County of San Bernardino, San Bernardino County Flood Control District, the City of Big Bear Lake
LAs				
Internal Sediment	17,943	8,555	52%	US Forest Service, Caltrans, the County of San Bernardino, San Bernardino County Flood Control District, the City of Big Bear Lake, and Big Bear Mountain Resorts[a]
Internal Macrophyte	21,388	15,700	27%	
Atmospheric Deposition	1,074	1,074	0%	N/A-Background
Forest	175	175	0%	US Forest Service
Resort	33	33	0%	Big Bear Mountain Resorts
Total	**41,088**	**26,012**	**37%**	

Source: Basin Plan
Notes:
a) The Nutrient TMDL requires the responsible parties to submit a Lake Management Plan for Big Bear Lake to address the non-point source LAs.

1.2 Relationship of the Project to the TMDL

The Agency Team is planning the Replenish Big Bear Program, which was developed to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The Replenish Big Bear Program is comprised of three independent projects, which may be implemented separately, when appropriate:

1) WWTP upgrades and effluent discharge to Stanfield Marsh (and subsequently to the Lake) and a separate discharge to Shay Pond;

2) Use of Lake water for landscape irrigation, construction uses and snowmaking; and

3) Use of Lake water for groundwater recharge in Sand Canyon.

The first project includes treatment upgrades at the BBARWA WWTP to produce disinfected advanced treated effluent by providing tertiary filtration, RO treatment and UV disinfection for 100% of the water discharged to the Lake and to Shay Pond. The proposed upgrades to the BBARWA WWTP include:

- Biological nutrient removal improvements to the existing oxidation ditches for improved nitrification and denitrification;
- Tertiary filtration and nitrogen and phosphorus removal via denitrification filters;
- Low- and high-pressure filtration with ultrafiltration (UF) membranes and 90% recovery RO membranes;
- Brine pellet reactor for brine minimization to produce a total system recovery of 99%; and
- UV disinfection.

The proposed upgrades (i.e., new advanced treatment train) would be designed for a treatment capacity of 2.2 million gallons per day (MGD). By 2040, accounting for expected growth, it is estimated that the WWTP could produce 2,210 AFY of advanced treated effluent, assuming a 99% total recovery rate could be achieved (90% RO recovery and 90% recovery of brine through brine minimization). The WWTP currently produces about 2.0 MGD of undisinfected secondary effluent on an average annual basis.

For this TM, the disinfected advanced treated effluent discharge to Stanfield Marsh and subsequently to the Lake is the focus of the analysis. **Table 3** shows the maximum design flow rate and TP concentration and loading for the Lake Discharge. While a portion of the total flow (up to 80 AFY) may be discharged to Shay Pond instead of Stanfield Marsh, this analysis is based on discharging 100% of the treated effluent to Stanfield Marsh to be conservative.

Table 3. Lake Discharge Proposed Max Discharge Flow Rate, TP Concentration and Loading

Parameter	Target Value
Proposed TP Concentration (mg/L)	0.03
Proposed Max Design Flow (MGD)	2.2
Proposed Max TP Discharge Load (lbs/yr)	200

The Lake Discharge will discharge approximately 200 lbs/yr of TP to the Lake, assuming the maximum discharge rate of 2.2 MGD at 0.03 mg/L. As discussed in the Nutrient TMDL Background section, the total loading capacity during dry hydraulic conditions is 26,012 lbs/yr of TP. The Lake Discharge will therefore add less than 1% of the total TP loading capacity to the Lake during dry hydrologic conditions and even less during other hydrologic conditions. In contrast, non-point sources, such as legacy in-lake sediments, contribute the majority of the TP loading to the Lake.

BBARWA WWTP previously held an NPDES permit for discharge to Stanfield Marsh, a tributary to the Lake (Order No. 00-12 NPDES No. CA8000344). In 2004, BBARWA submitted

a Report of Waste Discharge (ROWD) that noted the Stanfield Marsh discharge location was no longer being used and that the WWTP no longer had any discharges to Waters of the United States. Based on the ROWD, in 2005, the NPDES permit was determined to no longer be necessary and was replaced by Waste Discharge Requirements (WDRs) for the Lucerne Valley discharge location (Order R7-2021-0023).

Given that the BBARWA WWTP was not discharging to the Lake or its tributaries at the time of TMDL development, it was not assigned a TP allocation in the Nutrient TMDL. Additionally, the Nutrient TMDL fully assigned the identified TP loading capacity during dry hydrologic conditions to other sources. As a result, under dry hydrologic conditions, no unallocated TP loading capacity is available in the Nutrient TMDL for the BBARWA WWTP to be allocated for the Lake Discharge. Under other hydrologic conditions, the Nutrient TMDL allocations do not apply and loading capacity may be available to assign to the Lake Discharge. As noted in the Nutrient TMDL and in the Staff Report, greater lake volume and dilution is anticipated under wetter conditions.[2]

As discussed in the Nutrient TMDL, the Regional Water Board intends to revise the Nutrient TMDL in the future to address other hydrologic conditions. When the Nutrient TMDL is revised, TP allocations for the Lake Discharge can be incorporated. However, the Nutrient TMDL modifications may not occur until after the Lake Discharge begins. The purpose of this TM is to provide a structure for issuing an NPDES permit for the Lake Discharge assuming the TMDL has not been revised to incorporate TP allocations for the Lake Discharge prior to NPDES permit issuance.

2 Proposed Approach

When a TMDL exists for a waterbody, the Clean Water Act (CWA) and associated regulations require that the permit contain WQBELs that are "*consistent with the assumptions and requirements of any available wasteload allocation for the discharge*" (40 Code of Federal Regulations (C.F.R.) § 122.44(d)(1)(vii)(B)). Additionally, United States Code (U.S.C.) § 1313(d)(4)(A) notes that WQBELs associated with a TMDL can be revised if the cumulative effect of all WQBELs will assure attainment of the water quality standard. In general, WQBELs must be "*derived from and comply with*" all applicable water quality standards. (40 C.F.R. § 122.44(d)(1)(vii)(A).)

The key requirements for the permit are therefore that the WQBELs be consistent with the assumptions of the TMDL and that the cumulative effect of all of the limitations for the sources identified in the TMDL assure attainment of the water quality standards addressed

[2] "*Indeed, since the TMDL for dry hydrological conditions was developed to meet the targets under the critical, worst-case conditions, consistent compliance with these targets is expected to be achieved even in the absence of TMDLs for wet/average hydrological conditions, given the greater lake volume and dilution anticipated under wetter conditions.*" (Basin Plan, page 6-119)

by the TMDL. To address these requirements, the proposed approach to providing the rationale for permitting the Lake Discharge includes:

1) Demonstrating the Lake Discharge will support attaining the numeric targets in the Nutrient TMDL and by extension the applicable water quality standards addressed by the TMDL; and

2) Identifying TP WQBELs that can be assigned to be consistent with the assumptions of the Nutrient TMDL.

2.1 Demonstrating Lake Discharge Will Support Attainment of Nutrient TMDL Numeric Targets

To evaluate how the Lake Discharge could support the attainment of numeric targets in the Lake, the impacts were simulated in the 2021 Lake Model Analysis and a subsequent 2022 Lake Model Update. The relevant results of the modeling are summarized in **Section 4** and the complete results are provided in the reports entitled *Big Bear Lake Analysis: Replenish Big Bear Draft Final Report* (referred to as 2021 Lake Model Analysis; Anderson 2021) and Replenish Big Bear: Modeling of Higher Flows and with Zero TP Load (referred to as 2022 Lake Model Update, Anderson, 2022). The 2021 Lake Model Analysis and 2022 Lake Model Update demonstrated that the Lake Discharge will likely result in lower concentrations of TP and chlorophyll-a as compared to the baseline conditions without the project, particularly during dry hydrologic conditions. These reports are included in the Antidegradation

2.2 Identifying TP WQBELs Consistent with Assumptions of Nutrient TMDL

As discussed in the Background section, the Nutrient TMDL does not include a TP allocation for the Lake Discharge for dry hydrologic conditions. As a result, to be consistent with the Nutrient TMDL assumptions, the Lake Discharge in essence needs to have a zero TP WLA during dry hydrologic conditions and not contribute to exceedances of the numeric targets year-round. To be consistent with the Nutrient TMDL assumptions, TP WQBELs could be established as a combination of a TP WQBEL derived from the TMDL numeric targets and an offset framework that would result in a net zero TP loading (or zero TP WLA) to the Lake.

To address the lack of TP allocations in the TMDL during dry hydrologic conditions, the TP loads added to the Lake by the Lake Discharge will be offset through triennial alum applications to attain net zero TP loadings for the upcoming three years. In the event of extreme runoff (defined here as exceeding about 25,000 AFY[3]), which has the potential to bury the reactive alum cap on the sediments and reduce its effectiveness, an alum

[3] Approximately the 80th percentile annual inflow based on WaterMaster data for 1977-2018.

treatment will be conducted that following spring-summer and the triennial treatment schedule will be reset.

Should the TMDL be modified in the future by the Regional Water Board, TP allocations for the Lake Discharge could be included and the offset program could potentially be discontinued. However, the approach outlined above will provide the justification for issuing an NPDES permit without the need for a TMDL modification.

3 Demonstration that the Lake Discharge Will Support Attainment of Nutrient TMDL Numeric Targets in the Lake as Compared to Baseline Conditions

The 2021 Lake Model Analysis was used to evaluate the impact of the Lake Discharge on the Lake as compared to the water quality that would be predicted without the project. The 2021 Lake Model Analysis considered the impact of the Lake Discharge on lake levels, TP, chlorophyll-a and aquatic plants. The 2021 Lake Model Analysis simulated the period 2009 to 2019 with the Lake Discharge as compared to the baseline from that period and predicted future conditions through 2050 for TP and chlorophyll-a. The 2021 Lake Model 2009 to 2019 baseline analysis reflects the impacts of actions taken to date to implement the Nutrient TMDL. The predicted future conditions do not reflect any additional actions that may be taken by the responsible parties to attain the Nutrient TMDL requirements or the impacts of the offset program described above.

For the future model scenarios, the 2021 Lake Model Analysis presented results for three hydrologic conditions 1) 5th -percentile corresponded to an average inflow rate of 8,646 acre feet per year (AFY) and represents extended drought, 2) 50th -percentile (median) corresponded to intervals of both high runoff and drought comparable to 2009-2019 (average annual inflow of 10,595 AFY), and 3) 95th percentile represented a period of protracted above average rainfall and runoff (average annual inflow of 12,225 AFY). The 5th -percentile hydrologic conditions most closely reflect the dry hydrologic conditions determined to be the critical condition for the Nutrient TMDL and are therefore the focus of the discussion.

For the current model scenarios, the 2021 Lake Model Analysis predicted that the Lake Discharge would result in similar or lower TP concentrations in the Lake on average as compared to baseline conditions. For the time period 2009-2019, the 2021 Lake Model Analysis predicted that the Lake Discharge would result in concentrations similar to or lower than the chlorophyll-a concentrations and aquatic plants under the baseline conditions on average (see **Table 4**).[4]

[4] See 2021 Lake Model Analysis Report (**Attachment A**) pages 47, 48, 56, 58, 59 and 60 for more detailed discussion of the results. The presented results correspond with Alternative 3 in the 2021 Lake Model Analysis. Note that the 2021 Lake Model Analysis Report presents chlorophyll-a values as average annual, which are lower than the growing season average due to the inclusion of winter values.

Table 4. Average Annual Predicted Concentrations of TP, Chlorophyll-a and Plants for 2009-2019 Period under Baseline Scenario and with Replenish Big Bear Project.

Scenario	TP (mg/L)	Chlorophyll-a (µg/L)[a]	Plants (g/m2)
Baseline (without Project)	0.037	9.3	106.9
With Replenish Big Bear Project	0.035	7.1	103.1

For the future long term scenarios, the 2021 Lake Model Analysis predicted the Lake Discharge would result in similar to or slightly lower TP and chlorophyll-a concentrations for the 5th-percentile hydrologic condition as compared to simulations without the Lake Discharge (aquatic plants were not evaluated in the future model scenarios) (see **Table 5**). [5]

Table 5. Long-Term Median Predicted Concentrations of TP and Chlorophyll-a for 5th-Percentile (Extreme Drought) Hydrologic Condition under the Baseline Scenario and with the Replenish Big Bear Project (TP Expressed as Annual Average Concentrations; Chlorophyll-a Shown as Growing Season Average Concentrations).

Scenario	TP (mg/L)	Chlorophyll-a (µg/L)[a]
Baseline (without Project)	0.055	14.2
With Replenish Big Bear Project	0.046	11.3

Notes:

a) The 2021 Lake Model Analysis Report presents chlorophyll-a values as annual average, which is lower than the growing season average due to the inclusion of winter values. The data shown in this table was extracted from the 2021 Lake Model Analysis results to represent the growing season average only. Growing season is the period from May 1 through October 31 of each year.

After the development of the 2021 Lake Model Analysis, additional scenarios were completed in 2022 to investigate the impacts of a higher discharge volume, account for WWTP discharge seasonal variability, and assess the impacts of a TP Offset Program on

[5] Under other hydrologic conditions, the Lake Model predicted that the median concentrations of TP would be similar to or lower than the baseline condition, but that chlorophyll-a concentrations may be slightly higher than the baseline condition with the Project. However, the predicted median chlorophyll-a concentrations under these conditions would be lower than the numeric TMDL target. Further analysis was conducted to evaluate these results (see **Table 7**).

the attainment of the Nutrient TMDL numeric targets. The TP Offset Program results are discussed in **Section 4**.

Recent engineering work indicates that higher discharge flows, up to 2,210 AFY, can be attained by employing additional brine minimization technology (**Table 1**). Note that the 2021 Lake Model Analysis assumed steady annual flows of 1,920 AFY, as it excluded the 80 AFY that could be discharged to Shay Pond. For the 2022 Lake Model Update, to be conservative, the additional analysis assumed all of the disinfected advanced treated effluent produced is discharged to the Lake.

Table 6. Initial and Updated Lake Discharge Flow Projections

Scenario	Lake Discharge Inflow (AFY)	Daily Lake Discharge Inflow (MGD)
Baseline	0	0
2021 Lake Model Analysis – Alternative 3 [(a)]	1920	1.71
2022 Update High Flow (99% recovery) [(b)]	2210	1.57 – 2.18
2022 Update Mid Flow (90% recovery) [(b)]	2009	1.42 – 1.98

Notes:

a) The total Replenish Big Bear production in the 2021 Lake Model Analysis was assumed to be 2,000 AFY with 80 AFY going to Shay Pond.

b) The 2022 Lake Model Update was based on all of the advanced treated effluent being discharged to the Lake under two different total recovery rate scenarios, with no discharge to Shay Pond.

Moreover, deliveries are expected to vary seasonally (**Figure 1**), thus varying from the 2021 Lake Model Analysis that assumed a uniform Lake Discharge of 1.71 MGD throughout the year. Inflows to BBAWRA are lower in the summer months due to reduced inflow and infiltration.

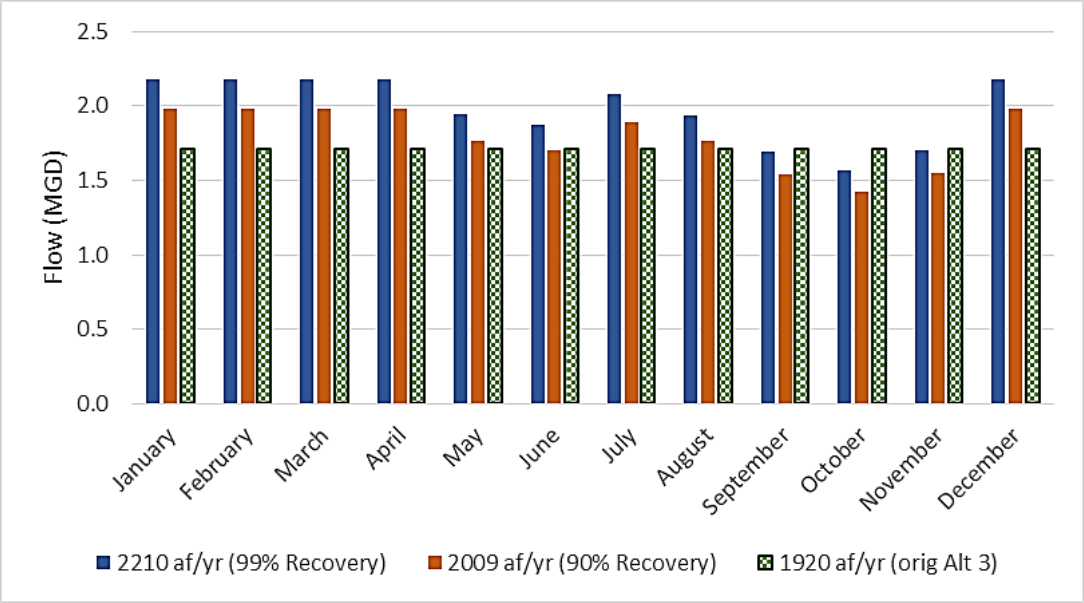

Figure 1. Monthly Flow Rates (Projected 2040) for Replenish Big Bear under Three Project Inflow Scenarios.

The 50th percentile hydrologic scenario for 2009-2050 was used in the additional analysis, noting that it includes a wide array of runoff conditions, including extended drought and periods of high runoff and was predicted to have slightly higher chlorophyll-a concentrations in the 2021 Lake Model Analysis. All other hydrologic, meteorological, biological, chemical and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021)[6].

Long-term average predicted concentrations of TP and chlorophyll-a were lower with the Lake Discharge compared with predicted baseline conditions (**Table 7**). Baseline conditions were predicted to yield growing-season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the TMDL target value of 14 µg/L, the 2021 Lake Model Analysis matched the target, and larger Lake Discharges that varied seasonally (**Figure 1**) yielded values below baseline and TMDL target values (**Table 7**).

[6] Anderson, M.A. 2021. *Big Bear Lake Analysis: Replenish Big Bear.* Final Report. 65 pp.

Table 7. Long-Term Average Predicted Concentrations of TP and Chlorophyll-a in Big Bear Lake under Different Operational Scenarios (TP Expressed as Annual Average Concentrations; Chlorophyll-a Shown as Growing Season Average Concentrations)

Operational Scenario (all at 50th percentile hydrology)	TP (mg/L)	Chlorophyll-a (µg/L)
TMDL target	***0.035***	***14.0***
Baseline	0.0477	14.1
1920 AFY (2021 Lake Model Analysis)	0.0433	14.0
2210 AF (99% recovery)	0.04.3	13.1
2009 AF (90% recovery)	0.0434	12.9

Based on the analysis provided by the 2021 Lake Model Analysis and the 2022 Lake Model Update, the Lake Discharge appears likely to improve water quality and increase the amount of time that the Lake would be meeting the water quality targets. In particular, the Lake Discharge is predicted to improve water quality during the dry hydrologic conditions that were determined to be the critical conditions for the TMDL.

Additionally, the 2021 Lake Model Analysis determined that the Lake Discharge would increase Lake levels by an average of two meters and significantly increase the lake volume. This increase results in the Lake levels being higher than the lake levels associated with the TMDL dry hydrologic condition (2,033 to 2,052 m) over 50% of the time during the model conditions associated with drought conditions and rarely falling below 2,052 m during other hydrologic conditions. In contrast, without the project, the Lake levels would be associated with the TMDL dry hydrologic condition approximately 85% of the time during extended drought conditions and between 20 and 45% of the time during other hydrologic conditions (see **Figure 2**). As noted in the Nutrient TMDL, the dry hydrologic conditions are considered to be the critical conditions for the Lake. The Lake Discharge will therefore also support attainment of the numeric targets by reducing the amount of time the critical conditions occur in the Lake.

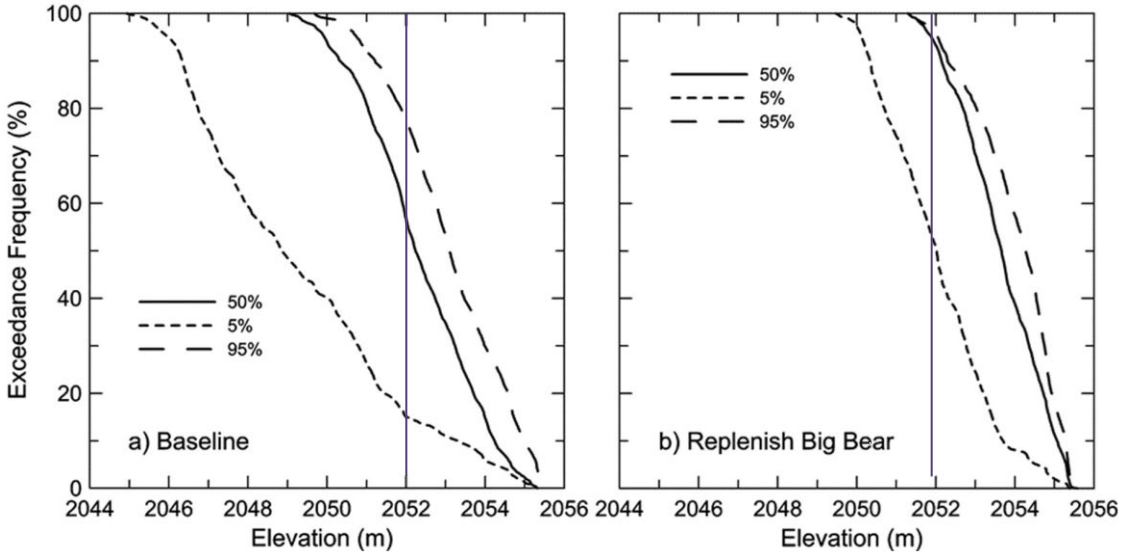

Figure 2. Predicted Lake Elevations at 5th-, 50th- and 95th Percentile Hydrologic Scenarios for a) Baseline Conditions and b) with the Lake Discharge. Vertical Lines Represent Upper Boundary for Lake Level under "Dry Hydrologic Condition".

4 Identifying TP WQBELs Consistent With the Assumptions of the Nutrient TMDL

Given that the Lake Discharge is predicted to improve conditions in the Lake, it is possible to determine an approach to assigning WQBELs without modifying the TMDL. The proposed approach is to include TP WQBELs consistent with the Nutrient TMDL TP numeric target and a TP offset framework. The TP offset framework will reduce TP loads by an amount equal to the Lake Discharge TP load, thereby resulting in a "net zero" TP load discharged to the Lake. This section describes the rationale for the approach to setting the TP WQBELs and the proposed offset program.

4.1 Background for Using Offsets in the Context of TMDLs

In 2005, the State Water Board developed "*A Process for Addressing Impaired Waters in California*" (Impaired Waters Policy). Appendix B to the Impaired Waters Policy compiled legal memorandums relevant to TMDLs. One of the memorandums is entitled "*Legal Authority for Offsets, Pollutant Trading, and Market Programs to Supplement Water Quality Regulation in California's Impaired Waters*" (State Water Board Offset Memo – see **Attachment A**) and provides a comprehensive discussion of the basis for establishing offsets in NPDES permits for waters that have TMDLs. While the memo was developed in 2001, the fundamental authorities remain and can be applied to permitting the Lake Discharge.

As noted in the State Water Board Offset Memo,

> *"When a TMDL is in place, the Clean Water Act (CWA) and California law give wide latitude to develop creative means of achieving compliance with water quality standards (WQS), subject to certain limitations."*
>
> *"Specifically, if the water is impaired, existing WQBELs may be relaxed if "the cumulative effect of all such revised effluent limitations based on such [TMDL] or waste load allocation will assure attainment of such [WQS]." (33 U.S.C. § 1313(d)(4)(A).)"*
>
> *"Federal regulations bolster these provisions. Under the regulations, WQBELs must be "consistent with the assumptions and requirements of any available wasteload allocation . . . ." (40 C.F.R. § 122.44(d)(1)(vii)(B).) The regulations do not require WQBELs to be "equivalent to" available waste load allocations. Accordingly, so long as the cumulative effect of all WQBELs assures attainment of WQS, hence the assumptions of the TMDL, WQBELs can be adjusted based upon whatever mechanisms the state determines is appropriate."*

The rationale outlined in the State Water Board Offset Memo for allowing offsets in the context of a TMDL is as follows:

1) Per Federal regulations implementing the CWA, WQBELs to implement a TMDL do not have to be equivalent to the available WLA as long as they are consistent with the assumptions in the TMDL.
2) As long as the cumulative effect of all effluent limitations assures attainment of water quality standards, the WQBELs can be calculated in any way the Regional Water Board determines to be appropriate.

Using offsets is an appropriate method for developing WQBELs for TP for the Lake Discharge because the result would be consistent with the assumptions of the Nutrient TMDL, as further described below.

4.2 Rationale for Assigning WQBELs

The Nutrient TMDL establishes a causal numeric target for TP of 0.035 mg/L as an annual average. As required by the CWA, TMDL numeric targets should be set at levels that will result in protection of beneficial uses and attainment of water quality standards. The Lake Discharge is currently anticipated to have an average discharge concentration of 0.03 mg/L TP, which is below the TMDL numeric target. Therefore, the proposed Lake Discharge quality would be consistent with attaining the numeric target and therefore the water quality standards. Additionally, as discussed in **Section 3**, modeling indicates the Lake Discharge will likely improve TP and chlorophyll-a concentrations in the Lake. The Lake Discharge would therefore be able meet one of the key requirements for attaining a permit by being able to "*comply with*" applicable water quality standards associated with the TMDL. (40 C.F.R. § 122.44(d)(1)(vii)(A)).

However, as noted in the Nutrient TMDL Background discussion, even though the discharge quality is projected to be below the TP numeric target, the Nutrient TMDL did not include a WLA for the Lake Discharge. As a result, to be consistent with the Nutrient TMDL assumptions, the Lake Discharge in essence needs to have a zero TP WLA during dry hydrologic conditions. Including requirements in the NPDES permit to implement

actions that will offset the TP loads entering the Lake would be equivalent to assigning a zero WLA. The combination of WQBELs calculated based on the TMDL numeric target and offsets would be consistent with the Nutrient TMDL assumptions and support attainment of the water quality standards. While the Nutrient TMDL WLA only applies during dry hydrologic conditions, the Agency Team proposes to conduct TP offsets during all hydrologic conditions to simplify implementation and tracking and to provide a more conservative approach.

The remainder of this section discusses the proposed offsets and how they align with the structure outlined above.

4.3 Proposed TP Offset Program

As part of the Replenish Big Bear Program, the Agency Team is proposing to offset the TP loads introduced by the Lake Discharge to attain a net zero TP loading to be consistent with the Nutrient TMDL WLA assumptions and to apply these offsets during all hydrologic conditions. The proposed TP offset strategy is to proactively apply alum every three years to offset the estimated TP load for the upcoming three years (estimated up to 200 lbs/yr or 600 lbs TP). In the event of extreme runoff (defined here as exceeding about 25,000 AFY), which has the potential to bury the reactive alum cap on the sediments and reduce its effectiveness, an alum treatment will be conducted that following spring-summer and the triennial treatment schedule will be reset. This approach will provide reliable TP load offsets.

In general, alum is a compound used to bind to reactive available phosphorus in the water column, flocculate particulate phosphorus, and reduce internal phosphorus loading from lakebed sediments. After the alum binds to the phosphorus it becomes aluminum phosphate, an inert crystalline compound which renders the phosphorus unavailable to plants and algae as a nutrient. Algae and plants require nitrogen and phosphorus to grow. Since the lake is phosphorus limited, removing phosphorus helps reduce the potential for algae blooms in the summer and slows the growth of aquatic plants in the lake. After the alum sinks to the bottom of the lake, it settles and creates a reactive floc layer which can cap the lakebed sediments and prevent the phosphorus therein from mobilizing out of the sediment and into the water column. Alum treatments often last up to ten years before sorption capacity is exhausted and reapplication is needed.

In 2004, BBMWD, in collaboration with the State Water Board, applied 700,850 gallons of alum across 1,500 surface acres to sequester phosphorus and aid in controlling chlorophyll-a. The estimated TP sequestered from this project was 17,170 lbs per the TMDL annual reports. The application had a significant immediate impact on sequestering phosphorus.

In 2015, BBMWD, in collaboration with the Nutrient TMDL stakeholders, applied 574,832 gallons of alum over 20 days in May and June of that year. Phosphorous concentrations in the lake were elevated at the time due to years of drought and external and internal nutrient loading. The treatment was limited to 420 acres at the western end of the lake where the highest concentrations of phosphorus were found. The estimated TP sequestered from this project was 14,100 lbs per the TMDL annual reports.

As done in 2015, the initial alum application for the TP Offset Program will target the phosphorus-rich organic sediments in the western end of the Lake, where highest dissolved (hypolimnetic) phosphorus and highest sediment phosphorus flux rates are found. Since the objective of these alum applications is to offset a very modest TP loading from the Lake Discharge, rather than substantially reduce internal TP loading and favorably alter the overall TP budget of the lake (which is on the order of 26,000 lbs/yr), it should be noted that marked quantifiable improvements in water quality would not be expected solely as a result of the offset program, especially given the natural variability in hydrology and water quality in the lake. It is anticipated that BBMWD, as the Lake manager, will lead the implementation of the TP Offset Program on behalf of the partner agencies.

4.4 Demonstration that Offsets are Aligned with TMDL Requirements

To evaluate the potential impact of the offsets, further modeling was conducted to evaluate predicted water quality with the TP offset for comparison with the baseline condition and project scenarios without the TP offset. Given the complexity of nutrient budgets of lakes and equivalence of a given form of nutrient irrespective of its particular origin, TP offset was modeled as equivalent to a Lake Discharge with a concentration of 0 mg/L TP. This is an approximation that holds when considering the whole-lake nutrient budget but is nonetheless a simplification; depending upon details of offset, hydrodynamic considerations and other factors, some modest lateral gradients in water quality may result.

Zeroing out the load of TP in the Lake Discharge yielded further reductions in chlorophyll-a. Larger total inflow volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 - 10.2 µg/L, significantly below predicted baseline and TMDL concentrations (**Table 8**).

Table 8. Long-Term Average Predicted Concentrations of TP and Chlorophyll-a in Big Bear Lake with TP Offset (TP Expressed as Annual Average Concentrations; Chlorophyll-a Shown as Growing Season Average Concentrations)

Operational Scenario (all at 50th % hydrology)	TP (mg/L)	Chlorophyll-a (µg/L)
TMDL target	***0.0350***	***14.0***
Baseline	0.0477	14.1
1920 AFY (2021 Lake Model Analysis)	0.0433	14.0
2210 AFY (99% recovery)	0.0423	13.1
2009 AFY (90% recovery)	0.0434	12.9
2210 AFY + offset TP	0.0399	10.2
2009 AFY + offset TP	0.0409	9.5

While it is important to recognize the uncertainty in model predictions, it is nonetheless noteworthy that the simulation of the TP offset yielded average chlorophyll-a concentrations significantly below baseline and Nutrient TMDL target values. Predicted long-term average TP concentrations remained above the Nutrient TMDL target but were nonetheless meaningfully lower than the predicted baseline level (**Table 8**). Inter-annual differences in water quality are also expected to persist. Cumulative distribution functions (CDFs) highlight the predicted wide range in annual and growing season average concentrations (**Figure 3**). The Lake Discharge resulted in lower annual average TP and growing season average chlorophyll-a concentrations than Baseline under all conditions (**Figure 3**).

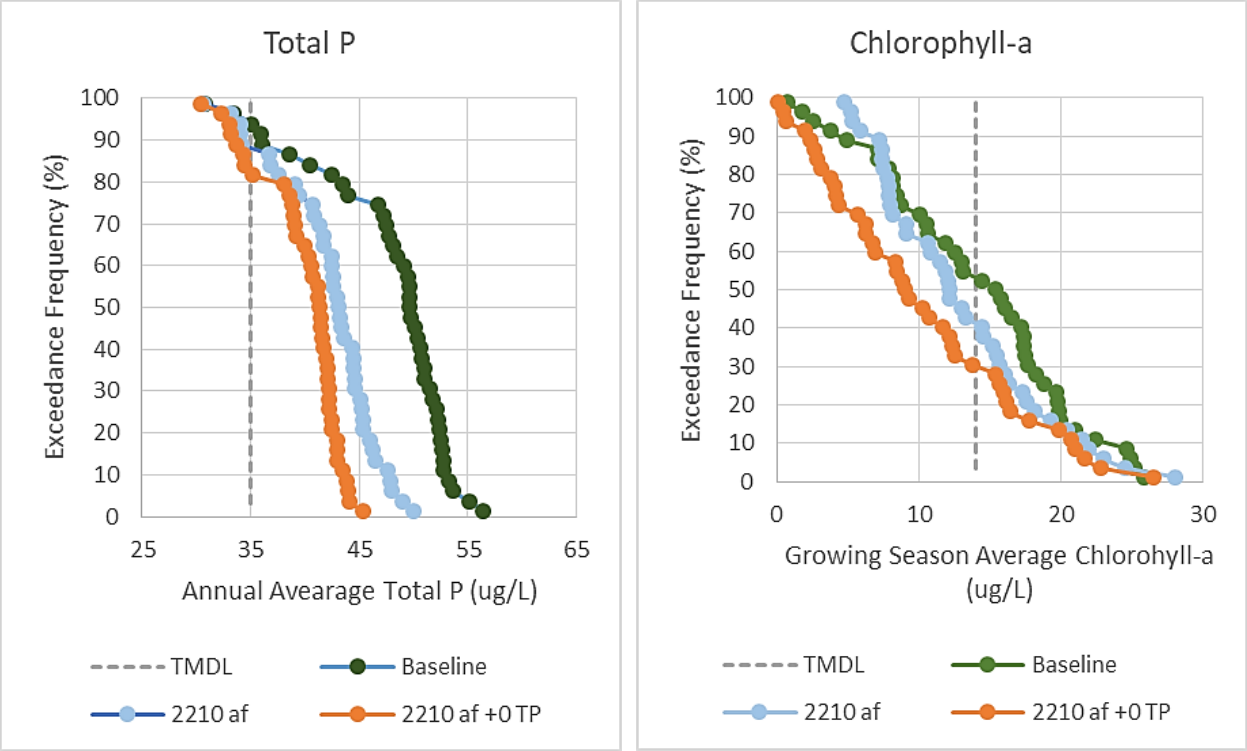

Figure 3. Cumulative Distribution Functions for Predicted Annual TP and Growing Season Average Chlorophyll-a Concentrations for Baseline Condition and with 2,210 AFY Lake Discharge with and without TP Offset.

The model predicted Baseline exceedance frequencies are similar to the observed annual exceedance frequencies based on the TMDL Annual Reports both TP and chlorophyll-a (**Table 9**)

Table 9. Predicted frequency of exceeding TMDL target under baseline conditions and different RBB inflow and TP offset scenarios (annual average or growing season average basis). Observed annual exceedance frequencies for 2009-19 period from TMDL Annual Reports shown in parentheses under Baseline.

Variable	Baseline	2210 AF	2210 AF + 0 TP
TP	94 % (100%)	87 %	82 %
Chlorophyll-a	53 % (55%)	41 %	31 %

As discussed above, the Lake Discharge contributes a minimal amount of loading compared to the other sources described in the Nutrient TMDL. Therefore, the Lake Discharge in and of itself does not need to result in attainment of the water quality standards. Rather, the Lake Discharge, in combination with the other efforts required by the Nutrient TMDL should result in attainment of the water quality standards. The 2021 Lake Model Analysis demonstrates that the Lake Discharge will likely contribute to more

frequent attainment of the Nutrient TMDL numeric targets and associated water quality standards, especially when combined with the offset program and actions taken by the TMDL responsible parties to attain the Nutrient TMDL requirements. Additionally, the Lake Discharge will increase Lake levels, which will contribute to protection of other beneficial uses and reduce the amount of time critical hydrologic conditions occur in the Lake.

5 Conclusion

In conclusion, permitting the Lake Discharge in the context of the existing Nutrient TMDL can be accomplished by:

1) Establishing TP WQBELs that are consistent with the Nutrient TMDL assumptions; and
2) Making permit findings that the WQBELs are derived from and comply with water quality standards.

The TP WQBELs that are based on the Nutrient TMDL numeric targets and include requirements to implement the offset strategies outlined in this TM would be consistent with the Nutrient TMDL numeric targets and the assumptions of the Nutrient TMDL allocations. Additionally, because the Nutrient TMDL numeric targets were established to meet water quality standards, WQBELs based on the Nutrient TMDL numeric targets would be derived from and comply with water quality standards. Finally, the 2021 Lake Model Analysis and subsequent additional model analysis results can be used to demonstrate that the Lake Discharge will provide benefits to beneficial uses and likely help improve water quality in the Lake.

In the future, if the Nutrient TMDL is revised, allocations can be assigned to the Lake Discharge. Then permit conditions could be revised (e.g., removing the offset framework), if appropriate to reflect the TMDL allocations.

6 References

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Attachment A: Legal Authority for Offsets, Pollutant Trading, and Market Programs to Supplement Water Quality Regulation in California's Impaired Waters Memo

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Gray Davis
Governor

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.swrcb.ca.gov.

TO: Arthur G. Baggett, Jr.
Chair

/ s /
FROM: Craig M. Wilson
Chief Counsel
OFFICE OF CHIEF COUNSEL

DATE: October 16, 2001

SUBJECT: LEGAL AUTHORITY FOR OFFSETS, POLLUTANT TRADING, AND MARKET PROGRAMS TO SUPPLEMENT WATER QUALITY REGULATION IN CALIFORNIA'S IMPAIRED WATERS

I. Introduction

This memorandum has been prepared to outline the existing legal authority to employ offsets, pollutant trading, and other market programs to supplement water quality regulation in impaired waters. While there is no fixed definition of these terms, "offsets" generally refer to unilateral abatement efforts by a discharger to remove a certain amount of pollutant discharge from existing sources to compensate for the discharger's own discharge. "Pollutant trading" generally refers to an exchange of either permitted discharge levels or required abatement levels between two or more dischargers, either in a formal "commodities" market or banking system, or a less structured exchange.

In sum, the extent to which such mechanisms may be employed varies greatly depending upon whether a TMDL has been adopted for the impaired water, although they may be permissible in either context. The analysis in this memorandum is equally applicable for any market-type mechanism, be it offsets, pollutant trading, or another analogous system that would authorize one discharger to perform (or to encourage another to perform) additional abatement or restoration in lieu of meeting an otherwise applicable or more stringent discharge limitation or prohibition.

This memorandum should not be construed as delineating the universe of possible market-scenarios that may be legal in given circumstances. Each such system must be evaluated in the context of its own circumstance. However, this document is intended to discuss some of the legal issues that will arise in considering such systems. These include at least the anti-

backsliding rule, and the extent to which the regulations authorize new or renewed permits to be issued for discharges into impaired waters.

In considering any of these approaches, Regional Water Quality Control Boards (Regional Boards) should be cognizant of the state's legal obligation to adopt and implement approximately 1400 TMDLs. Accordingly, any market system should only be contemplated under circumstances that will promote (and not forestall) TMDL development or attainment of water quality standards.

II. Irrespective of whether a TMDL exists, federal law requires each point source to be subject to applicable technology based effluent limitations (TBELs) as a floor.

Section 402(b) of the CWA requires that all NPDES permits issued by California contain applicable TBELs. (33 U.S.C. § 1342(b)(1)(A). See also 33 U.S.C. §§ 1311, 1313(e)(3)(A).) Effluent limitations based upon the best available technology are the floor and the minimum that must be required of any NPDES permitted discharge. Thus, no market system can be adopted that would afford relief from TBELs in NPDES permits, for either new or existing sources.

III. When a TMDL is in place, the Clean Water Act (CWA) and California law give wide latitude to develop creative means of achieving compliance with water quality standards (WQS), subject to certain limitations.

A. The water quality based effluent limitations (WQBELs) applicable to new or existing point sources can be adjusted in compliance with a TMDL.

NPDES permits must also incorporate "any requirements in addition to or more stringent than [TBELs] necessary to . . . [a]chieve water quality standards." (44 C.F.R. § 122.44(d)(1).) See also 33 USC §§ 1342(b), 1311(b)(1)(C).) Unlike TBELs, these water quality based effluent limitations (WQBELs) can be adjusted in contemplation of a TMDL. While the CWA's anti-backsliding provisions would ordinarily prohibit the state from permitting a less stringent effluent limitation, section 402(o) contains an express exception applicable when a TMDL is in place. (33 U.S.C. § 1342(o).) Specifically, if the water is impaired, existing WQBELs may be relaxed if "the cumulative effect of all such revised effluent limitations based on such [TMDL] or waste load allocation will assure attainment of such [WQS]." (33 U.S.C. § 1313(d)(4)(A).)

Federal regulations bolster these provisions. Under the regulations, WQBELs must be "consistent with the assumptions and requirements of any available wasteload allocation . . . ." (40 C.F.R. § 122.44(d)(1)(vii)(B).) The regulations do not require WQBELs to be "equivalent to" available waste load allocations. Accordingly, so long as the cumulative effect of all WQBELs assures attainment of WQS, hence the assumptions of the TMDL, WQBELs can be adjusted based upon whatever mechanisms the state determines is appropriate.

This regulatory structure is equally applicable to new sources. A WQBEL that otherwise would be applicable to a new source can also be adjusted based upon a TMDL, whether through the use of offsets or other appropriate measures, that insure attainment of WQS. The CWA's anti-backsliding provisions do not apply to new dischargers.

To avoid a claim that a given NPDES permit is inconsistent with a TMDL, if any such mechanisms are contemplated, it would be appropriate to incorporate pertinent details of the market-based provisions into the TMDL implementation plan. If sufficient details of potential market approaches are not known at the time the implementation plan is adopted, alternatively, Regional Boards can retain flexibility in translating WLAs into effluent limitations by articulating a provision similar to the following in the implementation plan:

> "While individual WQBELs shall be consistent with the assumptions and requirements of the available WLAs, LAs, and the TMDL, individual WQBELs need not be equivalent to corresponding allocations so long as the cumulative effect of all WQBELs assures attainment of WQS as quantified by the TMDL. (33 U.S.C. § 1313(d)(4)(A); 40 C.F.R. § 122.44(d)(1)(vii)(B).)"

Although failure to include the above language would not necessarily preclude subsequent flexibility in implementation, the better practice, given the public-participation requirements, would be to minimize surprises by disclosing up front that alternative attainment mechanisms may be employed.

Nonpoint Source Discharges

TMDLs must identify and grant allocations to all sources of pollution, including load allocations to nonpoint sources. The TMDLs therefore may disclose nonpoint sources as likely candidates to be offsets for point sources in addition to or apart from other point-source abatement. In appropriate circumstances, i.e., where load reductions can be calculated and enforceable, offsets may also be applied for the benefit of nonpoint sources as well as point sources.

Since the CWA does not directly regulate nonpoint sources, such discharges are subject to applicable limitations set forth under state law. California's primary mechanism to protect water quality for non-NPDES discharges (be they nonpoint source, or point source discharges to non-navigable waters) is through issuance of waste discharge requirements (WDRs) under Water Code section 13263. The extent to which offsets can be used in this context is derived from the state's authority to issue WDRs generally. Specifically:

> The requirements [for waste discharge] shall implement any relevant water quality control plans that have been adopted, and shall take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the

> provisions of Section 13241 [dictating matter to be considered in establishing water quality objectives]. (Water Code § 13263(a).)

Section 13241 in turn requires consideration of, among other things, "[w]ater quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area." (Water Code § 13241(c).)

Since the basin plans protect beneficial uses and articulate water quality objectives, any WDRs issued must be protective of those uses and meet the objectives. Notably, the Regional Boards are authorized (1) to not utilize the full waste assimilation capacities of the receiving waters and (2) to utilize time schedules if they determine them appropriate in their discretion. (Water Code § 13263(b) and (c).) These authorizations may be further elucidated upon or restricted in a region's applicable basin plan. Moreover, given Section 13241(c) of the Water Code, it would be appropriate in establishing WDRs for a particular discharger to consider the affect that other pollution control measures in the area could have on the water body. So long as such other measures are implemented, and the cumulative effect of such measures and the discharge meet water quality objectives, the level of abatement required in the WDRs could be adjusted accordingly.

Traditionally, California's nonpoint sources have been regulated through general WDRs or general waivers of WDRs. Waivers of WDRs are subject to the restriction that the waiver not be "against the public interest." (Water Code § 13269(a).) In its Nonpoint Source Management Plan, the state has committed to controlling nonpoint source pollution through a three-tiered approach, rather than though immediate issuance of individual WDRs. First, it will encourage self-determined pollution abatement measures. Second, it will employ regulatory incentives to achieve the desired results. Third, if the other tiers are unsuccessful, the state will issue WDRs to nonpoint source dischargers or use other direct regulatory mechanisms. (Nonpoint Source Program Strategy and Implementation Plan, 1998-2013 (PROSIP) pp. 54-60.)

The second tier is exceptionally amenable to use of conditional waivers of WDRs. Participation in an offset program that is part of a water quality attainment strategy (such as a TMDL) could be a proper condition upon which WDRs could be waived. Since the offset is part of a water quality attainment strategy, it would presumably not be against the public interest. Notably, the authority to waive WDRs is qualified by the provision that the Regional Boards must "require compliance with the conditions pursuant to which waivers are granted under this section." (Water Code § 13269(e).) It would also be permissible to incorporate an offset as a requirement in WDRs themselves, for the same purposes as set forth above.

IV. In the absence of a TMDL, offsets must be consistent with the regulations that require all discharge permits to implement WQS.

A degree of uncertainty exists about the U.S. Environmental Protection Agency's (EPA) position on whether offsets are appropriate in the absence of a TMDL. EPA proposed an offset program that was published in the Federal Register on August 23, 1999. That program would have allowed new discharges in the absence of a TMDL, provided the new discharge and offset together demonstrated "reasonable further progress" toward attainment, and therefore did not violate the antidegradation rules. At least a 1.5 to 1 offset ratio was determined to generally constitute reasonable further progress. On July 13, 2000, however, EPA published its abandonment of the rules that would have implemented the program. Notably, the program was not abandoned for illegality, but because EPA determined its offset requirement, as proposed, was not the best mechanism to achieve progress in impaired waters in the absence of a TMDL, especially given the existing regulations set forth at 40 Code of Federal Regulations (C.F.R.) sections 122.4(d)(1)(vii), and 122.4(i).

EPA's findings were directed to the utility of a nationwide fixed offset policy, and do not necessarily imply that EPA is opposed to offsets in any given or all circumstances. In fact, there are several prominent indications to the contrary. (See e.g., Draft Framework for Watershed-Based Trading, U.S. EPA Office of Water, EPA 800-R-96-001 (May, 1996); EPA Region 9 Draft Guidance for Permitting Discharges into Impaired Waterbodies in Absence of a TMDL (5/9/00).[1]) Given that no statutes or regulations directly address market-approaches to water quality regulation, any such programs must be examined within the confines of the existing regulatory structure.

<u>New Sources</u>: An NPDES permit cannot be issued to a new source if it would "cause or contribute" to a violation of WQS. In appropriate circumstances, however, a new discharge, coupled with an offset, might be deemed to not "cause or contribute" if the new discharge is not merely a substitute contributing source of pollution for the offset.

The NPDES regulations prohibit new discharges that would contribute to a violation of WQS:

> No permit may be issued … [¶ to] a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. (40 C.F.R. § 122.4(i).)[2]

[1] Note: Since these are draft documents, they should not be relied upon as reliable authority for any position. Their inclusion here is exclusively for illustrative purposes only.

[2] Notably, this regulation is also qualified when a TMDL is in place, and requires the discharger to undertake a load assessment to demonstrate that additional assimilative capacity exists to allow the discharge. (40 C.F.R. § 122.4(i).)

While this language could be interpreted as prohibiting all new discharges into impaired waters without a TMDL, neither the U.S. Supreme Court nor EPA have adopted that position. (See *Arkansas v. Oklahoma* (1992) 503 U.S. 91, 107-108, but see *In The Matter of: Mayaguez Regional Sewage Treatment Plant Puerto Rico Aqueduct and Sewer Authority* (1993) 4 E.A.D. 772, fn. 21 [limiting *Arkansas* to its facts]. See also 65 Fed.Reg. 23640 col. 3.)[3] In fact, it can properly be argued that a new discharge does not "cause or contribute" if coupled with an appropriate offset.

Determining whether a new discharge, coupled with an offset, will "cause or contribute to" the violation of WQS involves a degree of factual analysis, and a degree of interpretation. If a new discharger, for instance, were to propose a one-to-one mass offset from other dischargers (be they existing point or nonpoint sources) for the discharger's increased waste load, the discharge would involve merely the substitution of one contributing source of impairment for another. A new contributing source that substitutes for an existing contributing source is still a contributing source. As such, a one-for-one offset scenario would probably be prohibited by the federal regulations.

Likewise, offsets in a venue remote to the proposed discharge would not offset the impairment-contribution from a new discharge, as the offset program would not yield benefits to the relevant water quality limited segment. Such a new discharge would merely be an additional contributing source of impairment. Again, this would appear to be prohibited by the same authorities.

On the other hand, if a discharger performs offsets greater than one-to-one, in a venue relevant to the new discharge, it may well properly be deemed to not "cause or contribute" to the impairment. In such circumstances, the net result is actually to improve water quality.

Given the regulatory prohibition against contributing to excursions above objectives, in the absence of a TMDL benchmark, the safest offsets would involve projects whose relevance to attainment of WQS should be apparent. Accordingly, if a new discharger were to instigate, for example, a legacy-abatement program, especially if such a program was probably necessary to attainment but would not readily be accomplished were it not for the efforts of the new discharger, a good argument would be apparent that the offset is not merely a substitute for an existing contributing source. If the legacy abatement efforts created significant quantifiable mass abatement above and beyond the new discharge, the cumulative effect of the discharge and offset can properly be viewed as improving water quality. Likewise, if a new source cannot meet concentration-based effluent limitations, an offset that achieved a sufficient reduction in background levels might fall within this category as it could provide room for dilution that might not otherwise be available.

[3] Though not relevant to the subject of this memorandum, an obvious flaw in the no-discharge position is the fact that discharges meeting criteria end-of-pipe necessarily do not contribute to excursions above criteria.

The variable in the above analysis, however, is the lack of knowledge of the relevance of the offset to the water's impaired status. Without such knowledge, it may often be difficult to determine whether the improvement from the offset will be sufficient to defensibly reach the conclusion that the discharge is not merely a substitute cause of impairment. Any offset program in the absence of a TMDL will therefore be subject to significant scrutiny, and its defensibility in the absence of knowledge of the TMDL benchmark values, will be fact-specific, and will include an evaluation of numerous factors. These will no doubt include at least an evaluation of the substantiality of the offset achieved in exchange for the discharge (offset-ratio), as well the level of certainty that the offset program will abate a sum-certain of contributing pollutants. The inquiry may properly also include a consideration of the likelihood that the source to be offset would or could be abated through other means (the less likely the source is to be abated through other means, the more compelling the need to find alternative incentives to abate it) and whether the offset generates a permanent or temporal abatement. In any event, where a definitive improvement in water quality can be shown, such offsets ought to be encouraged.

The key legal point is that since federal law prohibits new discharges that cause or contribute to violations of water quality standards, to be defensible, any offset program must do more than substitute one contributing source for another. The program should significantly drive the watershed toward attainment or otherwise toward development of a TMDL. The key practical point is that an offset program in the absence of a TMDL should be chosen carefully to maximize the chances that a reviewing court (one that may be ideologically opposed to offsets) will find the facts compelling enough to sustain despite any skepticism.

Legacy-abatement and watershed-restoration efforts, for example, seem particularly amenable to pre-TMDL circumstances for the reasons set forth above. Such efforts may yield permanent benefits to the watershed in exchange for a temporal discharge. These offsets do not merely substitute one source for another, but create assimilative capacity through improvements to the overall environmental health of the watershed. In many cases, such efforts may ultimately need to be undertaken as part of a TMDL implementation plan in any event. Accordingly, rather than forestalling TMDL development and implementation, offsets of this nature may promote the state's performance of its TMDL obligations, and may do so in advance of formal TMDL implementation.

<u>Existing Sources</u>: Whether offsets can be used to allow relief from an otherwise applicable WQBEL, without a TMDL, depends upon whether the anti-backsliding rules apply, and if not, whether the discharge is protective of WQS.

1. Anti-backsliding

A key distinction between new and existing sources is the anti-backsliding rule. The anti-backsliding rule provides that, unless certain exceptions are met:

> [A] permit may not be renewed, reissued, or modified . . . subsequent to the original issuance of such permit, to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit except in compliance with section 1313(d)(4) of this title. (33 U.S.C. § 1342(o).)

Since an offset program by definition provides a discharger with an avenue to obtain flexibility in lieu of the application of an otherwise stringent effluent limitation, the extent to which the anti-backsliding rule applies could have significant consequences in terms of the permissibility of offsets. However, there are many circumstances in which the anti-backsliding rule does not apply.[4] The most notable of these is the limitation that the rule only applies to the "comparable effluent limitations in the previous permit." (*Id.*)

In SWRCB Order WQ 2001-06 (The Tosco Order), the State Water Resources Control Board (State Board) addressed the question of whether effluent limitations in interim permits—permits reissued prior to the adoption of a TMDL—are "comparable effluent limitations" to those in the previous permit. The Tosco Order held that the discharger's interim performance-based effluent limitation, in a compliance schedule, was not a comparable effluent limitation to that set forth in its final limit from the previous permit. The State Board reached this result for two reasons. First, the interim limit at issue was a performance-based effluent limitation, which was issued pursuant to a compliance schedule that was authorized under the applicable Regional Water Quality Control Plan. Such interim limits, the State Board held, are not designed to attain water quality, but to preserve the status quo during the term of the compliance schedule. Furthermore, if the anti-backsliding rule were deemed to apply to such limits, it would effectively prohibit compliance schedules. (Order WQ 2001-06, pp. 51-52.) Since the previously permitted final effluent limitation was a WQBEL, and the interim limitation was performance based, the two effluent limitations were not "comparable" as they were not derived with the same considerations in mind. Instead, the "comparable limit," the State Board held, would be the alternative final (water quality based) limit, not the interim (performance based) limit. Since the two effluent limits were not comparable, the fact that the interim limit was less stringent than the previous final effluent limit did not violate the anti-backsliding rule.[5]

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[4] 33 U.S.C. section 1342(o)(2) contains five exceptions to the anti-backsliding rule, that may render it inapplicable to a given discharge. While these are not discussed separately in this memorandum, if any of these exceptions apply, the analysis that follows would also apply.

[5] This theory would apply whenever a compliance schedule may authorize an interim discharge in excess of limits established in a prior permit. Other authorities provide for compliance schedules in appropriate, instances, most notably, EPA's California Toxics Rule (CTR) and the state's policy that implements it, authorizes a compliance schedule as to CTR criteria pollutants when a discharger shows that immediate compliance with criteria is infeasible, and the discharger had committed to support and expedite development of a TMDL. (Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California § 2.1.1 (2000).)

This finding has been challenged by a writ petition to the superior court. In that proceeding, the petitioner contends the term "comparable limit" refers to the permitted levels of pollutant discharge, not to the way the levels were derived. If the petitioners prevail, there will be far less permitting flexibility for interim permitting of existing facilities. Assuming the State Board's finding is affirmed, however, those regions whose applicable water quality control plans authorize compliance schedules may, if they choose, adopt offset requirements in conjunction with an interim permittee's compliance schedule. In cases where the interim limit is deemed comparable to the previous limit (be it on the basis of the Tosco reasoning or a subsequent judicial interpretation), section 402(o) may be an impediment to relaxing the effluent limitation to accommodate an offset in the absence of a TMDL.

2. Potential situations where the anti-backsliding rule may not apply

a. Bubbling of NPDES permitted sources

In the 1970s, the U.S. EPA endorsed permit "bubbling" for stationary sources subject to the federal Clean Air Act. Bubbling entailed treating multiple sources as though they were a single source, with an aggregate emissions limit. Since there was a total limit based on the bubble output, the individual sources within a given bubble could allocate the emissions amongst themselves, provided the sum of all emissions did not exceed the bubble limitation. This concept is similar to the mechanisms employed by the Grassland Bypass Project, which controls selenium in nonpoint source agricultural discharges to levels sufficiently protective that the San Luis Drain could be reopened. The San Luis Drain is treated as one outfall for purposes of the Project. As long as the Drain output attains standards, the dischargers may determine for themselves who may discharge what amount.

As noted, anti-backsliding applies only to "comparable effluent limitations in the previous permit." Nothing in the Clean Water Act prohibits issuing a single NPDES permit that regulates several sources. Certainly the limitations set forth in such a super-permit are not "comparable" to prior limitations imposed on individual sources now subject to the super-permit. At most all that could be said is that the super-permit is comparable to the totality of all the super-permittees' individual permits. Thus while such a super-permit could not properly expand the universe of what was individually permissible by the collective, individuals should not be deemed to backslide if the total output of the bubble does not exceed the cumulative total of the individuals. Of course, when using any bubbling mechanism, care must be taken to insure criteria are attained at all points within the bubble. A market system cannot authorize participants to discharge in a manner that would cause or contribute to excursions above criteria. (40 C.F.R. § 122.4(i); 40 C.F.R. § 122.44(d)(1)(vii)(A).)

b. Mini- or Partial TMDL

Although a TMDL may not have been created, often the major sources of impairment are well known. Frequently, abatement of these sources may be regarded as essential to any TMDL implementation plan even though such a plan is not yet being developed. Under such circumstances, it may be possible to create a mini- or partial TMDL that assigns preliminary LAs or WLAs to dischargers who undertake or participate in abatement of these sources in advance of the final TMDL. Since these LAs or WLAs would be assigned in exchange for abatement necessary to the success of the ultimate TMDL, they are plainly either "based on a [TMDL] or other waste load allocation." (33 USC § 1313(d)(4)(A).) The CWA, which thus contemplates that WLAs can be created apart from a final TMDL, supports this interpretation. Note that, as above, even with a TMDL, local excursions above criteria must be prevented.

3. Similar to new permits, existing permits must insure compliance with WQS.

Irrespective of anti-backsliding, interim permits must protect applicable WQS. 40 C.F.R. section 122.44(d) requires that NPDES permits contain any more stringent requirements necessary to achieve water quality standards. Specifically, when WQBELs are developed, the permitting authority "shall ensure that:"

> The level of water quality to be achieved by limits on point sources established under this paragraph *is derived from, and complies with all applicable water quality standards*. (40 C.F.R. § 122.44(d)(1)(vii)(A) (emphasis added).)

Moreover, permits shall incorporate "any more stringent limitation, including those necessary to meet water quality standards" or those "required to implement any applicable water quality standard established pursuant to this chapter." (33 U.S.C. § 1311(b)(1)(C). See also 40 C.F.R. § 122.44(d)(5).)

The extent to which the above language authorizes or prohibits offsets in the absence of a TMDL is not clear. While it appears to be somewhat less proscriptive than the companion "cause or contribute" requirement applicable to new sources (see 40 C.F.R. § 122.4(i), supra), in practice they appear to have the same effect. (See e.g. 40 C.F.R. § 122.44(d)(1)(i).) Accordingly, the analysis set forth in section IV.A., supra, would be equally applicable here.

Variances

Similar to compliance schedules, which grant extensions of time to comply with criteria, the federal regulations authorize the use of variances in the State's discretion, subject to EPA's approval. (40 CFR § 131.13.) Where variances are authorized, Regional Boards may grant such variances in consideration of, or condition them upon, the performance of an appropriate offset which helps guarantee that protection of beneficial uses will not be compromised or that the

public interest will be served. (See Water Code § 13269.) Variances are authorized in certain circumstances, e.g., in section III.I of the California Ocean Plan (2000), as well as in the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California at section 5.3, for categorical and case-by-case exceptions to CTR criteria for resource and pest management, and for drinking water. Individual Regional Water Quality Control Plans may also authorize variances for conventional pollutants as well. Notably, Water Quality Order No. 2001-12-DWQ, the recent statewide general NPDES permit for the discharge of aquatic pesticides, grants such a categorical exception.

V. Conclusion

The use of offsets, pollutant trading, or other market-based mechanisms to supplement water quality regulation in impaired waters is clearly appropriate when implemented in the context of a TMDL, in which case, substantial flexibility exists to achieve WQS. For impaired waters for which no TMDL has yet been created, the anti-backsliding rules must be considered. However, when considered in the context of regulating multiple sources with a single NPDES permit (bubbling), staged TMDL efforts, or other scenarios, the anti-backsliding rules may not be a restraint on the use of market-based regulation.

For new and existing sources, the federal regulations provide that new discharges may not "cause or contribute" to violations of WQS, and that existing discharges must be "derived from and comply with" all applicable WQS. However, significant legacy abatement programs or another large-scale offsets, may well meet regulatory scrutiny depending upon fact-specific circumstances that lead the Regional Board to conclude that, even in the absence of a TMDL, the offset coupled with the discharge, creates a watershed-based improvement of a magnitude that justifies a finding that the discharge does not contribute to impairment, and is consistent with WQS. As noted above, even in the absence of a final TMDL there may nonetheless be significant flexibility in certain circumstances, which must be evaluated within the context of the facts presented.

In any event, given the scope of California's obligations under CWA section 303(d), specifically the roughly 1400 TMDLs that must be adopted, as a practical matter, care should be taken that creative mechanisms, in advance of a TMDL, should be promotive of TMDL development or attainment of criteria generally.

Should you have any questions about this memorandum, please contact me at 341-5150, or Staff Counsel Michael Levy at 341-5193 or mlevy@exec.swrcb.ca.gov.

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Attachment C.

Antidegradation Analysis for Proposed Discharges to Big Bear Lake and Shay Pond

REPLENISH
Big Bear

Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/Big Bear Lake and Shay Pond

Prepared by:

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LIST OF ACRONYMS

4,4' DDT	4,4' Dichlorodiphenyltrichloroethane
AF	Acre Foot
AFY	Acre Feet Per Year
AGR	Agricultural Supply Beneficial Benefit
APU	Administrative Procedures Update
BBARWA	Big Bear Area Regional Wastewater Agency
BBCCSD	Big Bear City Community Service District
BBLDWP	Big Bear Lake Department Of Water And Power
BBMWD	Big Bear Municipal Water District
BO	Biological Opinion
BOD	Biological Oxygen Demand
BVBGSA	Bear Valley Basin Groundwater Sustainability Agency
CCC	Criterion Continuous Concentration
CDFW	California Department Of Fish And Wildlife
CEQA	California Environmental Quality Act
COLD	Cold Freshwater Habitat Beneficial Benefit
CSA53	County of San Bernardino Service Area
CTR	California Toxics Rule
CWA	Clean Water Act
DAC	Disadvantaged Community
DDW	California State Water Resources Control Board Division Of Drinking Water
DO	Dissolved Oxygen
EIR	Environmental Impact Report
GPM	Gallons Per Minute
GSP	Groundwater Sustainability Plan
GWR	Groundwater Recharge Beneficial Benefit
LWA	Larry Walker Associates
MCL	Maximum Contaminant Level
MG	Million Gallons
MGD	Million Gallon Per Day
MUN	Municipal And Domestic Supply Beneficial Benefit
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
MBAS	Methylene Blue-Activated Substances
MDL	Method Of Detection Limit

mg/L	Milligrams Per Liter
MSL	Mean Sea Level
Mutual	Bear Valley Mutual Water Company
N/A	Not Applicable
ND	Non-Detect
NS	Not Sampled
O&M	Operations And Maintenance
PCB	Polychlorinated Biphenyls
REC1	Water Contact Recreation Beneficial Benefit
REC2	Non-Contact Water Recreation Beneficial Benefit
RARE	Rare, Threatened, Or Endangered Species Beneficial Benefit
RL	Reporting Limit
RO	Reverse Osmosis
ROWD	Report Of Waste Discharge
SAR	Santa Ana River
SBNF	San Bernardino National Forest
SBVMWD	San Bernardino Valley Municipal Water District
SPWN	Spawning, Reproduction, and/or Early Development Beneficial Benefit
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TOT	Transient Occupancy Tax
TP	Total Phosphorus
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish And Wildlife Service
UV	Ultraviolet
VOCs	Volatile Organic Compounds
WARM	Warm Freshwater Habitat Beneficial Benefit
WDR	Waste Discharge Requirements
WILD	Wildlife Habitat Beneficial Benefit
WLA	Wasteload Allocation
WOTUS	Waters Of The U.S

WQO	Water Quality Objective
WSC	Water Systems Consulting
WWTP	Wastewater Treatment Plant

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EXECUTIVE SUMMARY

Project Description

The Big Bear Area Regional Wastewater Agency (BBARWA) operates an existing regional wastewater treatment plant (WWTP) and related facilities in the Big Bear Valley (Valley). BBARWA has partnered with Big Bear City Community Service District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), collectively known as the Agency Team, to develop the Replenish Big Bear Program. The Replenish Big Bear Program is intended to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The program is comprised of several elements; the first project includes treatment upgrades at the BBARWA WWTP to produce disinfected, advanced treated effluent by providing tertiary filtration, reverse osmosis (RO) treatment, and ultraviolet (UV) disinfection for 100% of the water proposed to be discharged to Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), a tributary of Big Bear Lake (Lake) and a separate discharge to Shay Pond, a tributary of Shay Creek. These discharges are referred to as the "Lake discharge" and the "Shay Pond discharge" and the approximate discharge locations are shown in **Figure ES-1**.

The new BBARWA WWTP facilities will be designed for a treatment capacity of 2.2 million gallons per day (MGD). By 2040, accounting for expected growth, it is estimated that the WWTP could produce 2,210 acre-feet per year (AFY) of advanced treated effluent, assuming a 99% total recovery rate could be achieved (90% RO recovery and 90% recovery of brine through brine minimization). Up to 80 AFY of the disinfected, advanced treated effluent will be sent to Shay Pond discharge, and any remaining disinfected, advanced treated effluent will be sent to the Lake discharge. All remaining flows in excess of the new treatment train's 2.2 MGD capacity will continue to be treated to undisinfected secondary standards and conveyed to BBARWA's existing Lucerne Valley site, which is regulated by the Colorado River Basin Regional Water Quality Control Board.

As described in the Technical Memorandum (Attachment B of the ROWD package) titled *Approach to Address Big Bear Lake Nutrient Total Maximum Daily Load in the NPDES Permit for Big Bear Area Regional Wastewater Agency (WSC & LWA, 2022)*, the Agency Team proposes to implement a total phosphorus (TP) Offset Program for the Lake discharge to attain net zero TP loads to the Lake to be consistent with the assumptions of the Big Bear Lake Nutrient Total Maximum

Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions. While a portion of the disinfected, advanced treated effluent is planned for discharge to Shay Pond, the maximum anticipated Lake discharge of 2,210 AFY, coupled with the TP Offset Program in the Lake, is the basis of the antidegradation analysis for the Lake discharge. Modeling analysis has also been conducted to evaluate a range of additional scenarios; these results are presented herein to provide additional information.

The proposed Lake discharge will be physically discharged at the east end of Stanfield Marsh, then flow through the Marsh into the Lake through a set of culverts under Stanfield Cutoff. Due to prolonged drought conditions, Stanfield Marsh has been mostly dry since 2015. Therefore, current ambient water quality data is not available. Additionally, the water quality objectives (WQOs) specified for the Lake in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) are more stringent than those for Stanfield Marsh. Therefore, this antidegradation analysis focuses on the impacts to water quality in the Lake.

This antidegradation analysis provides the Santa Ana Regional Water Quality Control Board (Regional Water Board) with the information needed to determine whether the proposed Lake discharge and Shay Pond discharge are consistent with the State of California (State) and federal antidegradation policies.

Note that the Replenish Big Bear Program also includes subsequent uses of Lake water for purposes such as 1) landscape irrigation, construction uses, and snowmaking at the golf course and ski resort and 2) direct groundwater recharge in Sand Canyon. It is anticipated that these uses will be regulated separately and are not discussed in this antidegradation report. Coordination with the California State Water Resources Control Board Division of Drinking Water (DDW) is underway to regulate these recycled water uses.

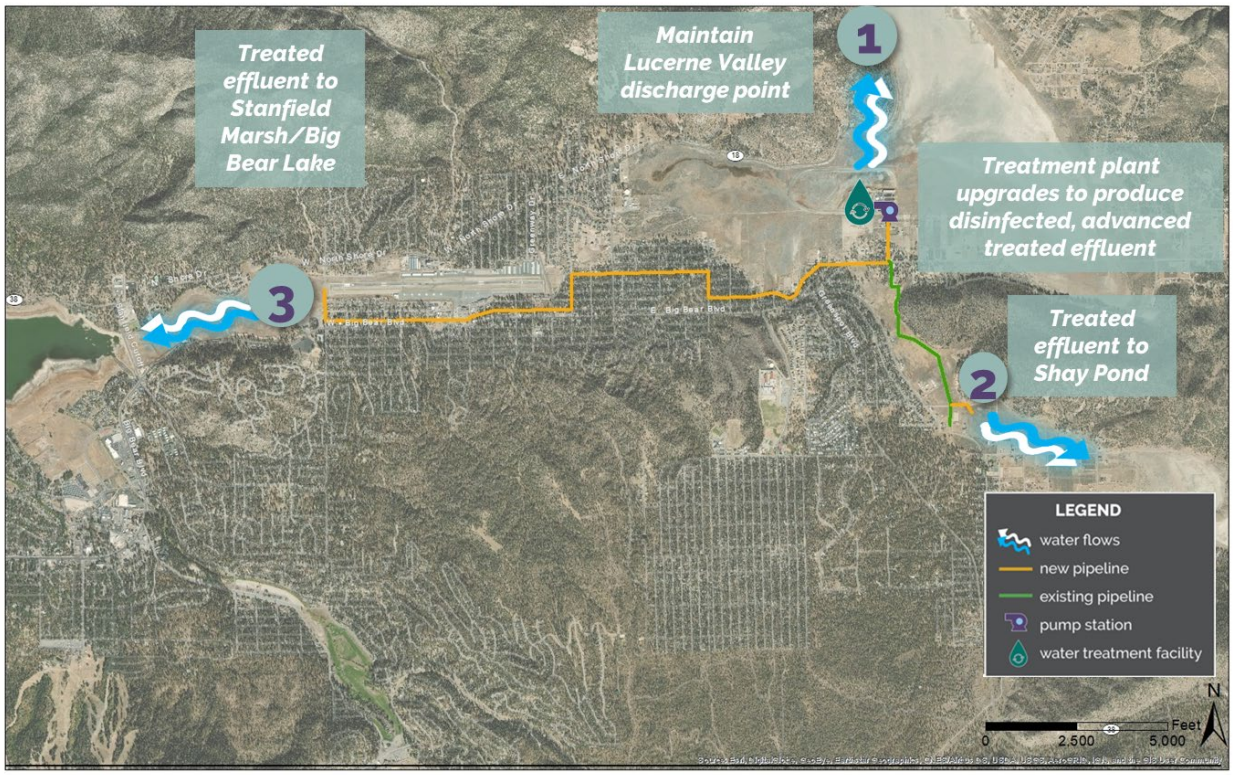


Figure ES - 1. Replenish Big Bear Program Lake and Shay Pond Discharge Locations

Water Quality Impacts of Proposed Discharges

The Replenish Big Bear Program Lake discharge is anticipated to improve Lake water quality for total dissolved solids (TDS), total phosphorus (TP), total nitrogen (TN), and chlorophyll-a as compared to modeled baseline (no project) conditions, and result in similar water quality for total inorganic nitrogen (TIN) as compared to the modeled baseline. In addition, the proposed discharge is anticipated to feature concentrations similar to or lower than ambient water quality and the most stringent WQO or criterion for all constituents evaluated except for boron. For boron, concentrations in the Lake are anticipated to increase as compared to baseline conditions, but remain well below the most stringent WQO of 0.75 mg/L.

The Shay Pond discharge is anticipated to be of better quality than the current potable water supply and ambient water quality for most constituents of interest. However, additional data may be needed to confirm these findings. Like the Lake discharge, boron may be the only constituent in the disinfected, advanced treated effluent discharged to Shay Pond that could be above existing ambient water quality for the constituent. However, it is well below the WQO of 0.75 mg/L that exists for the protection of water used to irrigate boron-sensitive agricultural crops, which is not a use of the water in Shay Pond. Additional coordination with the California Department of Fish and Wildlife (CDFW) will be conducted to ensure the Unarmored Threespine Stickleback (Stickleback) fish, a federally and State listed endangered species, and located in Shay Pond are protected.

Consistency with Antidegradation Policies

The proposed project, the discharge of disinfected, advanced treated BBARWA effluent to (1) Stanfield Marsh/ Lake at a discharge rate up to 2,210 AFY and (2) Shay Pond at a discharge rate up to 80 AFY, is determined to comprise best practicable treatment and control and is consistent with federal and State antidegradation policies for the following reasons:

- The proposed discharge to both Stanfield Marsh/ Lake and Shay Pond will not adversely affect existing or probable beneficial uses of either receiving water or downstream receiving waters, nor will the discharges cause water quality to not meet applicable water quality objectives.
- Overall, the proposed discharge is estimated to improve water quality in the Lake for TDS, TN, TP, and chlorophyll-a, maintain similar water quality for TIN, and have a very minor impact on boron. Future boron concentrations in the Lake are estimated to increase very slightly due to the proposed BBARWA discharge but are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron (see **Table 7** and **Section 5.3.2**). The Lake Analysis shows that projected ambient Lake concentrations of TIN and chlorophyll-a with the proposed discharge will exist below their relevant WQO (TIN) or TMDL target (chlorophyll-a). The Lake Analysis also shows that ambient Lake concentration of TDS and TP with the proposed discharge are estimated to exceed the 175 mg/L TDS WQO and the 35 µg/L TP TMDL target, respectively. However, the modeled baseline (no project) condition is projected to result in Lake concentrations for TDS, TP, TIN, and chlorophyll-a that exceed those concentrations more often than all modeled BBARWA discharge scenarios. Modeled results for the proposed BBARWA discharge, when combined with a TP Offset Program (see Attachment B of the ROWD package), show the greatest improvements to future, ambient Lake concentrations as compared to the modeled baseline (no project) condition.

- Overall, the proposed BBARWA discharge is estimated to have a very minor impact on Shay Pond water quality and Shay Creek water quality downstream of the pond. The proposed project is estimated to potentially cause a very minor increase in boron concentrations in the pond and downstream in Shay Creek, but concentrations are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron. The disinfected, advanced treated effluent proposed for discharge to the pond is anticipated to lower the concentrations of those constituents listed in **Table 13** as compared to existing ambient concentrations that are largely influenced by the groundwater currently discharged by BBCCSD to the pond to maintain water levels for the endangered Stickleback.
- Based on the above, the request to permit a new discharge to both Stanfield Marsh/ Lake and Shay Pond is consistent with federal and State antidegradation policies in that the minor lowering of water quality boron in the Lake (see **Table 7**) and Shay Pond (see **Table 13**) is necessary to accommodate important economic or social development[1], will not unreasonably affect beneficial uses, will not cause further exceedances of applicable WQOs, and is consistent with the maximum benefit to the people of the State.
- Based on the above, the request to permit new discharges to Stanfield Marsh/ Lake and Shay Pond are consistent with the Porter-Cologne Act in that the resulting water quality will constitute the highest water quality that is reasonable, considering all demands placed on the waters, economic and social considerations, and other public interest factors.

The proposed discharge of disinfected, advanced treated BBARWA effluent to Stanfield Marsh/ Lake and Shay Pond also fully supports California's *Recycled Water Policy* (SWRCB, 2013) in that it would result in an increased use of recycled water from municipal wastewater sources, would incrementally reduce reliance on the vagaries of annual precipitation, and would assist in the sustainable management of surface and groundwater resources.

[1] Maintain and improve recreation and tourism in the Big Bear Lake region which in turn stimulates the local and regional economies.

1 INTRODUCTION

This section provides an overview of the Replenish Big Bear Program, description of the proposed discharges to Stanfield Marsh, a tributary of the Lake, and a separate discharge to Shay Pond, a tributary of Shay Creek. This section also discusses the purpose and approach used in this antidegradation analysis report.

1.1 Program Overview

BBARWA is a joint powers authority formed in 1974 to provide centralized wastewater conveyance, treatment, and disposal for the City of Big Bear Lake, representing approximately 47% of the total connections, BBCCSD, representing approximately 48% of the total connections, and County of San Bernardino Service Area 53B (CSA53), representing approximately 5% of the total connections. Each of these member agencies maintains and operates its own wastewater collection system that conveys wastewater to BBARWA's interceptor system for transport to the BBARWA WWTP. The BBARWA service area includes the entire Valley and covers about 79,000 acres. BBARWA owns and operates a regional WWTP to treat the Valley's wastewater and currently discharges undisinfected secondary effluent to Lucerne Valley, which is located outside the Santa Ana Watershed.

The Replenish Big Bear Program is a collaborative regional water resources program being implemented by Agency Team to help protect the Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation through the recovery of this local water resource currently discharged outside of the watershed.

The Replenish Big Bear Program is comprised of three independent projects:

1) Discharge of disinfected, advanced treated effluent to Stanfield Marsh, which is tributary to the Lake, and a separate discharge to Shay Pond;
2) Use of Lake water for purposes such as landscape irrigation of the local golf course, construction uses and snowmaking; and
3) Use of Lake water for groundwater recharge in Sand Canyon.

The first project is the subject of this antidegradation analysis and is foundational to the Replenish Big Bear Program and necessary to enable implementation of the subsequent uses of Lake water. As part of the first project, the BBARWA WWTP will be upgraded to produce disinfected, advanced treated effluent through tertiary filtration using ultrafiltration, and RO treatment with UV disinfection for the proposed discharges to the Lake and Shay Pond.

Although the proposed Lake discharge will be physically discharged at the east end of Stanfield Marsh, then flow through the Marsh into the Lake through a set of culverts under Stanfield Cutoff, this antidegradation analysis was completed for the Lake since Stanfield Marsh has been mostly dry since 2015. Therefore, current ambient water quality data is not available for this antidegradation analysis. Additionally, the WQOs specified for the Lake in the Basin Plan are more stringent than those for Stanfield Marsh.

Figure 1 shows the WWTP and proposed discharge locations, which are components of the first project. The proposed project's two discharge points will allow BBARWA to minimize the discharge of disinfected, advanced treated effluent outside of the watershed. The Lake discharge will increase Lake levels to better support beneficial uses including recreation and habitat, particularly during times of drought. The Shay Pond discharge will replace potable water currently discharged to the waterbody to maintain the water flow through the pond. Up to 80 AFY of disinfected, advanced treated effluent will be sent to Shay Pond, and any remaining disinfected, advanced treated effluent will be sent to the Lake.

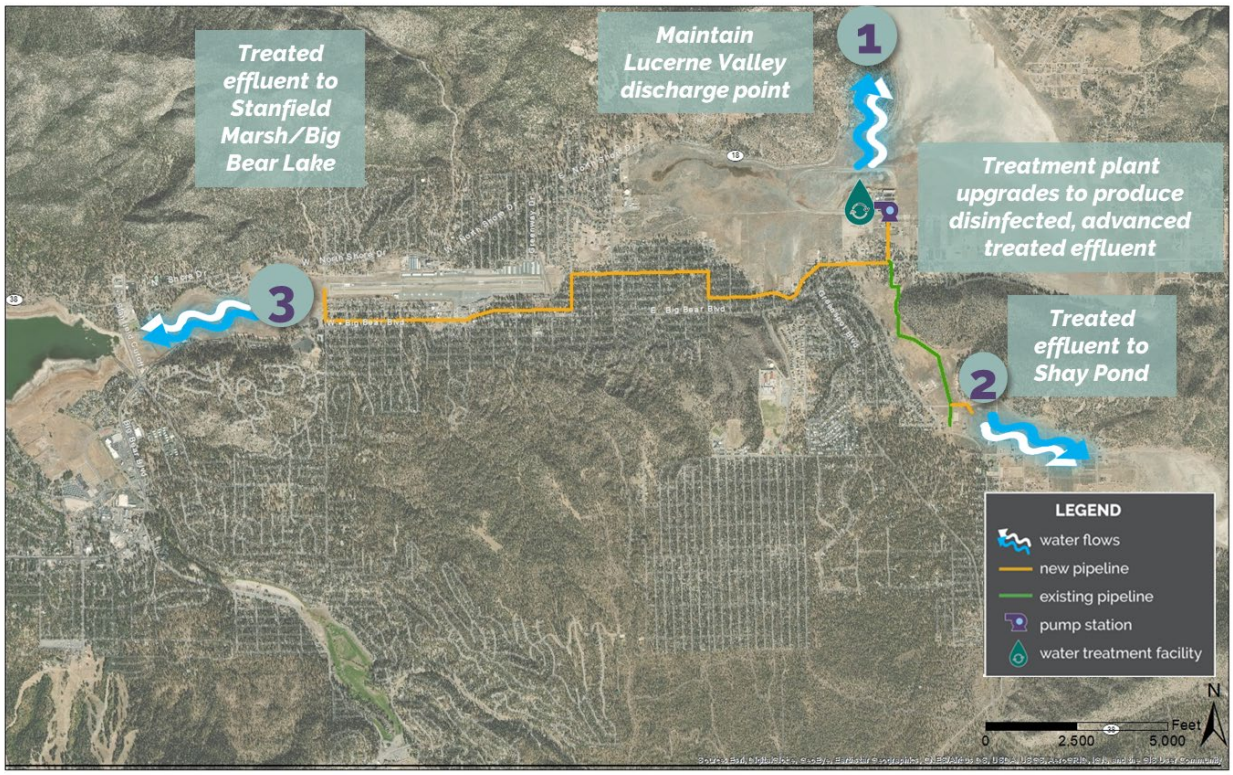


Figure 1. Replenish Big Bear Program Lake and Shay Pond Discharge Locations

The other two projects will utilize Lake water for purposes such as1) landscape irrigation, construction uses, and snowmaking at the ski resort, and 2) direct groundwater recharge in Sand Canyon. **Figure 2** shows the general location of these two projects. The golf course irrigation, construction uses, and snowmaking project can be implemented using existing infrastructure used for snowmaking that draws water from the Lake. The Sand Canyon recharge project will require construction of a pump station, pipeline, recharge ponds and monitoring wells and may be implemented in parallel with the Lake discharge.

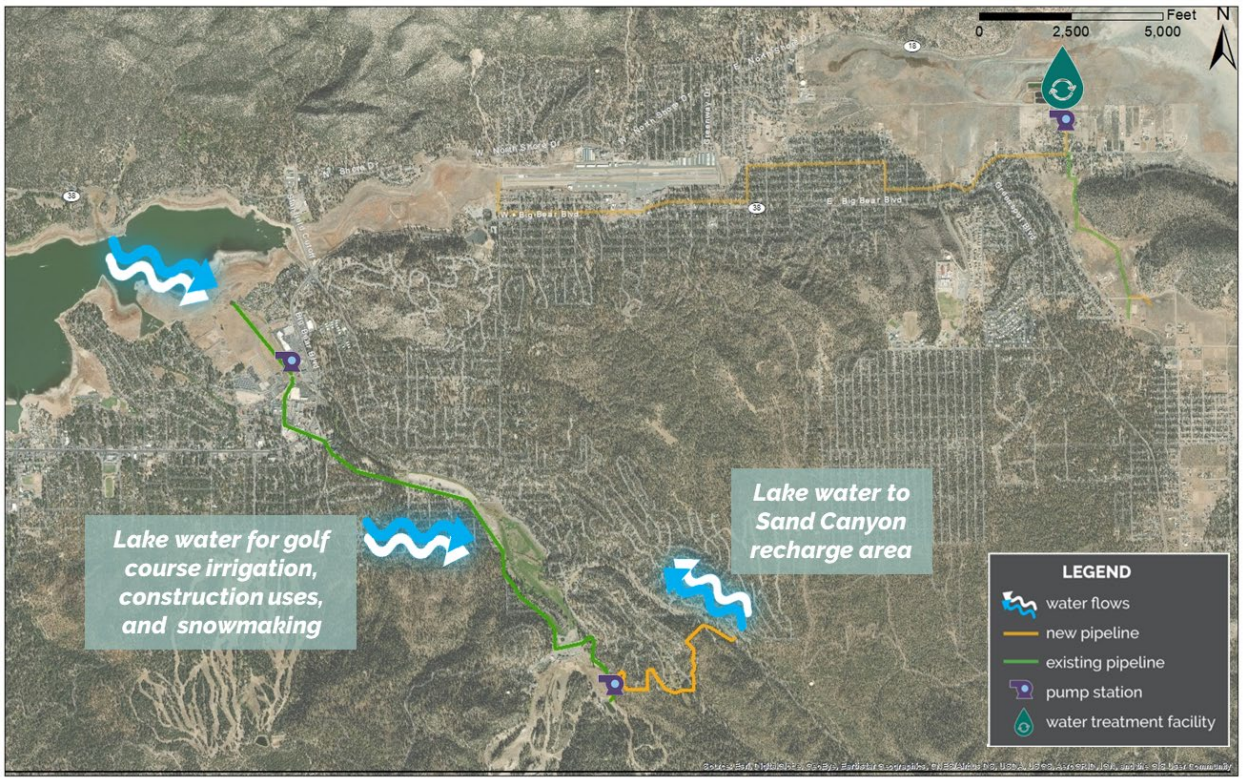


Figure 2. Replenish Big Bear Program Subsequent Uses of Lake Water

1.2 Project Description

The discharge of disinfected, advanced treated effluent to Stanfield Marsh, which is tributary to the Lake, and a separate discharge to Shay Pond is the subject of this antidegradation analysis. The proposed discharges require the construction of WWTP upgrades, an effluent booster pump station at the WWTP site and approximately seven (7) miles of pipeline to convey water to the discharge locations.

Figure 3 shows a process flow diagram of the existing BBARWA WWTP treatment process.

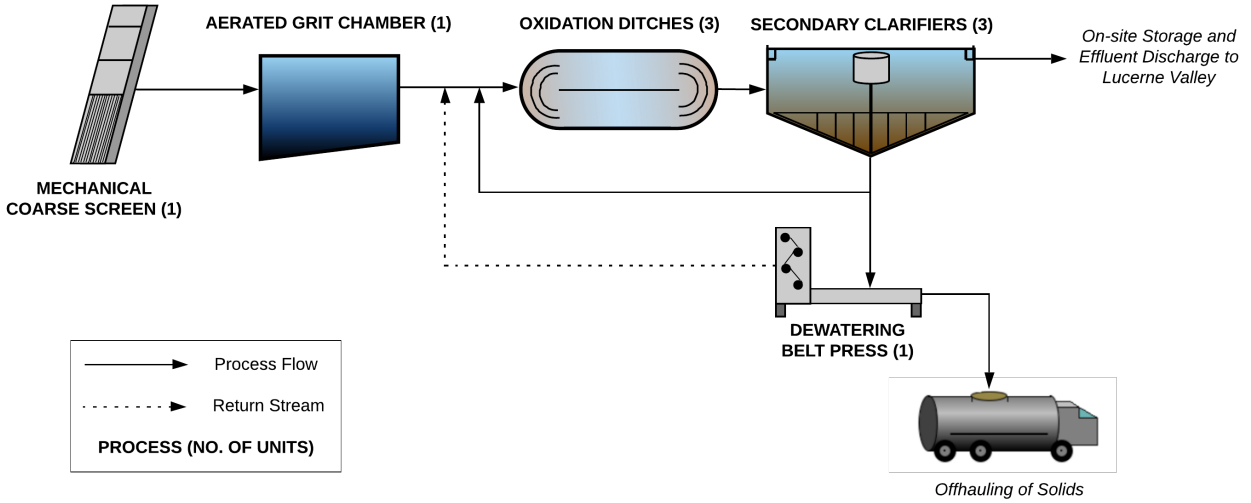


Figure 3. BBARWA Existing WWTP Process Flow Diagram

The existing BBARWA WWTP secondary treatment facility has a capacity of 4.89 MGD and a hydraulic capacity of 9.1 MGD. The WWTP treats commercial and domestic wastewater from the City of Big Bear Lake, BBCCSD, and CSA53 collection systems. The existing treatment process includes the following:

- Preliminary treatment consisting of a mechanical coarse screen and an aerated grit chamber;
- Secondary treatment consisting of extended aeration oxidation ditches and secondary clarifiers; and
- Solids handling through a dewatering belt filter press.

Treated effluent is temporarily stored on-site prior to discharge to Lucerne Valley and dewatered solids are hauled off-site. The undisinfected secondary effluent discharged to Lucerne Valley is currently used to irrigate crops used for livestock feed. This discharge is regulated under Order R7-2021-0023 Waste Discharge Requirements (WDR) permit, issued by the Colorado River Basin Regional Water Quality Control Board (**Appendix A**).

The proposed upgrades, as shown in **Figure 4**, to the BBARWA WWTP to produce disinfected, advanced treated effluent include:

- Biological nutrient removal improvements to the existing oxidation ditches for improved nitrification and denitrification;
- Tertiary filtration and nitrogen and phosphorus removal via denitrification filters;

- Low- and high-pressure filtration with ultrafiltration (UF) membranes and 90% recovery RO membranes;
- Brine pellet reactor for brine minimization to produce a total system recovery of 99%; and
- UV disinfection.

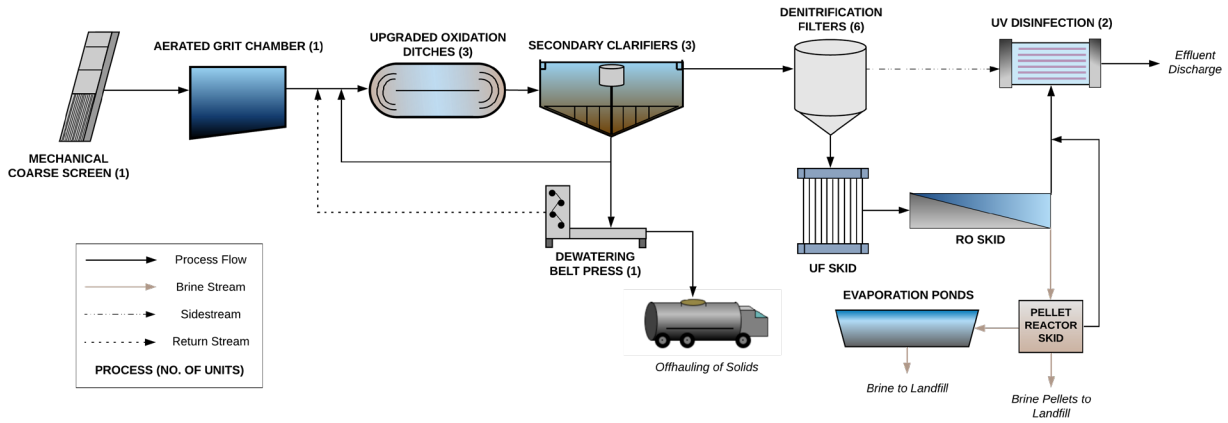


Figure 4. BBARWA Proposed WWTP Treatment Upgrades Flow Diagram

The proposed upgrades (i.e., new advanced treatment train) would be designed for a treatment capacity of 2.2 MGD. By 2040, accounting for expected growth, it is estimated that the WWTP could produce 2,210 AFY of advanced treated effluent, assuming a 99% total recovery rate could be achieved (90% RO recovery and 90% recovery of brine through brine minimization). The WWTP currently produces about 2.0 MGD of undisinfected secondary effluent on an average annual basis.

The RO brine management option included in the preliminary design for Replenish Big Bear is a brine minimization pellet reactor to reduce the volume of brine produced by the RO process. The reduced brine stream from the pellet reactor will be conveyed to evaporation ponds located on BBARWA WWTP property. It is assumed that an RO recovery of 90% at 2.2 MGD influent flow would result in 0.22 MGD of RO brine to be minimized through the pellet reactor and approximately 0.022 MGD of liquid brine to be conveyed to the evaporation pond based on a pellet reactor recovery of 90%. A total evaporation pond area of 23 acres is needed for the brine stream. The RO brine management strategy will be evaluated further as the Project enters the design phase, along with refinements to total system recoveries based on site-specific piloting results.

BBARWA also plans to maintain the existing Lucerne Valley discharge location. All WWTP process water in excess of the new treatment train's 2.2 MGD capacity will continue to be treated to undisinfected secondary levels and conveyed to the existing Lucerne Valley site, consistent with the current, permitted discharge requirements of the existing BBARWA WWTP.

1.3 Purpose of Report

As required by the Clean Water Act (CWA), the discharge of any pollutant or combination of pollutants to surface waters that are deemed waters of the United States (U.S.), as is the Lake discharge and potentially Shay Pond discharge, must be regulated by a National Pollutant Discharge Elimination System (NPDES) permit. Because the two proposed discharge locations are new discharges to surface waters of the U.S., a NPDES permit governing the proposed discharges must be requested from the Regional Water Board.

Under the State and federal antidegradation policies, the Regional Water Board is required to make a finding regarding the satisfaction of the policies as they pertain to surface water discharges for which the Regional Water Board issues a NPDES permit. The State antidegradation policy, which incorporates the federal antidegradation policy, seeks to maintain the existing high quality of water to the maximum extent possible, and only allows a lowering of water quality if:

- Changes in water quality are consistent with maximum benefit to the people of the state, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards, and
- Waste discharge requirements for a proposed discharge will result in the best practicable treatment or control of the discharge necessary to assure:
    - No pollution or nuisance; and
    - Highest water quality consistent with maximum benefit to the people of the State.

The purpose of this report is to provide the Regional Water Board with the information needed to determine whether the proposed discharges are consistent with State and federal antidegradation policies. This antidegradation analysis includes assessments of water quality impacts on the receiving waters and downstream receiving waters estimated to result from the proposed project; an evaluation of how these estimated changes in water quality compare to applicable WQO and relevant water quality criteria; how estimated changes in water quality may affect existing or probable beneficial uses; and a finding of consistency with antidegradation policies.

1.4 Analysis Approach

The following antidegradation analysis is tailored to be consistent with federal and State antidegradation policies and the guidance provided in the Administrative Procedures Update (APU) 90-004. Pursuant to the APU guidelines, this analysis follows the provisions for a "simple analysis" and evaluates whether changes in water quality resulting from the proposed new discharges to the Lake and Shay Pond are "*consistent with maximum benefit to the people of the State, will not unreasonably affect uses and will not cause water quality to be less than water quality objectives and that the discharge provides protection of existing in-stream beneficial uses and water quality necessary to protect those uses.*"

In general, the data available for existing secondary effluent quality, projected disinfected advanced treated effluent quality, and ambient water quality were assessed to determine if the proposed future discharge would result in concentrations that exceed existing ambient water quality and/or relevant WQOs or criteria. For constituents anticipated to lead to a lowering of existing ambient water quality or an exceedance of relevant WQOs or criteria, further analysis was conducted.

Additionally, TDS, TIN, TN, TP, and chlorophyll-a were evaluated using a two dimensional (2D) hydrodynamic-water quality model (CE-QUAL-W2) developed for Big Bear Lake by Dr. Michael A. Anderson (Dr. Anderson), a limnologist who has in-depth knowledge of the Lake. The model evaluation was conducted to help select the preferred treatment alternative and assess the impacts of the proposed Lake discharge on constituents of interest. The water quality impacts with and without the proposed project were assessed for three different treatment alternatives as documented in *Big Bear Lake Analysis: Replenish Big Bear* (2021 Lake Model Analysis; **Appendix B**). Additional model updates were recently completed to incorporate additional discharge volume scenarios and seasonal variability and documented in *Replenish Big Bear: Modeling of Higher Flows and with Zero TP Load* (2022 Lake Model Update; **Appendix C**). The model results from both analyses are discussed in this report.

For constituents not able to be evaluated by the CE-QUAL-W2 model, their potential impacts with regard to a lowering of existing ambient water quality and/or the exceedance of relevant WQOs or criteria were assessed using a simple mass balance equation.

2 REGULATORY REQUIREMENTS

This section summarizes the federal and State antidegradation policies considered in this antidegradation analysis.

2.1 Applicable Laws and Policies

The federal Clean Water Act (CWA) requires states to adopt, with United States Environmental Protection Agency (U.S. EPA) approval, water quality standards applicable to all intrastate waters (33 U.S.C. § 1313). U.S. EPA regulations also require state water quality standard submittals to include an antidegradation policy to protect beneficial uses and prevent further degradation of high-quality waters (33 U.S.C. § 1313(d)(4)(B); 40 C.F.R. § 131.12). The State's antidegradation policy is embodied in State Water Resources Control Board (SWRCB) Resolution 68-16.

BBARWA's requested discharge of disinfected, advanced treated effluent to the Lake and to Shay Pond requires the application of WQOs contained in the Basin Plan, as well as criteria promulgated by the U.S. EPA for California waters. Both the federal and State antidegradation policies apply to the proposed surface water discharges of treated effluent to the Lake and to Shay Pond.

2.2 Federal Policies and Guidance

The federal antidegradation policy is designed to protect existing uses and the level of water quality necessary to protect existing uses and provide protection for higher quality and outstanding national water resources. The federal policy directs states to adopt a statewide policy that includes the following primary provisions (40 C.F.R. § 131.12).

1) *Existing in-stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*

2) *Where the quality of waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after the full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost effective and reasonable best management practices for nonpoint source control*

3) *Where high quality waters constitute an outstanding National resource, such as water of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.*

4) *In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with Section 316 of the Act.*

Based on guidance developed by the U.S. EPA, Region 9 (Guidance on Implementing the Antidegradation Provisions of 40 C.F.R. § 131.12 (U.S. EPA, 1987)) and guidance issued by SWRCB with regard to application of the Federal Antidegradation Policy (Memorandum from William R. Attwater to Regional Board Executive Officers Federal Antidegradation Policy (Attwater, Oct. 1987)), application of the federal antidegradation policy is triggered by a lowering, or potential lowering, of surface water quality. A proposed increase in the volume of an existing discharge or a new discharge to surface water is typically considered a trigger to the application of the federal antidegradation policy. Because the Project is proposing two new discharges to surface waters, the federal antidegradation policy applies.

Both the Lake and Shay Pond are not designated as outstanding natural resource waters and therefore, the receiving waters are not subject to that portion of the federal policy. The application to other portions of the policy is determined on a constituent-by-constituent basis. For a water body where water quality is not significantly better than needed to meet designated uses, either because it does not meet or it just meets applicable water quality objectives or criteria to protect beneficial uses, a new discharge cannot cause further impairment.

For waters with water quality that is better than necessary to support beneficial uses, the new discharge may not lower water quality unless such lowering is necessary to accommodate important economic or social development. In August 2005, the U.S. EPA issued a memorandum discussing antidegradation reviews and significance thresholds (Memorandum from Ephraim S. King, Director, Office of Science and Technology, U.S. EPA, Office of Water to Water Management Division Directors, Regions 1-10 (August 2005). As discussed in the memorandum, an intent of the policy "is to maintain and protect high quality waters and not to allow for any degradation beyond a *de minimis* level without having made a demonstration, with opportunity for public input, that such lowering is necessary and important." (Memorandum at p. 1). U.S. EPA has determined that the significance threshold of a 10% reduction in available assimilative capacity is "workable and protective in identifying those significant lowering of water quality that should receive a full… antidegradation review, including public participation." (U.S. EPA, 2005). This determination by U.S. EPA is helpful in determining the magnitude of water quality change that is determined to be of significant interest in the antidegradation analysis.

2.3 State Policies and Guidance

2.3.1 Resolution 68-16

The State issued its own antidegradation policy in 1968 to protect and maintain existing water quality in California. The State's Resolution 68-16 is interpreted to incorporate the federal antidegradation policy and satisfies the federal regulation requiring states to adopt their own antidegradation policies. Resolution 68-16 states, in part:

1) *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses of such water and will not result in water quality less than that prescribed in the policies.*

2) *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality water will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.*

2.3.2 1987 Policy Memorandum

In 1987, SWRCB issued a policy memorandum to the Regional Water Quality Control Boards (Regional Water Boards) to provide guidance on the application of the federal antidegradation policy for State and Regional Water Board actions, including establishing water quality objectives, issuing NPDES permits, and adopting waivers and exceptions to water quality objectives or control measures (Attwater, 1987). In conducting these actions, the Regional Water Boards must assure protection of existing beneficial uses, that significant lowering of water quality is necessary to accommodate important economic or social development, and that outstanding national resource waters be maintained and protected. The 2005 U.S. EPA guidance referenced in the Federal Policies and Guidance Section above is useful in determining whether changes in water quality that may result from a proposed action are significant.

2.3.3 Administrative Procedures Update (APU) 90-004

SWRCB issued guidance (APU 90-004) to all Regional Water Boards in 1990 regarding the implementation of State and federal antidegradation policies in NPDES permits. By using this guidance, Regional Water Boards are to determine if a proposed discharge is consistent with the intent and purpose of the State and federal antidegradation policies. APU 90-004 provides Regional Water Boards with guidance on the appropriate level of analysis that may be necessary, distinguishing between the need for a "simple" antidegradation analysis and a "complete" antidegradation analysis. If it is determined that a simple analysis is not appropriate based on the estimated level of impact of the new discharge, then a more rigorous analysis – a complete analysis – is appropriate. A primary focus of the complete analysis is the determination of whether and the degree to which water quality is lowered as compared to the socioeconomic costs of maintaining existing water quality. This determination greatly influences the level of analysis required and the level of scrutiny applied to the "balancing test" – that is, whether the discharge is necessary to accommodate important economic and social development, and whether a water quality change is consistent with the maximum benefit to the people of the State.

The antidegradation analysis addresses the following questions stated in SWRCB APU 90-004 to maintain consistency with State and federal antidegradation policies.

- Whether a reduction in water quality will be spatially localized or limited with respect to the water body; e.g., confined to the mixing zone;
- Whether the proposed discharge of treated effluent will produce minor effects which will not result in a significant reduction of water quality;

- Whether the proposed discharge of treated effluent has been approved in a General Plan, or similar growth and development policy document, and has been adequately subjected to the environmental analysis required in an environmental impact report (EIR) required under the California Environmental Quality Act (CEQA); and
- Whether the proposed Project is consistent with maximum benefit to the people of the State.

The Replenish Big Bear Program seeks to discharge highly treated effluent receiving RO treatment and UV disinfection to the Lake and to Shay Pond. BBARWA has reviewed the NPDES guidance issued by SWRCB in APU 90-004 and believes that the proposed project meets the criteria for a simple antidegradation analysis. The following sections provide the rationale for this determination and an associated level of analysis and information for use by the Regional Water Board in its consideration of state and federal antidegradation requirements in accordance with APU 90-004.

3 APPLICABLE WATER QUALITY STANDARDS

This section summarizes the applicable water quality standards for Stanfield Marsh and the Lake. Stanfield Marsh and the Lake are both waters of U.S., which have several designated beneficial uses. Water quality standard applicable to Shay Pond are discussed in **Section 6**. **Figure 5** shows the proposed discharge location in reference to Stanfield Marsh and Lake.

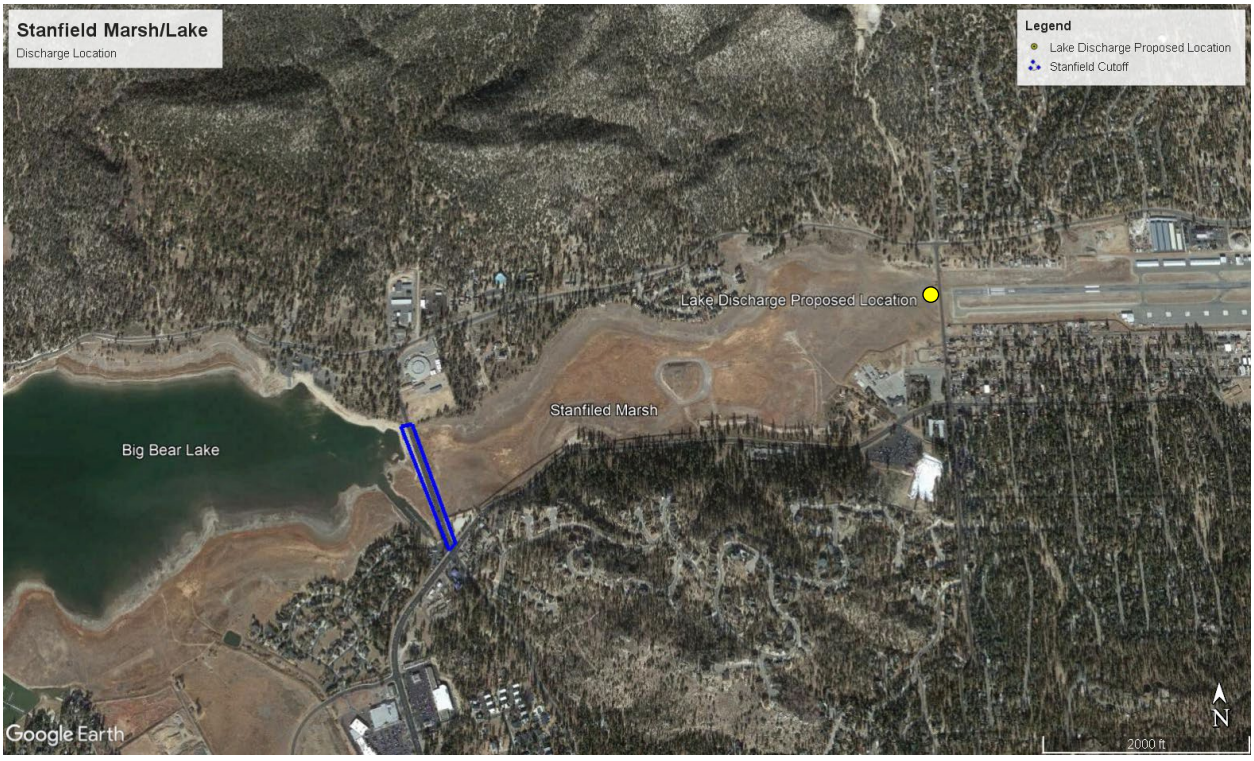


Figure 5. Overview of Lake Discharge Location in Reference to Stanfield Marsh/Lake

3.1 Beneficial Uses

The Basin Plan contains descriptions of the legal, technical, and programmatic bases for water quality regulation in the Santa Ana region. The Basin Plan describes the beneficial uses of major surface waters and their tributaries and the corresponding WQOs put into effect to protect these beneficial uses. **Table 1** shows the designated beneficial uses of the Lake and Stanfield Marsh.

Table 1. Beneficial Uses of Lake and Stanfield Marsh

Beneficial Uses	Big Bear Lake	Stanfield Marsh
AGR - Agricultural Supply	✓	
COLD - Cold Freshwater Habitat	✓	✓
GWR - Groundwater Recharge	✓	
MUN - Municipal and Domestic Supply	✓	✓
RARE - Rare, Threatened, or Endangered Species	✓	✓
REC1 - Water Contact Recreation	✓	✓
REC2 - Non-Contact Water Recreation	✓	✓
SPWN - Spawning, Reproduction, and/or Early Development	✓	
WARM - Warm Freshwater Habitat	✓	
WILD - Wildlife Habitat	✓	✓

3.2 Water Quality Objectives/Water Quality Criteria

To protect the designated beneficial uses, the Regional Water Board applies WQOs contained in the Basin Plan and criteria adopted in the California Toxics Rule (CTR) and the National Toxics Rule (NTR) to the receiving water (i.e., Lake) and downstream receiving waters (i.e., Bear Creek and subsequently Santa Ana River Reach 6). Per the Basin Plan, Stanfield Marsh does not have numeric WQOs. The Lake WQO objectives were used since these are more stringent and the Stanfield Marsh has been mostly dry since 2015.

The Regional Water Board uses these standards to determine if a proposed project will cause or contribute to impairments of the designated beneficial uses. **Table 2** presents the most conservative water quality criteria used to protect the most sensitive beneficial uses that apply to the Lake and downstream receiving waters. The constituents of interest included in **Table 2** are those:

- Included in the Basin Plan;
- Listed in the California 2018 Integrated Report for CWA Section 303(d) list;
- Identified by the Regional Water Board as pollutants of particular concern; and

- Constituents for which a Total Maximum Daily Load (TMDL) exists.

Table 2. Applicable WQOs and/or Criteria for the Lake Discharge

Constituent	Most Stringent WQO or Criterion	Unit	Reference for Most Stringent WQO or Criterion
Ammonia as N	0.46	mg/L	Basin Plan; used Basin Plan Table 4-4 (a)
Boron, Total	0.75	mg/L	Basin Plan(b)
Chloride	10	mg/L	Basin Plan
Fluoride	0.9	mg/L	Basin Plan (c)
Hardness, Total (as CaCO3)	125	mg/L	Basin Plan
Methylene Blue-Activated Substances	0.05	mg/L	Basin Plan (d)
Sodium	20	mg/L	Basin Plan
Sulfate	10	mg/L	Basin Plan
Total Dissolved Solids	**175**	**mg/L**	**Basin Plan**
Total Inorganic Nitrogen	**0.15**	**mg/L-N**	**Basin Plan**
Total Nitrogen	**1**	**mg/L-N**	**Regional Board Input (e)**
Chlorophyll-a	**14**	**µg/L**	**Nutrient TMDL**
Total Phosphorus	**35**	**µg/L-P**	**Nutrient TMDL**
Chlordane	0.00057	µg/L	Lake CWA 303(d) List; CTR
4,4'-DDT	0.00059	µg/L	Lake CWA 303(d) List; CTR
PCBs	0.00017	µg/L	Lake CWA 303(d) List; CTR
Cadmium, Dissolved	2.2	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Copper, Dissolved	8.9	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Lead, Dissolved	2.5	µg/L	Santa Ana River Reach 6 CWA 303(d) List (f)
Mercury	10	ng/L	Lake CWA 303(d) List; Statewide Mercury Provisions
Aluminum	200	µg/L	Title 22 MCL (g)
Specific Conductance	700/1,000	µmhos/cm	AGR Beneficial Use Goal (g)

Notes: Bolded constituents were identified as constituents of interest by the Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C** and discussed in **Section 5.3.1.**

a) The total ammonia was estimated using the equation presented in Table 4-4 of the Basin Plan. The Lake wide average pH is 8.28 based on the 2009-2019 TMDL data collected. The Lake water temperature ranges between 35 °F (1.8°C) and 70°F (20.7°C). The average Lake water temperature used is 53°F (11.8°C).
b) Boron concentrations shall not exceed 0.75 mg/L in inland surface waters of the region as a result of controllable water quality factors.

Constituent	Most Stringent WQO or Criterion	Unit	Reference for Most Stringent WQO or Criterion
c) Annual average concentration determined based on daily air temperature between 17.7-21.4 °C. d) MBAS concentrations shall not exceed 0.05mg/L in inland surface waters designated MUN as a result of controllable water quality factors. It is a secondary drinking water standard. e) Value is being considering by the Regional Water Board, as potential target. f) California Toxics Rule (CTR) hardness-based criterion continuous concentration (CCC) calculated using a median total hardness value of 99 mg/L calculated from measurements made in the Santa Ana River, Reach 6, upstream of Seven Oaks Dam, 2000-2006. g) Constituent added as it was detected in the secondary effluent and Lake.			

The Basin Plan contains both numeric and narrative objectives for inland surface waters, which were used to evaluate the Lake discharge. For this analysis, some of the narrative objectives were not evaluated for the following reasons:

- Algae, floatable, oil and grease, solids (suspended and settleable), sulfides, and surfactants were not evaluated because the Basin Plan does not specify numeric limits so these parameters could not be compared;
- Chlorine residual because chlorine will not be used for disinfection at the BBARWA WWTP;
- Chemical oxygen demand , dissolved oxygen, pathogen indicator bacteria, radioactivity material, color, temperature, and taste and odor because these are assumed to be non-conservative constituents (i.e., presumed to be destroyed, consumed, biodegraded or transformed through the treatment process or through Stanfield Marsh). The treatment process includes low- and high-pressure membrane systems capable of producing effluent that meets or exceeds the objectives for inland surface waters for these constituents, to be confirmed with site-specific piloting of the treatment process;
- Nitrate as N since the TN value being considered by the Regional Board is more stringent than the recommended 10 mg/L in Basin Plan; and
- pH because the treatment process maintains a neutral pH between 7 and 8 upstream of the reverse osmosis process, and then become slightly acidic downstream of reverse osmosis. Reverse osmosis chemical post-treatment will be employed to adjust the pH to a neutral level such that the effluent is within the numerical objectives for pH. In general, the pH of inland surface waters shall not be raised above 8.5 or depressed below 6.5 as a result of controllable water quality factors.

3.3 303 (d) Listings

Section 303(d) of the CWA requires states to develop lists of water bodies (or segments of water bodies) that will not attain water quality standards after implementation of minimum required levels of treatment by point-source dischargers (i.e., municipalities and industries). Section 303(d) requires states to develop a TMDL for each of the listed pollutant and water body combinations for which there is impairment. A TMDL is the amount of loading that the water body can receive and still meet water quality standards for that pollutant. The TMDL must include an allocation of allowable loadings for both point and non-point sources, with consideration of background loadings and a margin of safety. NPDES permit limitations for listed pollutants must be consistent with allocations identified in adopted TMDLs.

The U.S. EPA approved the California's 2018 Integrated Report for CWA Sections 305 (b) and 303(d) on June 9, 2021 (SWRCB, 2021). This list represents the most current listing of impaired water bodies in the project area and downstream areas. The Lake is included in the California's 2018 Section 303(d) list of impaired water bodies for mercury, nutrients, noxious aquatic plants, dichlorodiphenyltrichloroethane (DDT), chlordane, and polychlorinated biphenyls (PCBs). The Santa Ana River (SAR) Reach 6, which is located about 17 miles downstream from the Lake, is also listed for cadmium, lead, and copper. The potential water quality impacts of the proposed Lake discharge are discussed in **Section 5.**

Table 3 lists the constituents identified in the 2018 303(d) list for the Lake and SAR Reach 6, and their potential sources and proposed TMDL completion dates.

Table 3. 2018 CWA Section 303(d) Listed Constituents

Pollutant/Stressor	Potential Sources	Proposed TMDL Adoption
Lake		
Mercury	Source Unknown	2007
Nutrients	Construction/Land Development	Completed
Noxious aquatic plants	Source Unknown	Completed
DDT	Source Unknown	2027
Chlordane	Source Unknown	2027
PCBs	Source Unknown	2019
Santa Ana River Reach 6		
Cadmium	Source Unknown	2021
Lead	Source Unknown	2021
Copper	Source Unknown	2021

3.4 Lake Nutrient TMDL

The Big Bear Lake Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions (Resolution No. R8-2006-0023) was adopted by the Regional Water Board on April 21, 2006 and became effective on September 25, 2007. The Nutrient TMDL includes targets in the Lake for TP, macrophyte coverage, nuisance aquatic vascular plant species, and chlorophyll-a. **Table 4** shows the Nutrient TMDL targets. TP is the only constituent that would be directly discharged and controlled by BBARWA.

Table 4. Nutrient TMDL Numeric Targets for All Hydrologic Conditions

Indicator	Target Value [a][b]
TP Concentration [c]	Annual average no greater than 35 µg/L
Macrophyte Coverage[d]	30-40% on a total lake area basis
Percentage of Nuisance Aquatic Vascular Plant Species[d][e]	95% eradication on a total area basis of Eurasian Water milfoil and any other invasive aquatic plant species
Chlorophyll-a Concentration[e]	Growing season average no greater than 14 µg/L

Source: Basin Plan

Notes:

a) Targets to be attained no later than 2015 (dry hydrological conditions), 2020 (all other conditions)

b) Compliance date for wet and/or average hydrological conditions may change in response to approved TMDLs for wet/average hydrological conditions.

c) Annual average determined by the following methodology: the nutrient data from both the photic composite and discrete bottom samples are averaged by station number and month; a calendar year average is obtained for each sampling location by averaging the average of each month; and finally, the separate annual averages for each location are averaged to determine the lake-wide average.

d) Calculated as a 5-yr running average based on measurements taken at peak macrophyte growth.

e) Growing season is the period from May 1 through October 31 of each year. The chlorophyll-a data from the photic samples are averaged by station number and month; a growing season average is obtained for each sampling location by averaging the average of each month; and finally, the separate growing season averages for each location are averaged to determine the lake-wide average.

An analysis to demonstrate that the proposed Lake discharge is consistent with the Nutrient TMDL assumptions is provided in Attachment B of the ROWD package**.** This technical memorandum (TM) also discusses a TP offset framework to address the lack of wasteload allocation (WLA) for the proposed Lake discharge by proposing a TP net zero load. The TM also discusses the effects of the Lake discharge and TP Offset Program on chlorophyll-a, the response target, as documented in the Lake Analysis (**Appendix B**) and new model updates (**Appendix C**).

3.5 Statewide Mercury Provisions

On May 2, 2017, the California State Water Resources Control Board (State Water Board) adopted Resolution 2017-0027, which approved "*Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Tribal and Subsistence Fishing Beneficial Uses and Mercury Provisions.*" Resolution 2017-0027 established mercury limits to protect the beneficial uses associated with the consumption of fish by both people and wildlife. For lakes and reservoirs, the mercury water column concentration is to be calculated by the permitting authority (i.e., Regional Water Board). The mercury limit for the Lake has not yet been established. However, the State Water Board is also developing a Statewide Mercury Control Program for Reservoirs that are impaired for mercury. The draft "*2017 Amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Mercury TMDL and Implementation Program for Reservoirs,*" proposes to establish WLAs of 10 ng/L for major WWTPs (permitted flow >1 MGD), and a WLA of 20 ng/L for facilities with no "upstream" dischargers. The Statewide Mercury Provisions identified the Lake as one of the 131 impacted reservoirs. For this analysis, the 10 ng/L WLA was considered for evaluation with respect to potential water quality impacts due to the proposed Lake discharge.

3.6 Title 22 Recycled Water Criteria

Per conversations with DDW, the Lake may be designated as a non-restricted recycled water impoundment and the subsequent use of Lake water for snowmaking, landscape irrigation, construction uses, and groundwater recharge would be subject to recycled water regulations. Additional coordination and studies are being conducted to regulate these uses. It is anticipated that a separate WDR permit will be obtained to regulate the Sand Canyon groundwater recharge project. The non-potable recycled water uses for landscape irrigation, construction uses, snowmaking, and nonrestricted impoundment are anticipated to be regulated under the Statewide Water Reclamation Requirements for Recycled Water Use (Oder WQ 2016-0068-DDW).

4 ENVIRONMENTAL SETTING

This section provides additional context to understand the enviromental setting for the Lake discharge.

4.1 Stanfield Marsh

As part of Replenish Big Bear, the proposed project will discharge to the east end of Stanfield Marsh, then flow into the Lake, as shown in **Figure 5**.

Stanfield Marsh in 2016

Stanfield Marsh is a scenic 145-acre nature park that includes a gazebo, walking paths, and two boardwalks that extend out into the marsh, so visitors can observe the wildlife. Stanfield Marsh is home to rare and diverse species of birds, fish, amphibians, and mammals. Rainfall and snowmelt are the only sources of water for Stanfield Marsh, so the water level varies from season to season. During wet periods, Stanfield Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, the boardwalks extend over dry soil, and presence of wildlife becomes scarce. In the last 15 years, Stanfield Marsh has been less than half full nearly 40 percent of the time.

4.2 Big Bear Lake

Stanfield Marsh is hydrologically connected to the Lake through a set of culverts under Stanfield Cutoff. The Lake is located about 6,743 feet (ft; 2,055 meters) above mean sea level (MSL) in the San Bernardino Mountains in San Bernardino County. Together, Stanfield Marsh and the Lake have a surface area of approximately 3,000 acres, a storage capacity of 73,320 AF, and an average depth of 32 ft. The Lake's sole source of water is currently snowmelt and stormwater runoff, which are highly variable. The Lake has several sources of water loss including evaporation, water extraction for snow making, dam releases for flood control, fishery protection, and water rights discharges.

The Lake was formed following construction of the Bear Valley Dam in 1883-1884 to serve as an irrigation supply for the citrus industry in the downstream Redlands-San Bernardino communities. BBMWD was formed in 1964 to manage and help stabilize the water level in the Lake. Historically, the Lake was operated as a storage reservoir by the Bear Valley Mutual Water Company (Mutual). However, due to the drastic fluctuations in Lake levels, legal negotiations arising from disagreement between Mutual, BBMWD, and the community of Big Bear Valley regarding water rights and management of the Lake, a 1977 Judgment was established. Under the terms of this court judgment, Mutual retains a storage right and ownership of all water inflow into the Lake. BBMWD is required to provide Mutual with up to 65,000 AF of water from the Lake in a 10-year rolling period.

In 1996, an In-Lieu Agreement was executed that allows BBMWD to maintain higher Lake levels by delivering water to Mutual from an alternate source of water. This alternate source of water, referred to as In-Lieu Water, comes mainly from the State Water Project (SWP) through the San Bernardino Valley Municipal Water District (SBVMWD), a State Water Contractor. Under the In-Lieu Agreement, when the Lake level falls more than 6 foot below full, and during some months when the Lake is between 4 and 6 feet below full, SBVMWD delivers SWP water to meet Mutual's needs instead of BBMWD releasing water from the Lake. BBMWD pays SBVMWD an annual fee that is adjusted each year based on property tax values.

Due to variable precipitation and extended drought, the Lake has experienced drastic changes in water levels, which impact its water quality. In December 2018, the Lake reached a historic low of 18'1" below full, which is less than 40% full by volume. **Figure 6** shows the fluctuation in Lake levels between 2000 and 2021.

The Lake is an important resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland southern California region. The beneficial uses of the Lake and Marsh are presented in **Table 1**.

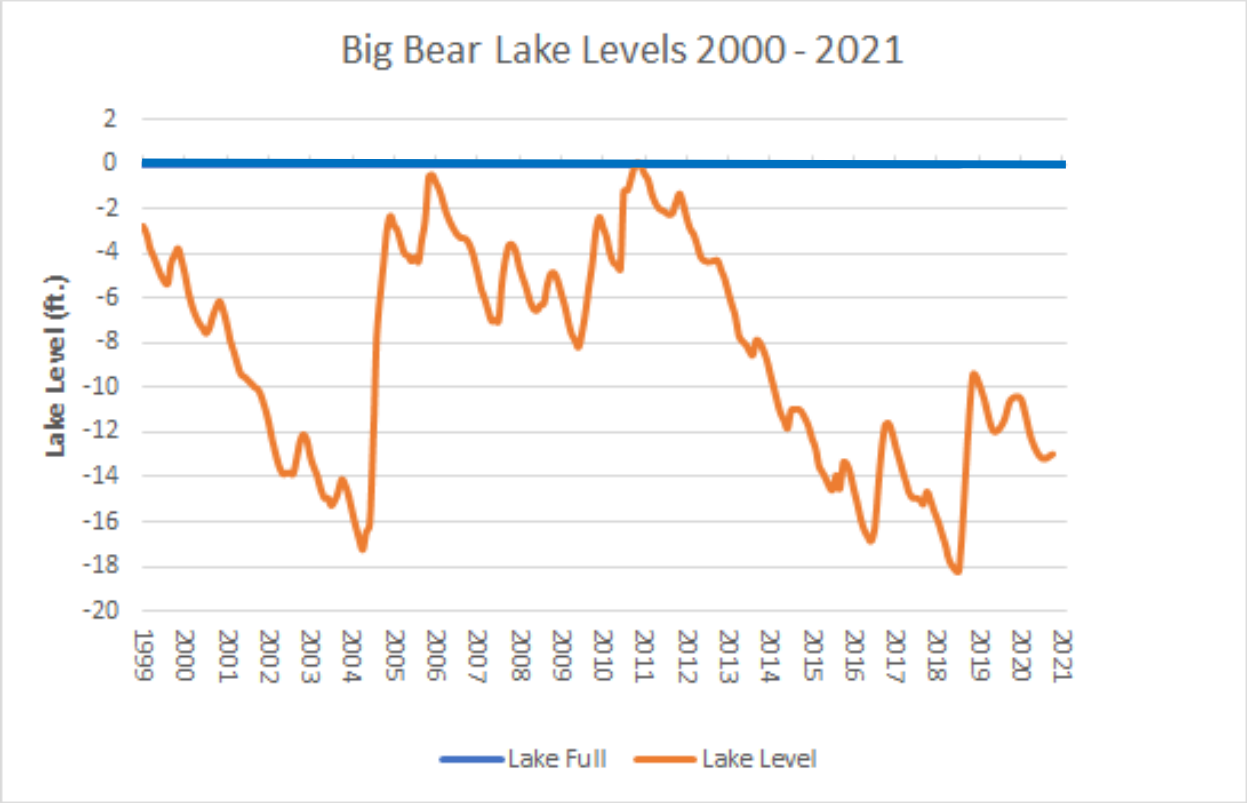


Figure 6. Big Bear Lake Levels: 2000 – 2021

4.3 Santa Ana Watershed

The Lake's dam releases are discharged to Bear Creek, a 17-mile stream, which enters the SAR at Reach 6. The Santa Ana River Watershed comprises portions of San Bernardino, Riverside, Los Angeles, and Orange Counties, covers an area of 2,840 square miles, and is home to over 6 million residents. The Santa Ana River is the major stream draining the watershed—about 100 miles in length from its headwaters near Big Bear to its discharge location in Huntington Beach. **Figure 7** shows the Santa Ana River Watershed, along with the Santa Ana River and its major tributaries.

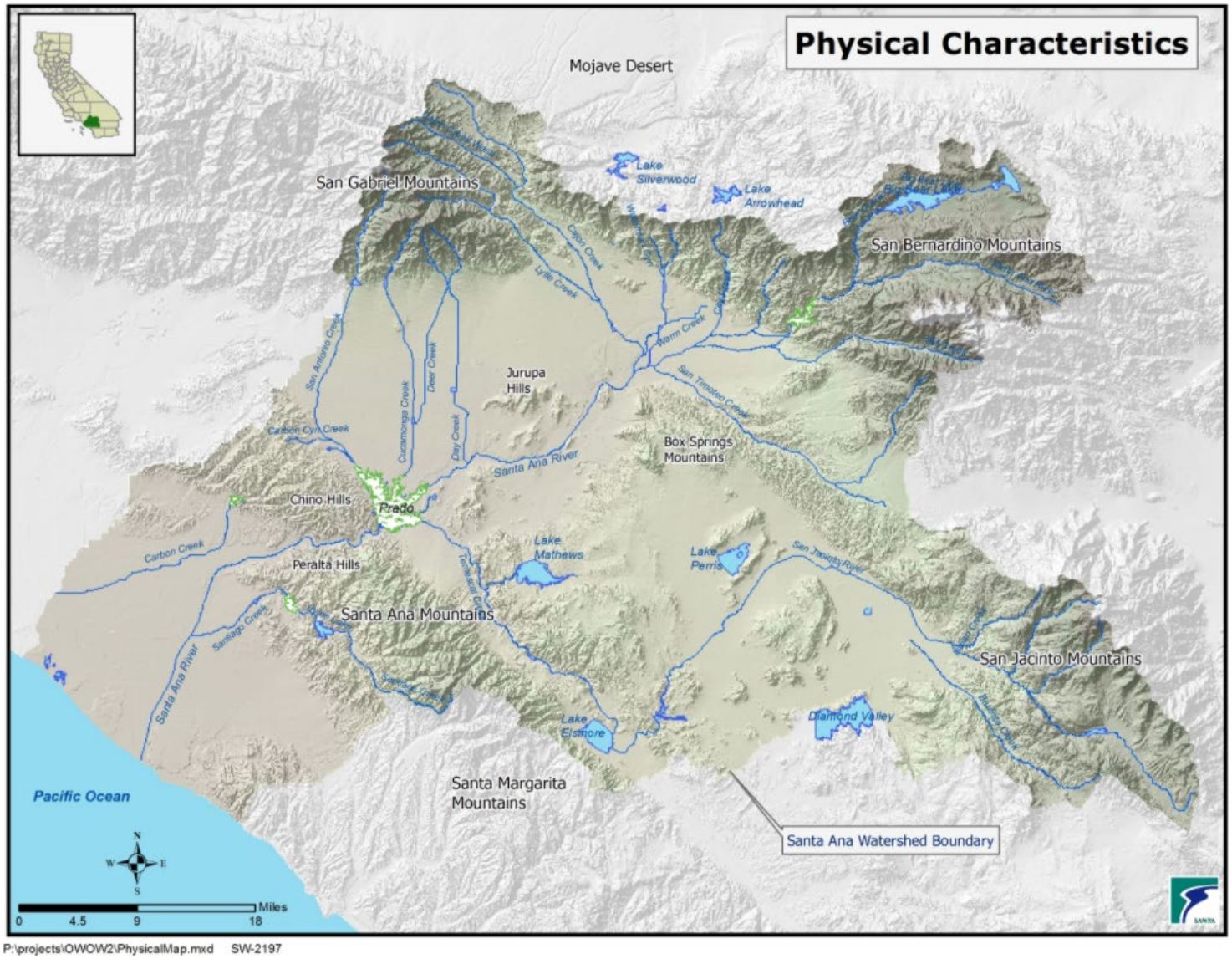


Figure 7. Santa Ana Watershed Map

5 ASSESSMENT OF WATER QUALITY IMPACTS TO BIG BEAR LAKE

This section summarizes the water quality assessment methodology and results for the proposed Lake discharge and potential associated impacts in downstream receiving waters.

5.1 Lake Discharge Project Description

As discussed in **Section 1**, one of the project components of the Replenish Big Bear Program is to discharge to the Lake disinfected, advanced treated effluent that has undergone RO and UV treatment. The Lake discharge is intended to help stabilize Lake levels especially during extended drought periods, assist to maintain the beneficial uses of the Lake, and reduce the in-lieu SWP water demands if higher lake levels allow for additional dam releases. The Lake has experienced record low levels over the last 15 years, forcing BBMWD to close one of their two boat ramps, which reduces the recreational benefit of the Lake.

The projected effluent quality of the proposed discharge is presented in **Table 5** for the constituents of interest in this study (constituents of interest are those listed in **Table 2**). Site-specific pilot testing of the proposed treatment process technologies will be completed in 2023 to establish design criteria and refine final effluent water quality estimates. The values presented in **Table 5** are based on mass balance calculations, vendor provided treatment performance estimates, and industry standard removal rates for RO treatment technology. The secondary effluent data were used as a basis for influent water quality to the advanced treatment train to estimate the projected effluent water quality for the proposed discharge.

Table 5. Projected Effluent Quality of Proposed Discharge and Existing Secondary Effluent Quality

Constituent	BBARWA Secondary Effluent Average Concentrations [a]	Projected Average Effluent Quality of Proposed Discharge	Unit
Ammonia as N	3.15	0.05	mg/L-N
Boron, Total	0.265	0.11	mg/L
Chloride	58	0.60	mg/L
Fluoride	0.41	<0.026[b]	mg/L
Hardness, Total (as CaCO3)	265	3.2	mg/L
Methylene Blue-Activated Substances	0.14	0.0014	mg/L
Sodium	NS	1.9	mg/L
Sulfate	41	0.20	mg/L
Total Dissolved Solids [c]	450	50	mg/L
Total Inorganic Nitrogen [c]	4.40	0.1	mg/L-N
Total Nitrogen [c]	7.80	0.6	mg/L-N
Chlorophyll-a [d]	N/A	N/A	µg/L
Total Phosphorus [c]	2.0	0.03	mg/L-P
Chlordane	<0.17 [e]	<0.17 [b][e]	µg/L
4,4'-DDT	<0.0052 [e]	<0.0052[b] [e]	µg/L
PCBs	<2.5 [e]	<2.5 [b] [e]	µg/L
Cadmium, Total	<0.11	<0.11[b]	µg/L
Copper, Total	14 [f]	0.07	µg/L
Lead, Total	1.3	0.01	µg/L
Mercury, Total	0.76 [g]	<0.5 [b]	ng/L
Aluminum, Total	180	1.3	µg/L
Specific Conductance	755 [e]	18	µmhos/cm

Notes: NS – Not sampled; N/A – Not applicable.

a) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages.
b) The projected effluent quality is anticipated to be below the detection limit. The estimated projected concentration is shows as "<MDL".
c) Values were estimated as part of Draft Treatment Alternatives Analysis TM using BBARWA WWTP average effluent concentrations from weekly and monthly analyses for the 2017 - 2019 calendar years (WSC, 2020).
d) Chlorophyll-a is not a constituent that will be discharged by the BBARWA WWTP.
e) Based on one data point.
f) Values detected below the RL; reported concentration is estimated. Reported as "J-Flag."

Constituent	BBARWA Secondary Effluent Average Concentrations [a]	Projected Average Effluent Quality of Proposed Discharge	Unit
g) On June 18, 2020, BBARWA collected a sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. This result is well below the 10 ng/L target described in the Statewide Mercury Control Program for Reservoirs.			

5.2 Selection of Water Quality Constituents

5.2.1 Selection Criteria

As presented in **Section 3**, water quality constituents assessed in this antidegradation analysis were identified based on one or more of the following conditions being satisfied:

1) Constituent has a WQO or criterion applicable to the Lake and/or downstream receiving waters;
2) Constituent for which an adopted TMDL exists;
3) Constituent identified as a pollutant/stressor on the 2018 CWA Section 303(d) list for the Lake or downstream of the proposed discharge; and
4) Constituent is a known water quality concern of the Regional Water Board.

Based on the conditions listed above, 22 constituents of interest were initially identified for evaluation and are presented in **Table 2.** The data available for the secondary effluent, proposed discharge effluent quality, and ambient water quality were assessed to determine the type of analysis needed for a given constituent. The following approach was used:

- No further analysis was needed for constituents reported as non-detect (ND) in the secondary effluent and the Lake. It is anticipated that RO treatment will achieve additional removal of these constituents and thus, will further reduce any water quality impacts potentially associated with these constituents.
- For constituents with detected concentrations in the secondary effluent, the proposed discharge water quality was compared to the ambient water quality and most stringent WQO or criterion.
- For the proposed discharge water quality constituents exceeding the ambient water quality or most stringent WQO or criterion, a mass balance analysis was completed.

- For constituents of greater interest to the Regional Water Board, such as TIN, TN, TP, and chlorophyll-a, the 2D hydrodynamic-water quality model (CE-QUAL-W2) developed by Dr. Anderson was used to evaluate the potential impacts of the proposed Lake discharge. A summary of the Lake Analysis (**Appendix B**) report along with the model updates recently completed to incorporate additional discharge volume scenarios and seasonal variability are presented in this report and in **Appendix C**.

5.2.2 Data Sources

Table 6 shows the water quality data used for the analysis. Per BBARWA's current WDR Permit, BBARWA is required to monitor for biological oxygen demand (BOD), total suspended solids (TSS), pH, dissolved oxygen (DO), TDS, sulfate, chloride, fluoride, nitrate as N, TN, E.coli, and volatile organic compounds (VOCs) in the secondary effluent on a monthly or annual basis. To support the preparation of the proposed project's Report of Waste Discharge (ROWD) and this analysis, water samples of the secondary effluent and Lake were collected and analyzed for priority pollutants. BBARWA collected its samples on November 18, 2021, and BBMWD collected the Lake samples on December 2, 2021. On June 18, 2020, BBARWA also collected a secondary effluent sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. **Appendix D** contains the BBARWA, Lake, and Shay Pond (discussed in **Section 6**) water quality data.

As part of the Nutrient TMDL, a variety of constituents, including ammonia as N, total hardness, nitrate as N, nitrite as N, total kjeldahl nitrogen (TKN)[2], TP, and chlorophyll-a are collected at the four TMDL monitoring locations (Station 1 Dam, Station 2 Gilner Point, Station 6 Mid Lake Middle, and Station 9 Stanfield Middle. (See **Figure 2** in **Appendix B**). In the Lake Analysis, TIN[3], TN[4], TP, and chlorophyll-a were evaluated using the Nutrient TMDL data from 2009 through 2019. The average results calculated in the Lake Analysis are presented in **Table 6**.

Ammonia and hardness were not modeled in the Lake Analysis because these were not identified as constituents of interest at the time of the model development. For this analysis, the lake-wide annual average was estimated by averaging the four station annual averages consistent with the Nutrient TMDL approach, which consist of averaging the photic and bottom samples for each sampling date. From 2009 through 2019, about 1,280 and 1,180 data points were collected for ammonia and hardness, respectively, at these locations. The calculations are presented in **Appendix E**.

[2] TKN is the sum of organic nitrogen and ammonia.
[3] TIN is the sum of ammonia, nitrate, and nitrite.
[4] TN is defined as the sum of TKN, nitrite, and nitrate.

BBMWD also has manually recorded specific conductance data since 2001 measured at the first 10 to 15 feet below Lake surface. The specific conductance data was used to evaluate TDS in the Lake Analysis as specific conductance can be converted to TDS using a conversion factor that is dependent on the type of minerals and salts dissolved in the Lake. In August 2019, BBMWD collected TDS samples at the four TMDL monitoring locations to compare TDS and specific conductance results and calculated a conversion factor of 1 mg/L of TDS = 0.642 µmhos/cm, which was used in the Lake Analysis model. The Lake TDS average from this report was converted to µmhos/cm using this convention factor.

Table 6. Summary Statistics for Constituents Evaluated in Secondary Effluent and Big Bear Lake

Constituent	Unit	BBARWA Secondary Effluent [a]				Big Bear Lake[a]			
		No. of Samples	% Non-Detected	Avg.[b]	Max.	No. of Samples	% Non-Detected	Avg.[b]	Max.
Ammonia as N	mg/L	24	29%	3.15	22	1,281	33%	0.063 [c]	0.094
Boron, Total	mg/L	2	0%	0.265	0.270	1	0%	0.054 [d]	0.054 [d]
Chloride	mg/L	25	0%	58	63	1	0%	26	26
Fluoride	mg/L	2	0%	0.41	0.52	1	0%	0.41	0.41
Hardness, Total (as CaCO3)	mg/L	2	0%	265	270	1,176	0%	157 [c]	183
MBAS	mg/L	2	50%	0.14	0.14	1	0%	0.058 [d]	0.058 [d]
Sodium	mg/L	0	NS	NS	NS	1	0%	33	33
Sulfate	mg/L	20	0%	41	44	1	0%	18	18
Total Dissolved Solids	mg/L			450 [e]				251 [f]	
Total Inorganic Nitrogen	mg/L			4.40 [e]				0.049 [f]	
Total Nitrogen	mg/L			7.80 [e]				0.948 [f]	
Chlorophyll-a	µg/L			N/A				9.3 [f]	
Total Phosphorus	mg/L			2.00 [d]				0.037 [f]	
Chlordane	µg/L	1	100%	<0.17	<0.17	1	100%	<0.034	<0.034
4,4'-DDT	µg/L	1	100%	<0.0052	<0.0052	1	100%	<0.001	<0.001
PCBs (Aroclors) [g]	µg/L	1	100%	<2.5	<2.5	1	100%	<0.5	<0.5
Cadmium, Total	µg/L	8	100%	<0.11	<0.11	1	100%	<0.11	<0.11
Copper, Total	µg/L	8	88%	14 [d]	14 [d]	1	100%	<6.5	<6.5
Lead, Total	µg/L	8	75%	1.3	1.8 [d]	1	100%	1.8 [d]	1.8 [d]
Mercury, Total	ng/L	8	100%	0.76 [h]	0.76 [h]	2	50%	270	270
Aluminum, Total	µg/L	2	0	180	250	1	0%	58	58
Specific Conductance	µmhos/cm	1	0	755	755			391 [i]	

Notes: Bolded constituents were identified as constituents of interest by the Santa Ana Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C**).

NS – Not sampled; N/A – Not applicable.

a) For constituents with only ND data, the method of detection limit (MDL) is shown as "<MDL."
b) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages. For samples with only one data point, the reported value or "<MDL" is presented.
c) The averages and maximums are for the Lake-wide results and were calculated using Nutrient TMDL 2009-2019 data. See **Appendix E** – for estimates. ND were used and assumed to be "MDL/2".
d) Values detected below the RL; reported concentration is estimated. Reported as "J-Flag."
e) Values were estimated as part of Draft Treatment Alternatives Analysis TM using BBARWA WWTP average effluent concentrations from weekly and monthly analyses for the 2017 - 2019 calendar years (WSC, 2020).
f) TDS average was obtained from the Lake Analysis Table 19, and nutrients and chlorophyll-a from the Lake Analysis Table 22 (**Appendix B**).
g) PCBs are a class of chemicals which include Aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016. The aquatic life criteria apply to the sum of the set of seven Aroclors. All results were non-detect.
h) On June 18, 2020, BBARWA collected a sample to measure mercury using EPA Method 1631E, which has a reporting limit of 0.5 ng/L. This result is well below the 10 ng/L target described in the Statewide Mercury Control Program for Reservoirs.
i) The Lake TDS average from the Lake Analysis report was converted to µmhos/cm using a 1 mg/L of TDS = 0.642 µmhos/cm conversion factor.

5.2.3 Selection of Constituents

The simple qualitative analysis described in **Section 5.2.1** was applied to the 22 constituents of interest to determine if additional analysis was required. **Table 7** shows the results of the comparison of the secondary effluent quality, projected effluent quality, ambient water quality, and the most stringent WQO or criterion.

Overall, no constituents exceeded their most stringent WQO or criterion and only boron and TIN exceeded existing, ambient water quality concentrations. For the remainder of the constituents—where the projected effluent quality is below the ambient water quality and the most stringent WQO or criterion—no additional analysis was conducted.

The Lake Analysis evaluated TDS, TIN, TN, TP, and chlorophyll-a, so potential TIN water quality impacts were addressed by the Lake Analysis. For boron, a simple mass balance spreadsheet model was used to evaluate the potential impacts of boron on the Lake with the proposed project due to the limited data available.

With respect to the three trace metals – cadmium, copper, and lead – included in the 2018 303(d) list for Reach 6 of the SAR as impairing the water body segment, projected average concentrations of the three trace metals in the proposed discharge are significantly below the hardness-based CTR chronic criterion calculated for each metal using a median total hardness value of 99 mg/L calculated for Reach 6 (see **Table 2**). Cadmium, copper, and lead concentrations contained in the disinfected, advanced treated effluent proposed for discharge to the Lake are not anticipated to lower water quality in Reach 6 for these trace metals, nor are they anticipated to affect future load or WLA included in an adopted TMDL.

Table 7. Comparison of Most Stringent Water Quality Objective or Criterion to Existing Ambient Lake Water Quality and Projected Effluent Quality of Proposed Discharge

Constituent	Unit	Most Stringent WQO or Criterion	Average Lake Concentration [a] [b]	Projected Average Effluent Quality of Proposed Discharge [c]	Comparison of Projected Effluent Quality to Most Stringent WQO (see table Notes)
Ammonia as N	mg/L	0.46	0.063 [d]	0.05	1
Boron, Total	mg/L	0.75	0.054 [e]	0.11	2
Chloride	mg/L	10	26 [e]	0.60	1
Fluoride	mg/L	0.9	0.41 [e]	<0.026	1
Hardness, Total (as CaCO3)	mg/L	125	157 [d]	3.2	1
MBAS	mg/L	0.05	0.058 [e]	0.0014	1
Sodium	mg/L	20	33 [e]	1.9	1
Sulfate	mg/L	10	18 €	0.20	1
Total Dissolved Solids	mg/L	175	251	50	3
Total Inorganic Nitrogen	mg/L	0.15	0.049	0.1	2,3
Total Nitrogen	mg/L	1	0.948	0.6	3
Chlorophyll-a	µg/L	14	9.3	N/A	3
Total Phosphorus	mg/L	0.035	0.037	0.03	3
Chlordane	µg/L	0.00057	<0.034 [e]	<0.17	4
4,4'-DDT	µg/L	0.00059	<0.001 [e]	<0.0052	4
PCBs	µg/L	0.00017	<0.5 [e]	<2.5	4
Cadmium, Total	µg/L	2.2	<0.11 [e]	<0.11	4
Copper, Total	µg/L	8.9	<6.5 [e]	0.07	1
Lead, Total	µg/L	2.5	1.8 [e]	0.01	1
Mercury, Total	ng/L	10	270	<0.5	1
Aluminum, Total	µg/L	200	58 [e]	1.3	1

Constituent	Unit	Most Stringent WQO or Criterion	Average Lake Concentration [a] [b]	Projected Average Effluent Quality of Proposed Discharge [c]	Comparison of Projected Effluent Quality to Most Stringent WQO (see table Notes)
Specific Conductance	µmhos/cm	700/1,000	391	18	1

Notes: Bolded constituents were identified as constituents of interest by the Regional Water Board and were modeled in the Lake Analysis (**Appendix B** & **C**).
N/A – Not applicable.

a) For constituents with only ND data, the method of detection limit (MDL) is shown as "<MDL."
b) The average was estimated using detected values only, unless stated otherwise. NDs were not included due to the limited number of samples. This approach may result in higher averages. For samples with only one data point, the reported value or "<MDL" is presented.
c) If the projected effluent quality is anticipated to be below the detection limit. The estimated projected concentration is shows as "<MDL".
d) The averages and maximums are for the Lake-wide results and were calculated using Nutrient TMDL 2009-2019 data. See **Appendix E** – for estimates. ND were used and assumed to be "MDL/2".
e) Average is based on one data point.

Blue – Projected effluent quality is below the ambient and most stringent WQO or criterion
Red – Projected effluent quality is above the ambient or most stringent WQO or criterion

1) Projected effluent quality is below the ambient and most stringent WQO or criterion. No degradation anticipated.
2) Projected effluent quality is above the ambient, but below the most stringent WQO or criterion. Further analysis needed to determine impacts on water quality.
3) Impacts evaluated in the Lake Analysis (**Appendix B & C**).
4) Secondary effluent and ambient water quality were ND. No further analysis conducted. It is anticipated that RO will achieve additional removal, resulting in even fewer impacts.

5.3 Water Quality Impacts Assessment

5.3.1 Lake Analysis Model Analysis Results

The Lake Analysis (**Appendix B**) was completed to evaluate the short- and long-term impacts of the Lake discharge on lake level, lake area, TDS, TIN, TN, TP, and chlorophyll-a under three different treatment alternatives:

- Alternative 1: TIN & TP Removal
- Alternative 2: 70% RO (in addition to TIN & TP Removal)
- Alternative 3: 100% RO (in addition to TIN & TP Removal)

These treatment alternatives were evaluated under three hydrologic conditions (i.e., extended drought (5th percentile), median (50th percentile), and prolonged above average rainfall (95th percentile)). The model predicted that Alternative 3 would result in a slight improvement in concentrations of TDS, TIN, TN, TP, and chlorophyll-a as compared to modeled baseline conditions. Informed by the results of this study, the 100% RO treatment alternative was selected as the preferred project and the projected effluent quality of Alternative 3 is the focus of this antidegradation analysis.

Additional refinements to the Lake Analysis were completed in 2022, as documented in **Appendix C**, to investigate the impacts of a higher discharge volume, account for WWTP discharge seasonal variability, and assess the impacts of a TP Offset Program as discussed in **Section 3.4** and Attachment B of the ROWD package. The 50th percentile hydrologic scenario for 2009-2050 was used in the updated analysis (i.e., the median hydrologic condition), as it includes a wide array of runoff conditions. All other hydrologic, meteorological, biological, chemical, and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021).

The Lake Analysis report assumed a steady annual flow of 1,920 AFY of disinfected, advanced treated effluent discharged to the Lake that excludes the 80 AFY that could be discharged to Shay Pond. However, the proposed Lake discharge may be higher than previously modeled as it did not account for a 99% total recovery rate of BBARWA effluent and potentially a lower discharge rate to Shay Pond. **Table 8** presents the Lake discharge flow projections that were considered in the Lake Analysis model and in the 2022 update.

Table 8. Initial and Updated Lake Discharge Flow Rate Projections

Lake Analysis Modeled Scenario	RBB Inflow (AFY)	Daily RBB Inflow (MGD)
Baseline (No Project)	0	0
Alternative 3 [(a)]	1,920	1.71
High Flow (99% recovery) [(b)]	2,210	1.57 – 2.18
Mid Flow (90% recovery) [(b)]	2,009	1.42 – 1.98

Notes:

a) Alternative 3 was assessed in the 2021 Lake Analysis and assumed that of the total Replenish Big Bear effluent contribution considered in the Lake Analysis (i.e., 2,000 AFY), 80 AFY would be delivered to Shay Pond. Therefore, only 1,920 AFY would be discharged to the Lake.

b) In the 2022 Lake Analysis update it was assumed that no discharge to Shay Pond would occur and all disinfected, advanced treated effluent would be discharged to the Lake under two different total recovery rates scenarios.

The Lake discharge is expected to vary seasonally, as shown in **Figure 8**, and thus, differs from the earlier "Alternative 3" scenario that assumed a uniform flow rate of 1.71 MGD throughout the year. Inflows to the WWTP are lower in the summer months due to reduced inflow and fewer visitors relative to the winter season.

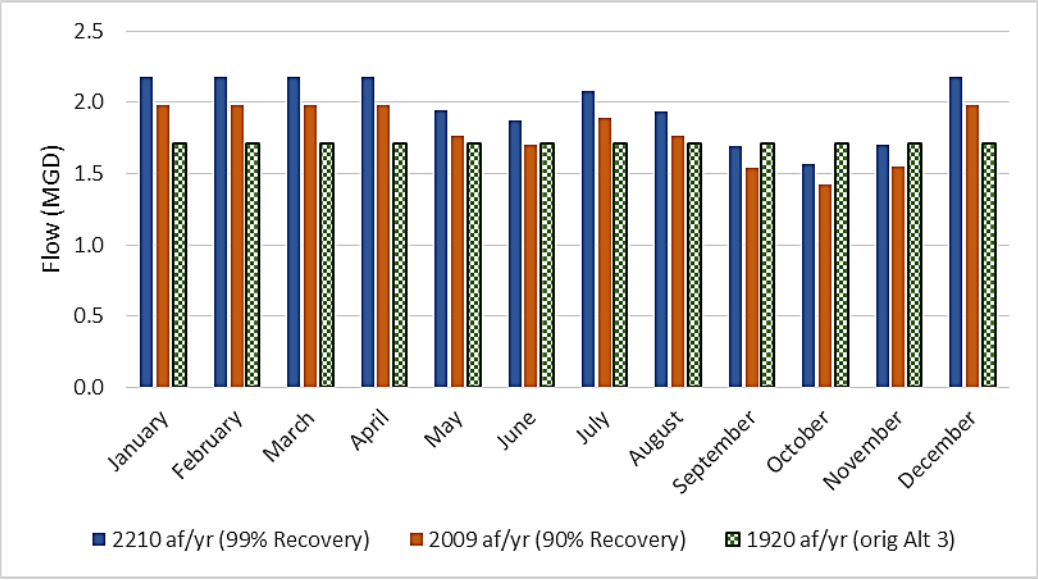


Figure 8. Projected 2040 Monthly BBARWA Discharges to the Lake under Three Inflow Scenarios

Since the Replenish Big Bear Program proposed Lake discharge has not been assigned a WLA for TP in the nutrient TMDL, a TP Offset Program is being proposed to attain a net zero TP contribution to be consistent with the Nutrient TMDL assumptions. A detailed analysis supporting the TP Offset Program is discussed in Attachment B of the ROWD package. In the Lake Analysis model update, the TP offset was modeled as equivalent to a 0 (zero) influent concentration. This approach is a simplification that may hold when considering a whole-lake nutrient budget. However, the Lake dynamics are complex, so projections may not have accounted for these complexities.

5.3.1.1 Lake Discharge Impacts Water Quality

The predicted long-term average water quality in the Lake under the updated modeled operational scenarios (increased and time-varying flows, with and without TP offset) are presented in **Table 9**. For comparison, the previously predicted baseline condition (no project) and Alternative 3 scenario are shown.

Table 9. Predicted Long-term Average Lake Concentrations for TDS, TIN, TN, TP, and Chlorophyll-a Under Different Operational Scenarios

Operational Scenario [a] (All at 50th %tile hydrologic condition)	TDS [b] (mg/L)	TIN [b] (mg/L)	TP [b] (µg/L)	TN [b] (mg/L)	Chlorophyll-a [c] (µg/L)
WQO/(TMDL target)	***175***	***0.15***	***0.15 (35.0)***		***(14.0)***
Baseline (No Project)	195	0.069	47.7	1.15	14.1
Alternative 3 (1920 AFY)	182	0.052	43.3	1.07	14.0
2,210 AFY (99% recovery)	179	0.045	42.3	1.04	13.1
2,009 AFY (90% recovery)	180	0.041	43.4	1.06	12.9
2,210 AFY + TP Offset	179	0.072	39.9	1.00	10.2
2,009 AFY + TP Offset	180	0.040	40.9	1.00	9.5

Notes:

a) The Baseline and Alternative 3 were evaluated in the 2021 Lake Analysis. The other operational scenarios were evaluated in the 2022 Lake Analysis Update and assume no discharge to Shay Pond. The TP Offset scenarios assume a TP Offset Program is implemented.
b) Expressed as annual average concentrations
c) Chlorophyll-a shown as growing season average concentrations

Overall, the predicted long-term average concentrations of TDS, TIN, TN, TP, and chlorophyll-a were lower with the proposed Lake discharge at various rates as compared to the predicted baseline condition, except for TIN under the 2,210 AFY + TP Offset. It is unclear why the model predicted increased TIN under this scenario while all other scenarios showed significantly reduced TIN values relative to the modeled baseline; however, the modeled difference in TIN between the Baseline and 2,210 AFY + TP Offset scenarios is approximately 4%, which is within the range of model variance and is considered statistically insignificant. Therefore, this analysis concludes that projected long-term average concentration of TIN is similar to the modeled baseline condition.

Focusing on chlorophyll-a as the key response target, baseline conditions were predicted to yield a growing season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the Nutrient TMDL target value of 14 µg/L, while Alternative 3 matched the target value, and increased Lake discharges that varied seasonally (**Figure 8**) yielded values below the modeled baseline condition and the Nutrient TMDL target values. The assumption of a TP Offset Program yielded further reductions in chlorophyll-a. The increased Lake discharge volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 to 10.2 µg/L, significantly below predicted baseline and TMDL concentrations.

Cumulative distribution functions (CDFs) were prepared to evaluate the inter-annual differences in water quality, as differences are expected to persist. **Figure 9** shows the CDFs for TP, TN, and chlorophyll-a, which show that increased Lake discharges are predicted to lower the annual average TP and TN concentrations and growing season average chlorophyll-a concentrations. However, wide ranges in predicted concentrations remained in place. **Table 10** shows the predicted frequency of exceedance of the Nutrient TMDL targets or potential targets. Overall, the growing season chlorophyll-a average TMDL target (14 µg/L) was predicted to be exceeded about 53% of the time under baseline conditions and exceeded about 41% and 31% of the time at a 2,210 AFY Lake discharge rate with and without TP offset, respectively.

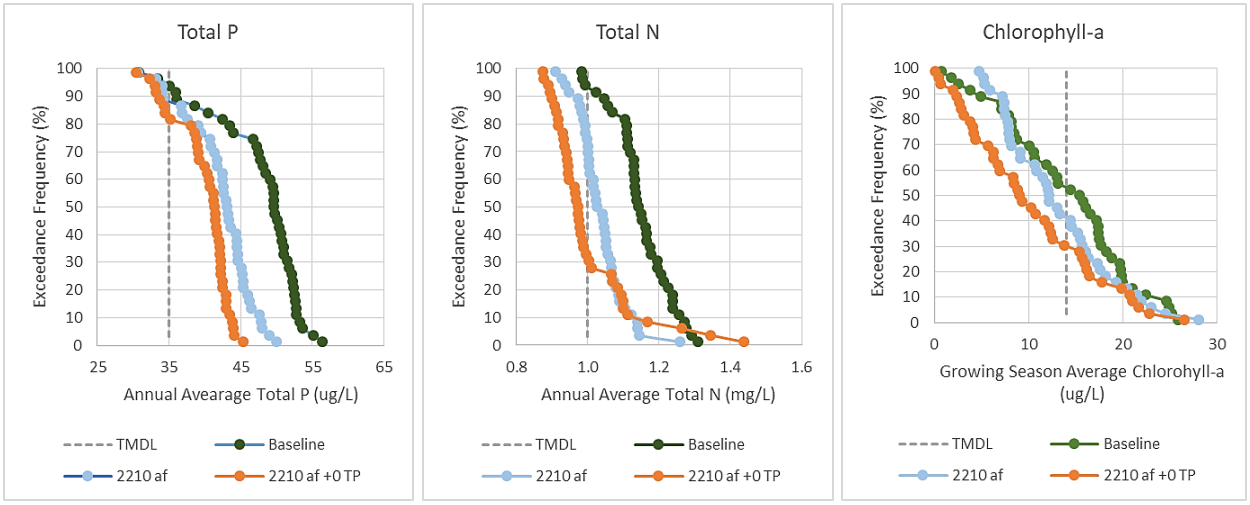


Figure 9. CDFs for Predicted Annual TP and TN Concentrations and Growing Season Average Chlorophyll-a Concentrations for Baseline Condition and at 2,210 AFY Lake Discharge with and without TP Offset

Table 10. Predicted Frequency of Exceeding TMDL Target Under Baseline Conditions and Different Lake Discharge Rates and TP Offset Scenarios (Annual Average or Growing Season Average Basis)

Operational Scenario (All at 50th %tile hydrologic condition)	TP (µg/L)	TN [a] (mg/L)	Chlorophyll-a [b] (µg/L)
WQO/(TMDL target)	***0.15 (35.0)***		***(14.0)***
Baseline (No Project)	94%	91%	53%
Alternative 3 (1920 AFY)	87%	72%	51%
2,210 AFY (99% recovery)	87%	72%	41%
2,009 AFY (90% recovery)	91%	80%	40%
2,210 AFY + TP Offset	82%	30%	31%
2,009 AFY + TP Offset	90%	55%	22%

Notes:
a) Possible target of 1 mg/L, per the Regional Water Board input.
b) Growing season is the period from May 1 through October 31 of each year.

In general, the Lake Analysis demonstrates that the Lake discharge will likely contribute to more frequent attainment of the Nutrient TMDL numeric targets and associated water quality standards, especially when combined with the offset program and actions taken by the TMDL responsible parties to attain the Nutrient TMDL requirements. Additionally, the Lake discharge will increase Lake levels, which will contribute to protection of other beneficial uses and reduce the amount of time critical hydrologic conditions occur in the Lake. A more robust analysis of this Lake discharge on the Nutrient TMDL is provided in Attachment B of the ROWD package.

5.3.1.2 Lake Discharge Impacts on Lake Level, Volume, and Area

The Lake Analysis simulations for the 2009-2019 evaluation period demonstrated that the Replenish Big Bear Program Lake discharge would result in significant increases in predicted lake levels, volumes, and surface areas relative to baseline conditions. Long-term (2009 to 2050) simulations of the proposed Lake discharge under three different hydrologic scenarios indicate that the discharge would be especially beneficial under an "extended drought" scenario where the discharge is predicted to increase the median lake level by more than 10 ft and the median lake area by nearly 600 acres, which in turn would improve recreational access and provide additional Lake habitat as compared to modeled baseline (no project) conditions. The increased lake level and area benefits provided by the Lake discharge would be more modest under the "prolonged above average rainfall" scenario because higher natural inflows would result in higher lake levels. **Table 11** summarizes the projected impacts on Lake level, area, and volume under three hydrologic conditions modeled in the 2021 Lake Analysis.

Table 11. Predicted Lake Level, Area, and Volume under Three Hydrologic Scenarios

Lake Physical Parameter (median values shown)	Scenario	Hydrologic Scenario		
		Extended Drought (5th Percentile)	Median Hydrologic Condition (50th Percentile)	Prolonged Above Average Rainfall (95th Percentile)
Lake Level (ft) (Lake max 6,743 ft)	Baseline	6,722	6,733	6,736
	+Project	6,732 (+10.5)	6,738 (+7.2)	6,740 (+5.2)
Volume (AF)	Baseline	23,400	47,536	54,724
	+Project	45,750 (+22,340)	59,664 (+12,128)	65,204 (+10,480)
Area (acres)	Baseline	1,720	2,328	2,474
	+Project	2,290 (+572)	2,568 (+240)	2,669 (+195)
Notes: Data taken from Table 24 of Lake Analysis report. Assumed a discharge rate of 1,920 AFY. Additional benefit is expected with a higher discharge rate.				

5.3.2 Boron Mass Balance

The projected boron effluent quality of the proposed Lake discharge is anticipated to exceed the Lake ambient water quality (0.054 mg/L – based on one sample collected in December 2021) but remain well below the most stringent criterion of 0.75 mg/L for the protection of sensitive crops. Therefore, the Lake's boron assimilative capacity, defined as the difference between the criterion and the ambient water quality, is 0.694 mg/L (i.e., 0.75 mg/L – 0.054 mg/L).

Due to the limited amount of water quality data available, a simple spreadsheet model was completed to evaluate the contribution of the Lake discharge to boron concentrations in the Lake over time. The calculations are shown in **Appendix F**. The only available data for boron contributions to the Lake from natural inflows is based on boron samples collected in 1972 from several creeks. These data indicated that boron in natural inflows could range between 0.02 and 0.26 mg/L. These results were not used in this analysis due to it high variability, age of the samples, small sample size, and changes in watershed characteristics since the samples were collected.

This analysis did not establish a baseline condition based on ambient water quality; rather, it was assumed that the Lake and natural inflows had a boron concentration of 0 mg/L and the analysis determined the incremental increase of boron in the Lake as result of the Lake discharge.

The 1977-2020 annual inflow and outflow were obtained from the Big Bear Watermaster annual reports and a 43-year simulation was performed based on a repeat of this historic hydrology. The following equations were used to perform the mass balance:

$$Lake\ Storage\ =\ Initial\ Lake\ Storage\ +\ Lake\ Inflows\ -\ Lake\ Outflows$$

$$Lake\ Inflows\ =\ Lake\ inflows\ from\ precipitation\ and/or\ snowmelt$$

$$Lake\ Outflows\ =\ Spills\ +\ Releases\ +\ Leakage\ +\ Withdrawals\ +\ Evaporation$$

$$Boron\ Mass\ =\ Boron\ in\ Lake\ +\ Boron\ from\ Lake\ Inflow + Boron\ from\ Discharge\ -\ Boron\ from\ Lake\ Outflows$$

$$Boron\ Concentration\ in\ Lake\ (mg/L) = \frac{Boron\ mass\ in\ Lake\ at\ end\ of\ simulation\ year}{Lake\ volume\ at\ end\ of\ simulation\ year}$$

Figure 10 shows the projected boron Lake concentrations over the simulation period. The Lake discharge is anticipated to increase boron concentrations over the 44-year simulation, boron is predicted to increase by about 0.065 mg/L. This is less than the 10% assimilative capacity.

The projected incremental increase in boron concentration in the Lake as a result of the project is 0.065 mg/L at the end of the 44-year simulation. The simulation results represent an incremental increase above the current ambient quality, which was 0.054 mg/L based on one sample collected in December 2021. Based on this sample, the estimated total boron concentration in the Lake with the proposed discharge would be below 0.12 mg/L, which is considered safe for agricultural crops like citrus trees that show sensitivity to boron starting at concentrations between 0.5 – 0.75 mg/L (USDA, 1990). The projected boron concentration will remain low compared to the most stringent criterion of 0.75 mg/L which exists in the Basin Plan for the protection of water used to irrigate sensitive crops.

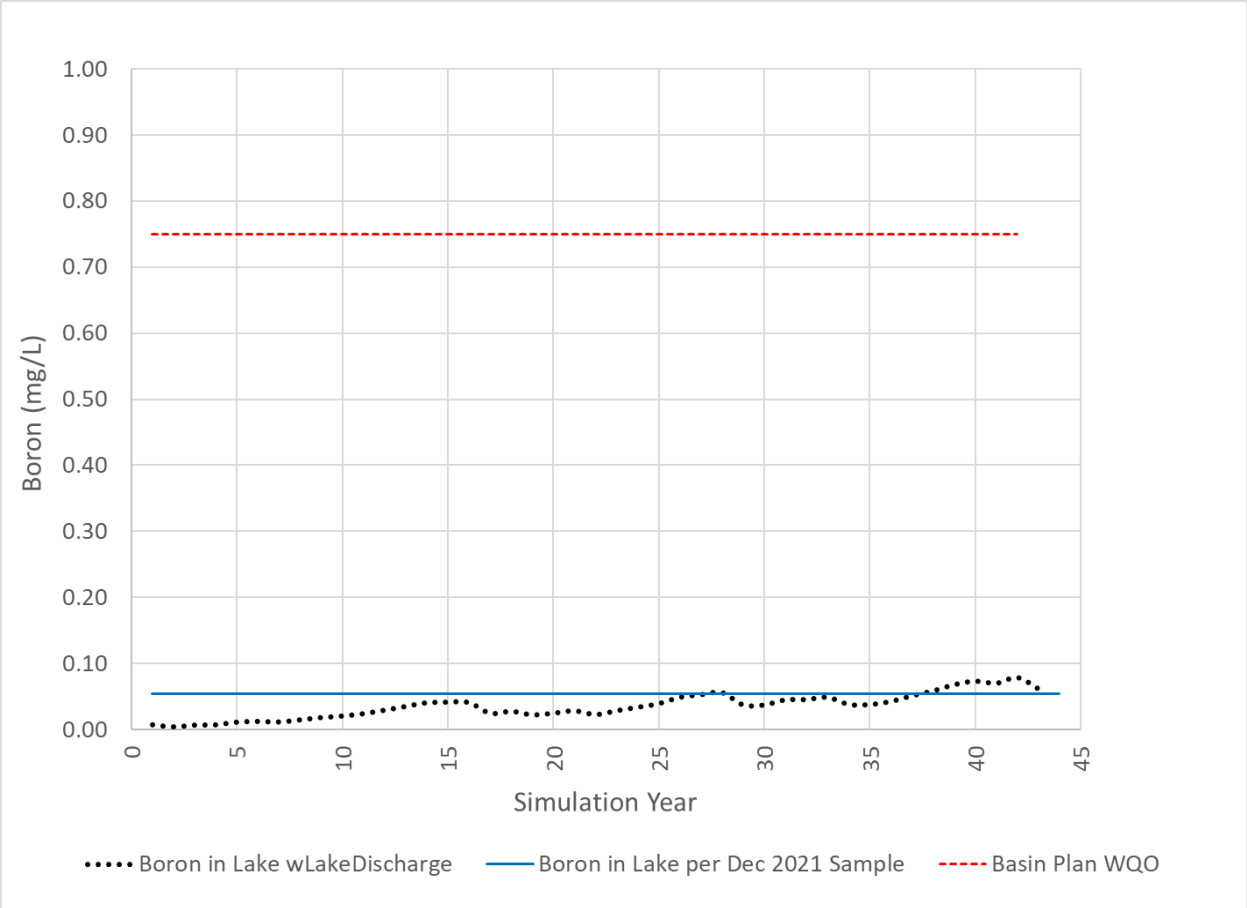


Figure 10. Projected Boron Concentrations with Proposed Lake Discharge

5.4 Summary of Water Quality Impacts

Overall, the Replenish Big Bear Program Lake discharge under most modeled discharge scenarios is anticipated to improve water quality for TDS, TIN, TP, TN, and chlorophyll-a as compared to baseline conditions, and result in similar water quality for total inorganic nitrogen (TIN) as compared to the modeled baseline. In addition, the proposed discharge is projected to contain concentrations of constituents of interest that are similar to or lower than existing ambient water quality and most stringent WQO or criteria for all constituents evaluated except for TIN and boron. For boron, concentrations in the Lake are anticipated to increase compared to baseline conditions but remain well below the most stringent WQO of 0.75 mg/L and the estimated increase is below the U.S. EPA significance threshold of a 10% reduction in available assimilative capacity.

Overall, the Lake Analysis and the 2022 Lake Model Update show that the implementation of the Lake discharge will help improve water quality of the Lake, especially during extended drought and typical (median) conditions. In addition, the proposed Lake discharge will increase lake levels, surface area, and volumes which will help to protect the beneficial uses designated for the Lake.

6 ASSESSMENT OF WATER QUALITY IMPACTS TO SHAY POND

This section describes the proposed Shay Pond discharge component of the Replenish Big Bear Program and presents an antidegradation analysis of the proposed discharge. Currently, it is unknown if Shay Pond and Shay Creek are considered Waters of the U.S. (WOTUS), as the federal regulations that define a WOTUS are currently under review. Regional Water Board input is required to determine the appropriate permitting approach for the proposed discharge to Shay Pond. The necesarry background information to assist the Regional Water Board with this determination is provided in this section.

6.1 Shay Pond Environmental Setting and Project Description

As part of the Replenish Big Bear Program, up to 80 AFY of disinfected, advanced treated effluent is proposed for discharge to Shay Pond. The proposed Shay Pond discharge is intended to replace potable water that is currently discharged to the pond to support the Unarmored Threespine Stickleback (Stickleback) fish, a federal and State listed endangered species.

Shay Pond has a surface area of approximately 10 acres and is located about 1.2 miles southeast of the BBARWA WWTP (**Figure 1**). According to the Bear Valley Basin Groundwater Sustainability Plan (GSP), "*Shay Pond is a natural surface water body at the southern base of an unnamed ridge that separates it from Baldwin Lake (. The nature of this pond is unknown, but it may be fed, in part, from spring flow, surface runoff, and periodically, groundwater intersecting the land surface. Although the pond may have historically been fed from surface water runoff in the ephemeral, upstream segment of Shay Creek, urban development has altered the course of this stream, and it no longer flows into the pond. Surface water exits Shay Pond via the downstream segment of Shay Creek, which flows northwards toward Baldwin Lake and intermittently provides water to Baldwin Lake lake.*" "*Surface water sources to Baldwin Lake are primarily in the form of ephemeral streams with relatively low flow volumes. The only stream where surface water flow periodically has been measured is Shay Creek at its outlet from Shay Pond.*" "*Surface water runoff does not reach Baldwin Lake during most years but percolates into the groundwater system. However, during prolonged precipitation, surface water does flow into Baldwin Lake. All surface water that enters Baldwin Lake is lost to evaporation. The high clay content of the playa sediments prevents vertical migration, and the topographical configuration of the lake prevents outflow from Baldwin Lake*" (TH&Co, 2022). **Figure 11** shows how

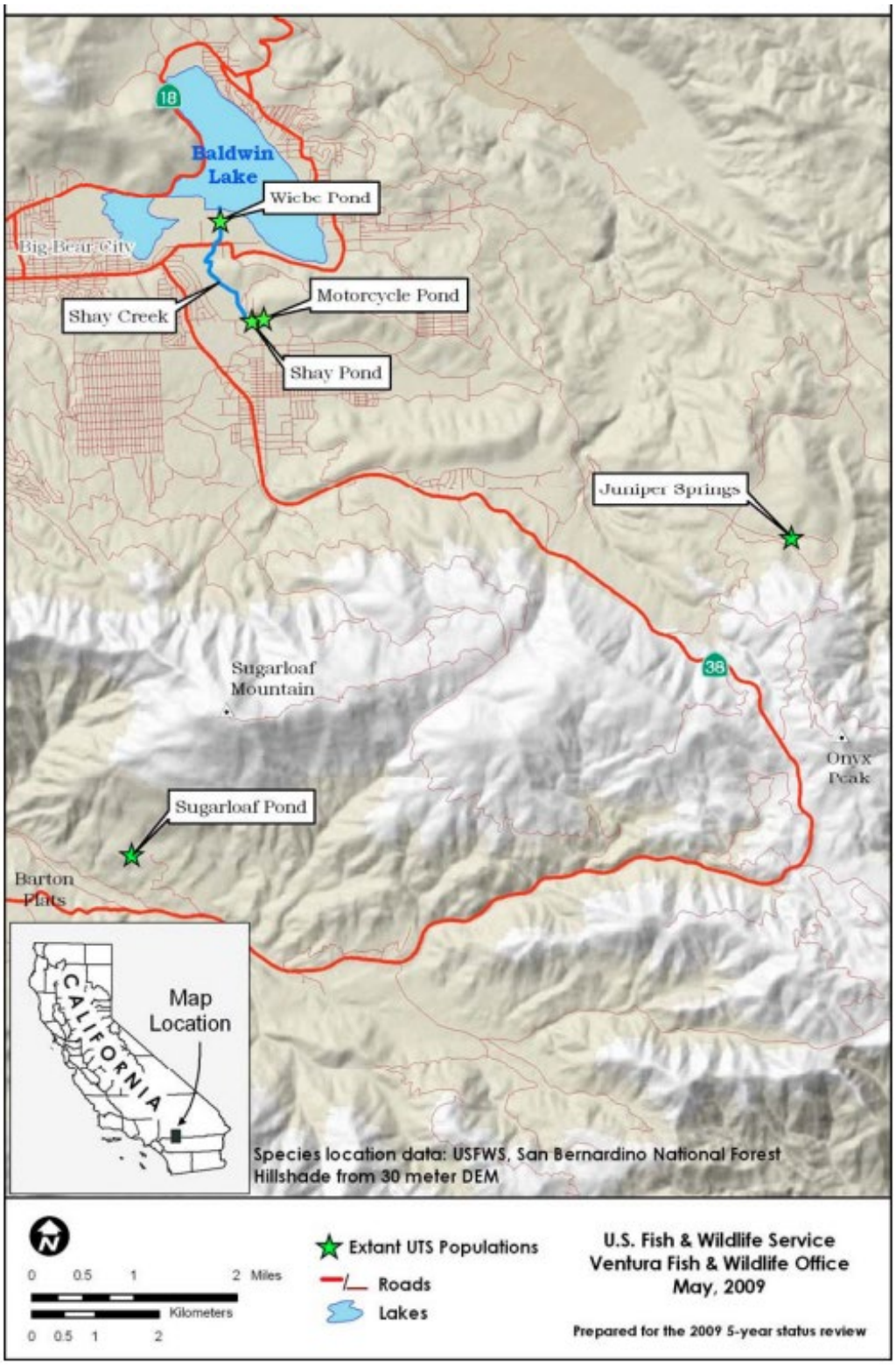
Baldwin Lake, an ephemeral lake, is connected to Shay Pond via Shay Creek. This figure also shows the population of Stickleback fish in the vicinity of Shay Pond.

The population of Stickleback is unique in that it occurs at a high elevation, about 6,700 ft above mean sea level, while all other Stickleback populations inhabit streams below 3,000 ft. In 1985 and 1986, catastrophic mortality of Stickleback in the Valley occurred due to insufficient amounts of water. By the summer of 1990, it was thought that the Stickleback remained in only Shay Pond.

There is a long history of study and group effort regarding the Stickleback in the Shay Creek area. The main stakeholders include the United States Fish and Wildlife Service (USFWS), CDFW, the San Bernardino National Forest (SBNF), BBCCSD, BBLDWP, and BBARWA. Additionally, the Shay Creek Working Group, which includes representatives from the USFWS, CDFW, SBNF, BBCCSD, BBLDWP, and BBARWA, was formed during the process of preparing the USFWS' 2002 Biological Opinion (2002 BO) for the area (Evans, 2002).

The requirements of the 2002 BO state that BBCCSD will provide water to Shay Pond to maintain a minimum 20-gallon-per-minute outflow from Shay Pond. The objective is to maintain a minimum pond water level that will support suitable habitat conditions for the fish. BBCCSD currently meets this requirement by discharging potable water into Shay Pond, but the 2002 BO also states that, should a suitable alternative supply of water be found to be appropriate for the stickleback in the future, BBCCSD may use an 'in-lieu' water supply, which could include the use of tertiary-treated water. The potable water discharged to Shay Pond represents approximately 5% of BBCCSD's customer water demand and could be reserved for potable use instead of discharging to Shay Pond.

The discharge rate needed to maintain the required outflow, accounting for evaoparation and infiltration, has varied from year to year. However, based on the average volume of discharges measured between 2012 and 2020, BBCCSD discharges approximately 50 AFY of potable water to Shay Pond on average. At times, the required discharge has been up to 80 AFY; this maximum volume is used as the basis for the project design and analysis to be conservative. **Figure 12** shows an aerial view of Shay Pond and the proposed discharge location.



(Source: USFWS, 2009)

Figure 11. Population of Stickleback Fish in the Vicinity of Shay Pond

Figure 12. Shay Pond Aerial View

6.2 Applicable Water Quality Standards

Per the Basin Plan, the protection of beneficial uses designated for Shay Creek and Baldwin Lake is primarily provided by narrative water quality objectives. **Table 12** shows the designated beneficial uses of Shay Creek and Baldwin Lake, which are receiving waters for flows from Shay Pond. Baldwin Lake has intermittent beneficial uses as the lake is ephemeral. The water quality objectives used to protect the beneficial uses designated for Shay Creek and, therefore, Shay Pond are presented in **Table 13**, along with ambient Shay Pond water quality, the quality of the current potable water supply to the pond, and the proposed effluent quality of the proposed discharge.

Table 12. Beneficial Uses of Shay Pond Receiving Waters

Beneficial Uses	Shay Creek	Baldwin Lake
COLD – Cold Freshwater Habitat	✓	I
GWR – Groundwater Recharge	✓	
MUN – Municipal and Domestic Supply	✓	I

Beneficial Uses	Shay Creek	Baldwin Lake
RARE – Rare, Threatened, or Endangered Species	✓	I
REC1 – Water Contact Recreation	✓	I
REC2 – Non-Contact Water Recreation	✓	I
SPWN – Spawning, Reproduction, and/or Early Development	✓	
WARM – Warm Freshwater Habitat		I
WILD – Wildlife Habitat	✓	I
Notes: ✓ - Existing or Potential Beneficial Use; I - Intermittent Beneficial Use		

6.3 Assessment of Water Quality Impacts

The water quality data available for Shay Pond are limited, so a detailed water quality assessment using Shay Pond data could not be completed. For this analysis, the existing water quality of potable water supplies near Shay Pond were compared to the projected effluent quality of the proposed Shay Pond discharge to determine if there is a potential for degradation of Shay Pond water quality as a result of the proposed discharge. The water quality collected in Shay Pond as part of the ROWD application is provided as reference. A similar approach as outlined in **Section 5.2.1** was used to determine if the proposed discharge to Shay Pond could contribute to ambient water quality degradation. **Table 13** presents the results of this analysis.

Water quality data for the specific well that discharges to Shay Pond is not available so the data used for this analysis was obtained by compiling and averaging the water quality data from seven drinking water wells near Shay Pond, which is expected to be representative of the quality of groundwater currently discharged to Shay Pond. BBCCSD collected these data in 2020. The projected effluent quality was estimated as described in **Section 5.1** and presented in **Table 5.** As part of the ROWD process, BBCCSD sampled Shay Pond for 156 constituents, of which only 19 analytes were detected.

Overall, the projected effluent quality of the proposed discharge to Shay Pond is better than the current potable water supply for chloride, hardness, sodium, sulfate, TDS, TN, aluminum, and specific conductance. The projected effluent quality of the proposed discharge is expected to be of similar quality as existing potable water supplies for ammonia, fluoride, MBAS, cadmium, copper, and lead. However, additional data may be needed to confirm these findings. Boron may be the only constituent that could be above the existing potable water supply quality. However, the average boron concentration in the disinfected, advanced treated effluent proposed for discharge to the pond is well below the 0.75 mg/L Basin Plan objective for boron for the protection of sensitive agricultural crops, which is not a use of Shay Pond water.

Additional coordination with the CDFW will be conducted to ensure the Stickleback fish are protected.

Table 13. Comparison of Most Stringent Water Quality Objective or Criterion to Current BBCCSD Potable Water Supply Quality and Projected Effluent Quality of Proposed Discharge

Constituent	Units	Reference for Most Stringent WQO or Criterion	Average Quality of Potable Groundwater Supply [a]	Shay Pond Ambient Quality [b]	Projected Effluent Quality of Proposed Discharge	Comparison of Projected Effluent Quality to Most Stringent WQO (See Table Notes)
Ammonia as N	mg/L	1.4 [c]	NS	0.24	0.05	1
Boron	mg/L	0.75	<0.1	0.059	0.11	2
Chloride	mg/L	500	9	7.6	0.60	1
Fluoride	mg/L	0.9	2.1	1.2	<0.026	1
Hardness, Total (as CaCO3)	mg/L	100	209	180	3.2	1
MBAS	mg/L	0.05	<0.1	<0.1	0.0014	1
Sulfate	mg/L	500	39	23	0.20	1
Total Dissolved Solids	mg/L	1000	291	320	50	1
Total Nitrogen	mg/L-N	10	NS	1.2	0.60	1
Cadmium	µg/L	1.5 [d]	<1	<1	<0.11	1
Copper	µg/L	16.6 [d]	<50	<50	0.07	1
Lead	µg/L	3.5 [d]	<5	<5	0.01	1
Aluminum	µg/L	200	<50	120	1.3	1
Specific Conductance	µmhos/cm	700/1000	496	450	18	1

Notes: NS – Not sampled/no data

a) The average groundwater potable water supply was estimated from 7 domestic wells that were tested and are near Shay Pond. NDs were excluded from the average. Constituents with all ND are reported as "<RL." The MDL was not provided.
b) For Shay Pond, only one sample is available. The results are reported. ND are reported as "<MDL."
c) The total ammonia was estimated using the equation presented in Table 4-4 of the Basin Plan. The field temperature on November 17, 2021, was 56 °F (13.3°C) and pH was 7.7.
d) The cadmium, copper, and lead SSO were estimated using a total hardness value of 180 mg/L, based on the sample collected as Shay Pond.

Constituent	Units	Reference for Most Stringent WQO or Criterion	Average Quality of Potable Groundwater Supply [a]	Shay Pond Ambient Quality [b]	Projected Effluent Quality of Proposed Discharge	Comparison of Projected Effluent Quality to Most Stringent WQO (See Table Notes)

Blue – Projected effluent quality is below the ambient and most stringent WQO or criterion
Red – Projected effluent quality is above the ambient or most stringent WQO or criterion

1) Projected effluent quality is below the ambient and most stringent WQO or criterion. No degradation anticipated.
2) Projected effluent quality is above the ambient, but below the most stringent WQO or criterion. Further analysis needed to determine impacts on water quality.

7 EVALUATION OF CONSISTENCY WITH ANTIDEGRADATION POLICY

The guidelines set by the State Water Board for the antidegradation analysis (APU 90-004) provide direction on evaluating the proposed discharges to Stanfield Marsh/ Lake and Shay Pond by focusing on whether and the degree that water quality is lowered, and by considering whether or not the assumed water quality discharge is consistent with the maximum benefit to the people of the State. In developing the antidegradation analysis, the beneficial uses and relevant water quality objectives and commonly used criteria for the Lake and Shay Pond were considered.

7.1 Benefits of Proposed Project

The proposed discharges of disinfected, advanced treated wastewater to Stanfield Marsh and Shay Pond maximize the use of a local sustainable water supply within the Valley region through the surface water discharge of highly treated wastewater produced by BBARWA to directly benefit the community and environment and support the following beneficial uses in the Lake, Stanfield Marsh, and Shay Pond: AGR (Lake only), COLD, GWR (Lake and Pond), MUN, RARE, REC1, REC2, SPWN (Lake and Pond), WARM (Lake and Pond), and WILD (see **Table 1** and **Table 12** for additional details). The proposed Lake and Shay Pond discharges as part of the Replenish Big Bear Program are anticipated to provide the following benefits:

- A new local drought proof water supply will reduce the Valley's vulnerability to drought, both for the community and the environment.
- A new constant source of water supply to Stanfield Marsh that will provide more stable aquatic and riparian habitat for diverse species and more opportunities for the community to realize the educational and recreational benefits of Stanfield Marsh. The marsh has been mostly dry since 2015 but with the project, the 145-acre marsh area will be at least 50% wetted even during dry years.
- Increased Lake levels will provide more wetted shoreline to enhance aquatic and riparian habitat in the Lake.
- Increased lake levels provide increased opportunities and flexibility for BBMWD to conduct lake management activities, such as weed harvesting to control aquatic macrophytes. Such activities are anticipated to enhance the contact and non-contact recreation in the Lake.

- Increased Lake levels will improve Lake access for boats and personal watercraft and allow for continued use of Lake water for snowmaking in the winter, both of which will act to maintain and enhance tourism, the single largest driver of the Big Bear economy.
    - The number of boat permits sold is directly impacted by Lake levels, and it is anticipated that increased levels will result in the sale of additional boat permits and increased rates of associated recreation and tourism, all of which stimulate the local and regional economies.
    - Visitors in the winter are directly tied to weather conditions and the Resorts' ability to facilitate snow activities by extracting Lake water to make snow when Lake levels are high enough.
    - The Transient Occupancy Tax (TOT) is the second largest revenue source for the City of Big Bear Lake, making up approximately 27% of the general-purpose revenues. Revenue from tourists fluctuate depending on the timing and amount of precipitation the region receives and Lake levels.
    - A strengthened tourist economy is expected to provide additional job growth and stability. Project implementation is estimated to create 3 new permanent positions at the WWTP, 242 temporary construction jobs and 480 indirect jobs.
- Higher Lake levels will result in reduced demand on SWP water, which is used in lieu of Lake water to meet Mutual's water needs when Lake levels are low.
- Increased inflow to the Lake will result in the Lake being full more frequently and will provide BBMWD additional flexibility in optimizing Lake releases to provide new downstream benefits to the Santa Ana Watershed, including increased flows in Bear Creek and the Santa Ana River to support habitat and additional downstream capture of surface water for groundwater recharge.
- The Lake discharge provides opportunities to use of a portion of the Lake water for subsequent uses that provide additional potable water supply and recreational benefits through direct and in-lieu groundwater recharge and enhanced snowmaking capabilities (these uses are anticipated to be permitted separately).

- A new source of high-quality water will be discharged to Shay Pond to support 10 acres of habitat for the federally listed Stickleback. The new source of water enables the potable water currently used for this purpose to be stored in the groundwater basin to enhance water supply sustainability.

7.2 Socioeconomic Considerations

As a result of the project benefits described in **Section 7.1**, the proposed project will act to support important economic and social development in the Valley.

The project proponents are voluntarily committing the resources necessary to construct and operate an advanced wastewater treatment facility to discharge disinfected, RO treated effluent of the quality that could be permitted to be discharged to the Lake as a means to achieve the multiple project benefits described above. The commitment of resources by the project proponents to construct, operate, and maintain the proposed treatment facility will result in increased wastewater fees paid by residents and businesses in the Valley. The capital cost of the proposed facilities required for the Lake and Shay Pond discharges is estimated at $56 M (in 2021 dollars) and the annual operations and maintenance (O&M) costs are estimated at $2.4 M (in 2021 dollars). These capital and O&M expenditures are estimated to result in an increase in wastewater fees of approximately $150-$200 per connection per year.

Increased wastewater fees that would be paid by residents and businesses in the Valley with implementation of the proposed project are not without local and regional economic impacts. The estimated increase in wastewater fees would need to be paid by households and businesses out of their existing household incomes or operations budgets, respectively. In effect, additional wastewater fees would be paid out of funds that are currently available for other purposes. With respect to households, future increased wastewater fees would result in less disposable personal income available to a household for the purchase of other goods and services. Similarly, an increase in annual utility costs for a business could result in one or more of the following: increased costs for the goods and/or services it provides and/or decreased reinvestment in the business. With respect to individual households, increases in utility costs have a disproportionate effect on households at the lowest socioeconomic levels.

While the estimated increase in annual wastewater fees with implementation of the proposed project is not estimated to produce substantial and widespread economic impacts in the Valley, a requirement to add additional wastewater treatment beyond the advanced level of treatment included in the proposed project could trigger substantial and widespread socioeconomic impacts. Furthermore, the project proponents believe that the cost of any additional required wastewater treatment would not produce improvements in receiving

water quality that are proportionate with the cost of additional treatment. The benefits of maintaining existing water quality and mass emissions in the Lake and Shay Pond for the constituents analyzed in this antidegradation analysis are not commensurate with the costs of additional wastewater treatment, beyond what is included in the proposed project, should such treatment be recommended. The small decrease in water quality with respect to the constituents considered in this analysis is unlikely to affect beneficial uses of the Lake, Shay Pond, and downstream receiving waters.

7.3 Consistency with Antidegradation Policies

The proposed project, the discharge of disinfected, advanced treated BBARWA effluent to (1) Stanfield Marsh/Big Bear Lake at a discharge rate up to 2,210 AFY and (2) Shay Pond at a discharge rate up to 80 AFY, is determined to comprise best practicable treatment and control and is consistent with federal and State antidegradation policies for the following reasons:

- The proposed discharge to both Stanfield Marsh/Big Bear Lake and Shay Pond will not adversely affect existing or probable beneficial uses of either receiving water or downstream receiving waters, nor will the discharges cause water quality to not meet applicable water quality objectives.
- Overall, the proposed discharge is estimated to improve water quality in the Lake for TDS, TN, TP, and chlorophyll-a, maintain similar water quality for TIN, and have a very minor impact on boron. Future boron concentrations in the Lake are estimated to increase very slightly (i.e., less than 10% of the available assimilative capacity) due to the proposed BBARWA discharge but are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron (see **Table 7** and **Section 5.3.2**). The Lake Analysis shows that projected ambient Lake concentrations of TIN and chlorophyll-a with the proposed discharge will exist below their relevant water quality objective (TIN) or TMDL target (chlorophyll-a). The Lake Analysis also shows that ambient Lake concentration of TDS and TP with the proposed discharge are estimated to exceed the 175 mg/L TDS objective and the 35 µg/L TP TMDL target, respectively. However, the modeled baseline (no project) condition is projected to result in Lake concentrations for TDS, TP, TIN, and chlorophyll-a that exceed those concentrations more often than all modeled BBARWA discharge scenarios. Modeled results for the proposed BBARWA discharge, when combined with a TP Offset Program (see Attachment B of the ROWD package), show the greatest improvements to future, ambient Lake concentrations as compared to the modeled baseline (no project) condition.

- Overall, the proposed BBARWA discharge is estimated to have a very minor impact on Shay Pond water quality and Shay Creek water quality downstream of the pond. The proposed project is estimated to potentially cause a very minor increase in boron concentrations in the pond and downstream in Shay Creek, but concentrations are estimated to remain well below the 0.75 mg/L Basin Plan objective for boron. The disinfected, advanced treated effluent proposed for discharge to the pond is anticipated to lower the concentrations of those constituents listed in **Table 13** as compared to existing ambient concentrations that are largely influenced by the groundwater currently discharged by BBCCSD to the pond to maintain water levels for the endangered Stickleback fish.
- Based on the above, the request to permit a new discharge to both Stanfield Marsh/Big Bear Lake and Shay Pond is consistent with federal and state antidegradation policies in that the minor lowering of water quality for boron in Big Bear Lake (see **Table 7**) and Shay Pond (see **Table 13**) is necessary to accommodate important economic or social development[5], will not unreasonably affect beneficial uses, will not cause further exceedances of applicable water quality objectives, and is consistent with the maximum benefit to the people of the State.
- Based on the above, the request to permit new discharges to Stanfield Marsh/Big Bear Lake and Shay Pond are consistent with the Porter-Cologne Act in that the resulting water quality will constitute the highest water quality that is reasonable, considering all demands placed on the waters, economic and social considerations, and other public interest factors.

The proposed discharge of disinfected, advanced treated BBARWA effluent to Stanfield Marsh/Big Bear Lake and Shay Pond also fully supports California's *Recycled Water Policy* (SWRCB, 2013) in that it would result in an increased use of recycled water from municipal wastewater sources, would incrementally reduce reliance on the vagaries of annual precipitation, and would assist in the sustainable management of surface and groundwater resources.

[5] Maintain and improve recreation and tourism in the Big Bear Lake region which in turn stimulates the local and regional economies.

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APPENDIX A: WDR R7 R7-2021-0023

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

Office
73-720 Fred Waring Dr. #100
Palm Desert, CA 92260

waterboards.ca.gov/coloradoriver/

ORDER R7-2021-0023

Order Information

Discharger:	Big Bear Regional Wastewater Agency
Facility:	Export of Recycled Water to Lucerne Valley
Address:	122 Palomino Drive, Big Bear City, California 92314
County:	San Bernardino County
WDID:	7A360100011
GeoTracker ID:	WDR100027897

I, PAULA RASMUSSEN, Executive Officer, hereby certify that the following is a full, true, and correct copy of the order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on May 11, 2021.

Original signed by
PAULA RASMUSSEN
Executive Officer

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

ORDER R7-2021-0023

WASTE DISCHARGE REQUIREMENTS
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
LUCERNE VALLEY-SAN BERNARDINO COUNTY

The California Regional Water Quality Control Board, Colorado River Basin Region (Regional Water Board) hereby makes the following Findings:

1. Big Bear Area Regional Wastewater Agency (BBARWA or Discharger), P.O. Box 517, Big Bear City, California 92314, owns 480 acres in the Lucerne Valley, of which 340 acres are irrigated with recycled water from the Discharger's Wastewater Treatment Plant (WWTP). There are an additional 140 acres available for irrigation, also in the Lucerne Valley. BBARWA's WWTP provides sewerage service to the City of Big Bear Lake, Big Bear City Community Services District, and County Service Area 53-B. The WWTP is located at 122 Palomino Drive, Big Bear City, California 92314, and has a design treatment capacity of 4.89 million gallons-per-day (MGD) and a hydraulic capacity of 9.2 MGD. The Facility is assigned California Integrated Water Quality System (CIWQS) number CW-208930, Waste Discharge Identification (WDID) number 7A360100011, and GeoTracker Global Identification number WDR100027897.

2. The WWTP is located outside the boundary of the Colorado River Basin Water Board (Regional Water Board) and is regulated by the California Regional Water Quality Control Board, Santa Ana Region (Santa Ana Water Board) under Waste Discharge Requirements (WDRs) Order R8-2005-0044.

3. The WWTP has the following types of treatment: preliminary treatment, secondary treatment, and sludge drying and treatment. Secondary treated wastewater from the WWTP is disposed of through three possible discharge points that are designated in Order R8-2005-0044 as Point 001, Point 002, and Point 003. The discharges from the WWTP at Points 002 and 003 are regulated by the Santa Ana Regional Water Quality Control Board. The majority of the treated wastewater is discharged through Discharge Point 001 into the Lucerne Valley to irrigate fodder, fiber, and seed crops. A minimal volume of treated wastewater is discharged through Points 002 and 003 for recycling and reuse at various sites for irrigation, dust control at construction sites, and wildlife habitat restoration in the Baldwin Lake.

4. This Order regulates the discharge from the WWTP at Point 001. Infrastructure associated with this discharge includes a concrete-lined reservoir and two overflow

ponds that are used to dispose of treated recycled wastewater by percolation and evaporation in the Lucerne Valley (Lucerne Valley Facility or Facility).

5. The Lucerne Valley Facility is located near the intersection of State Highway 247 (Old Woman Springs Road) and Camp Rock Road in the Lucerne Valley of San Bernardino County in Section 14, T4N, R1E, SBB&M, and Assessor's Parcel Number (APN) 0449-082-040000, 34.438554°N Latitude, -116.851225°W Longitude. The Facility's location is shown in **Attachment A**- Vicinity Map, made part of this Order by reference.

6. The Lucerne Valley Facility was most recently regulated by WDRs in Order R7-2016-0026, which was adopted by the Regional Water Board on June 30, 2016.

7. On October 28, 2020, the Discharger submitted an application and Report of Waste Discharge (ROWD) to the Regional Water Board, applying for updated WDRs for the Facility.

8. This Order updates the WDRs to comply with current laws and regulations applicable to the discharge. Accordingly, this Order supersedes WDRs in Order R7-2016-0026 upon the effective date of this Order, except for enforcement purposes.

Wastewater Treatment Facility and Discharge

9. Wastewater that is discharged at the Lucerne Valley Facility goes through preliminary and secondary treatment at the WWTP before it is sent via gravity to the concrete reservoir at the Lucerne Valley Facility. The WWTP components that are used for treatment are described below and the Process Flow Diagram for the WWTP is shown in **Attachment B**–Process Flow Diagram.

    a. **Preliminary Treatment**. Untreated wastewater flows to the preliminary treatment system, which consists of bar screens, aerated grit chamber with grit washer, and a flow bypass channel. This treatment stage removes screenings, rag material, and grit.

    b. **Secondary Treatment**. Effluent flows by gravity from the preliminary treatment system to three parallel oxidation ditches for secondary (biological) treatment and timed processes for nutrient (nitrogen) removal. The number of ditches in operation depends on the seasonal fluctuations of the influent flow. The effluent from the oxidation ditches flows into a system of three secondary clarifiers for removal of floatable and settleable solids/materials. The secondary treated effluent flows to two cement-lined balancing chambers and then flows to equalization storage ponds at the WWTP until pumped for offsite irrigation disposal.

    c. **Offsite Irrigation/Disposal**. Undisinfected secondary treated wastewater is pumped from the WWTP's main pump building (5.2 MGD) or auxiliary

pump building (9.2 MGD) approximately 16.5 miles to an offsite 2.26-million-gallon, concrete-lined reservoir (undisinfected secondary recycled water reservoir). This reservoir is located one mile south of the irrigation site. Wastewater from the reservoir flows by gravity through an outfall line connected to the irrigation system. In the event of an overflow at the concrete-lined reservoir, the wastewater flows by gravity to earthen overflow ponds located adjacent to the irrigation site.

10. Approximately 2.12 MGD of undisinfected secondary recycled water (as defined in California Code of Regulations, title 22, section 60301.900) is discharged to the Lucerne Valley Facility for irrigation of fodder and fiber crops. Undisinfected secondary wastewater was approved by the California Department of Public Health (succeeded by the State Water Resources Control Board's [State Water Board] Division of Drinking Water) for irrigation use at this site. Approximately 340 acres are currently irrigated at the Lucerne Valley Facility, with an additional 140 acres available for irrigation at the site. The effluent discharge limit of 4.8 MGD in this Order is based on the capacity of the irrigated crops to take up nitrogen. The Lucerne Valley Facility site layout is shown in **Attachment C**, made part of this Order by reference.

11. The State Water Board's Division of Drinking Water has established statewide reclamation criteria in California Code of Regulations, title 22, section 60301 et seq. for the use of recycled water and developed guidelines for specific uses. Section 60304(d)(4) allows the use of undisinfected, secondary recycled water for the surface irrigation of fodder and fiber crops and pasture for animals not producing milk for human consumption. BBARWA's Title 22 Engineering Report was initially approved on November 3, 1980 and was last updated November 4, 1998, to allow for the use of tertiary treated wastewater in the Big Bear Area.

12. The grazing of sheep on the irrigation site has been allowed under certain conditions, as outlined in a letter from Regional Water Board staff dated November 15, 1994, and in Discharge Specification D.18 of this Order.

13. No sewage sludge is discharged at the recycled water reuse site.

14. BBARWA's Self-Monitoring Reports (SMRs) from January 2016 through December 2020 characterize the WWTP effluent as follows:

Table 1. Effluent Characterization

Constituent	Units	Average	Maximum	Minimum
Flow	MGD	2.12	8.39	0.441

Constituent	Units	Average	Maximum	Minimum
20° C BOD_5[1]	mg/L[2]	8	36	ND[3]
TSS[4]	mg/L	8	44	1
pH	s.u.[5]	7.61	8.46	6.85
Total Dissolved Solids (TDS)	mg/L	441	520	350
Total Inorganic Nitrogen (TIN)[6]	mg/L	3.9	22.3	0.4
Total Nitrogen (TN)	mg/L	4.9	12	1.8
Nitrate as N	mg/L	1.7	7.7	0.04
Chloride	mg/L	56	87	34
Sulfate	mg/L	40	48	29
Fluoride	mg/L	0.43	0.61	0.24
Boron	mg/L	0.20	0.32	<0.1

Hydrogeologic Conditions

15. Lucerne Valley Groundwater Basin underlies Lucerne and North Lucerne Valleys and is bounded on the south by the San Bernardino Mountains and on the west by the Granite Mountains and the Helendale fault. The Ord Mountains bound the basin on the north. The Camp Rock fault and Kane Wash Area Groundwater Basin bound this basin on the east and the Fry Mountains bound this basin on the southeast. Parts of the eastern and southeastern boundaries are surface drainage

[1] 5-day biochemical oxygen demand at 20 degrees Celsius.

[2] Milligrams per Liter

[3] Not Detected at the laboratory's Reporting Limit.

[4] Total Suspended Solids

[5] Standard pH units

[6] Total Inorganic Nitrogen is the sum of nitrate, nitrite, and total ammonia.

divides. Surface water drains toward Lucerne (dry) Lake in the western portion of the basin, which has an altitude of 2,850 feet above sea level (Schaefer 1979[7]).

16. The principal water-bearing deposits are Quaternary age alluvium, and dune sand. The deposits are unconsolidated or semi-consolidated and the alluvium is composed of gravel, sand, silt, clay, and occasional boulders. Where saturated, the alluvium yields water freely to wells. The average specific yield for these deposits is 11 percent. Irrigation wells in the basin yield as much as 1,000 gallons per minute (Schaefer 1979).

17. BBARWA has three groundwater monitoring wells (MW-1-upgradient; MW-2-downgradient; and MW-3-downgradient). Groundwater levels in monitoring wells have increased since the wells were constructed in 1991. BBARWA has reported that the depth to groundwater at the Lucerne Valley Facility is within the range of 125 to 175 feet below ground surface (bgs) and groundwater flow direction is generally to the northwest, towards Lucerne Dry Lake.

18. Groundwater monitoring data collected from monitoring wells MW-1, MW-2, and MW-3 during the period from 2017 through 2020 show the following average characteristics:

Table 2. Groundwater Monitoring Data

Constituent	Units	MW-1	MW-2	MW-3
Depth to Groundwater	ft	170	125.2	138.1
TDS	mg/L	435.5	655.2	583
TN	mg/L	9.54	15.1	15.9
Nitrate as N	mg/L	8.97	14.5	15.4
Sulfate	mg/L	62.1	138.4	179.7
Chloride	mg/L	70.3	123.4	109.1
Fluoride	mg/L	0.19	0.14	0.24
Boron	mg/L	0.12	0.11	0.09
VOCs	ug/L	ND	ND	ND

[7] Schaefer, D.H. 1979. *Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California*. U.S. Geological Survey Water Resources Investigations 78-118. 37 p.

19. Annual precipitation in the Lucerne Valley region averages about 14 inches.

20. Typically, November through April are considered wet weather, while May through October are considered dry weather months.

21. There are several domestic wells in the vicinity of the irrigation recycled use area and the evaporation/percolation ponds.

22. Water supply to the Big Bear area communities is from numerous groundwater production wells located in Big Bear Valley. TDS in the water supply averages about 280 mg/L based on data reported in the BBARWA's SMRs from 2017 through 2020.

23. BBARWA conducted a geotechnical study referenced as *Geotechnical Study, Irrigation Site, Lucerne Valley Area, San Bernardino County, California for Big Bear Area Regional Wastewater Agency, July 29, 1977,* as an initial investigation of the site for use for irrigation. The report shows that the site is underlain by soils consisting of fine to coarse, clean to silty sands containing various amounts of gravel from 5 to 24 feet below ground surface. Beneath this, to a depth of 60 to 100 feet below ground surface, the soil consists of fine to medium silty sands containing varying amounts of gravel and is locally cemented with calcium carbonate accumulated during deposition of the sediments. Bedrock underlies the older alluvium at a depth of 400 to 600 feet.

Basin Plan, Beneficial Uses, and Regulatory Considerations

24. The Water Quality Control Plan for the Colorado River Basin Region (Basin Plan), adopted on November 17, 1993 and most recently amended on January 8, 2019, designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. Pursuant to Water Code section 13263, subdivision (a), WDRs must implement the Basin Plan and take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of Water Code section 13241.

25. The Facility is located within the Lucerne Hydrologic Unit, and the Basin Plan designates the following beneficial uses for groundwater:

    a. Municipal Supply (MUN),
    b. Industrial Supply (IND), and
    c. Agricultural Supply (AGR).

26. This Order establishes WDRs pursuant to division 7, chapter 4, article 4 of the Water Code for discharges that are not subject to regulation under Clean Water Act section 402 (33 U.S.C. § 1342).

27. These WDRs implement numeric and narrative water quality objectives for groundwater and surface waters established by the Basin Plan and other applicable state and federal laws and policies. The numeric objectives for groundwater designated for municipal and domestic supply include the maximum contaminant levels (MCLs) specified in California Code of Regulations, title 22, section 64421 et seq. Groundwater for use as domestic or municipal water supply (MUN) must not contain taste- or odor-producing substances in concentrations that adversely affect beneficial uses as a result of human activity.

28. It is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. This Order promotes that policy by requiring discharges to meet MCLs designed to protect human health and ensure that water is safe for domestic use.

29. The discharge authorized by this Order, except for discharges of residual sludge and solid waste, are exempt from the solid waste requirements of California Code of Regulations, title 27, section 20005 et seq. This exemption is based on section 20090, subdivisions (a) and (b) of title 27 of the California Code of Regulations, which provides that discharges of domestic sewage or wastewater to land, including but not limited to evaporation ponds, percolation ponds, or subsurface leach fields are not subject to the requirements of title 27 if the following exemption conditions are met:

    a. The applicable regional water board has issued WDRs, reclamation requirements, or waived such issuance;

    b. The discharge is in compliance with the applicable water quality control plan; and

    c. The wastewater does not need to be managed according to chapter 11, division 4.5, title 22 of the California Code of Regulations as a “hazardous waste.”

30. The discharge of waste authorized by these WDRs satisfies the conditions to be exempted from the requirements of title 27 of the California Code of Regulations, because (1) the discharge is regulated by these WDRs; (2) these WDRs will ensure the discharge complies with the Basin Plan; and (3) the discharge will not be of a “hazardous waste.”

31. Consistent with Water Code section 13241, the Regional Water Board, in establishing the requirements contained herein, considered factors including, but not limited to, the following:

a. Past, present, and probable future beneficial uses of water;

b. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;

c. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;

d. Economic considerations;

e. The need for developing housing within the region(s); and

f. The need to develop and use recycled water.

32. Water Code section 13267 authorizes the Regional Water Board to require technical and monitoring reports. The monitoring and reporting requirements in Monitoring and Reporting Program (MRP) R7-2021-0023 are necessary to demonstrate compliance with this Order. The State Water Resources Control Board's (State Water Board's) electronic database, GeoTracker Information Systems, facilitates the submittal and review of monitoring and reporting documents. The burden, including costs, of the MRP bears a reasonable relationship to the need for that information and the benefits to be obtained from that information.

33. Pursuant to Water Code section 13263, subdivision (g), the discharge of waste is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

Antidegradation Analysis

34. State Water Board Resolution 68-16, entitled *Statement of Policy with Respect to Maintaining High Quality Waters in California* (Resolution 68-16), generally prohibits the Regional Water Board from authorizing discharges that will result in the degradation of high quality waters, unless it is demonstrated that any change in water quality will (a) be consistent with maximum benefit to the people of the state, (b) not unreasonably affect beneficial uses, and (c) not result in water quality less than that prescribed in state and regional policies (e.g., the violation of one or more water quality objectives). The discharger must also employ best practicable treatment or control (BPTC) to minimize the degradation of high quality waters. High quality waters are surface waters or areas of groundwater that have a baseline water quality better than required by water quality control plans and policies.

35. Some degradation of groundwater from the discharge to the irrigation recycled use area and the infiltration basins is consistent with Resolution 68-16, provided that the degradation:

a. Is confined to a reasonable area;

b. Is minimized by means of full implementation, regular maintenance, and optimal operation of BPTC measures by the Discharger;

c. Is limited to waste constituents typically encountered in domestic wastewater;

d. Does not unreasonably affect any beneficial uses of groundwater prescribed in the Basin Plan, and will not result in the violation of any water quality objective; and

e. Is consistent with the maximum benefit to the people of the state.

36. Recycled water used for irrigation at the Lucerne Valley Facility is treated to secondary standards and has undergone substantial removal of soluble organic matter, solids, and nitrogen treatment. Constituents in the wastewater effluent that have the potential to degrade groundwater include nitrogen, chloride, sulfate, TDS, and total coliform. Each of these constituents is discussed below:

a. **Nitrogen.** The Primary Maximum Contaminant Level (MCL) found in California Code of Regulations, title 22, section 64431 for nitrate plus nitrite as nitrogen is 10 mg/L. To account for the fate of transport for the various components of total nitrogen, as a conservative value, it is assumed that all nitrogen present converts to nitrate/nitrite. BBARWA's SMRs report an average of 3.9 mg/L for Total Inorganic Nitrogen and 4.9 mg/L for Total Nitrogen between January 2016 and December 2020. BBARWA conducted a study of the groundwater in the vicinity of the recycled water irrigation use site in September 2016 which included an analysis of potential sources of nitrate in the groundwater other than BBARWA recycled water. Some of the sources included onsite farming practices, irrigation and fertilization in excess of plant demands, and potential upgradient sources, such as discharges from individual onsite septic systems. The study found that nitrate concentrations have been increasing in the upgradient groundwater monitoring well but have been decreasing in the downgradient monitoring wells. To verify no degradation due to nitrogen is occurring, this Order requires quarterly total nitrogen and nitrate as nitrogen monitoring in the groundwater monitoring wells. This Order also provides an average monthly effluent limit for total nitrogen of 10 mg/L.

b. **Chloride and Sulfate**. The "recommended" Secondary MCLs in California Code of Regulations, title 22, section 64449 for chloride and sulfate are both 250 mg/L. Concentrations of chloride and sulfate are included in TDS measurements. BBARWA's SMRs report an average of 56 and 40 mg/L for chloride and sulfate, respectively, between January 2016 and December 2020. Additionally, BBARWA's SMRs, for the same time period, report a maximum of 87 and 48 mg/L for chloride and sulfate, respectively.

BBARWA occasionally experience increases in chloride due to the use of salt and brine on local roadways prior to snowstorm events. To evaluate the incremental degradation due to chloride and sulfate, this Order requires quarterly chloride and sulfate monitoring in the groundwater monitoring wells. This Order also provides an average monthly effluent limit of 60 mg/L and a daily maximum effluent limit of 80 mg/L for both chloride and sulfate.

c. **TDS.** The Secondary MCL specified in California Code of Regulations, title 22, section 64449 for TDS ranges between the "recommended" consumer acceptance level of 500 mg/L and the "upper" consumer acceptance level of 1,000 mg/L, if it is neither reasonable nor feasible to provide more suitable waters. The typical incremental addition of dissolved salts from domestic water usage in wastewater treatment plants ranges from 150 to 380 mg/L. Domestic water supply to the Big Bear area communities showed an average concentration of about 280 mg/L based on data reported in the BBARWA's SMRs from 2017 through 2020. From 2016 to December 2020, treated wastewater discharged had an average TDS concentration of approximately 440 mg/L. Thus, the average TDS increase over the domestic water supply in the discharge was about 160 mg/L. Based on the study that the Discharger conducted in September 2016, which analyzed the impacts of groundwater by the discharge, the results would help establish an appropriate effluent limitation for TDS. The study states that the average TDS concentration in the Lucerne Valley Groundwater Basin is closer to 500 mg/L in the vicinity of the discharge location, whereas the Basin as a whole has an average of approximately 1,100 mg/L. Downgradient TDS concentrations in groundwater were found to be equal to or above concentrations of water delivered to the discharge location and the basin-wide average TDS concentration is above that of the delivered water. Therefore, the delivered water is not expected to degrade the existing groundwater quality or limit existing downgradient beneficial uses. To verify there is no degradation due to TDS is occurring, this Order includes quarterly TDS monitoring in the groundwater monitoring wells. This Order also provides an effluent limit for TDS of 550 mg/L over a 12-month period.

d. **Total Coliform.** Secondary treatment reduces fecal coliform densities by 90 to 99%; the remaining organisms in effluent are still 10^5 to 10^6 most probable number (MPN)/100 mL (U.S. Environmental Protection Agency, *Design Manual: Municipal Wastewater Disinfection*, EPA/625/1-86/021, October 1986.) Other sources of *E. Coli* may include residential septic systems and runoff from animal waste, which are both present in the areas surrounding the groundwater monitoring wells. Given the depth to groundwater, which is approximately 125 to 175 feet, it is not likely that pathogen-indicator bacteria will reach groundwater in excess of that prescribed in California Code of Regulations, title 22, section 64426.1, due to significant attenuation and removal in the soils in the vadose zone. To evaluate the potential degradation to groundwater due to pathogens, this

Order includes quarterly *E. coli* monitoring in the groundwater monitoring wells and monthly *E. coli* monitoring in the effluent.

37. The discharge of wastewater from the Facility, as permitted herein, reflects BPTC. The Facility incorporates:

    a. Technology for secondary treated domestic wastewater;

    b. Structural controls to dispose of waste constituents in a designated area;

    c. A network of groundwater monitoring wells;

    d. An operation and maintenance manual;

    e. An Irrigation Management Plan;

    f. Staffing to ensure proper operation and maintenance; and

    g. A standby emergency power generator of sufficient size to operate the treatment plant and ancillary equipment during periods of loss of commercial power.

38. Degradation of groundwater by some of the typical waste constituents associated with discharges from a facility treating domestic wastewater, after effective source control, treatment, and control measures are implemented, is consistent with the maximum benefit to the people of the state. The technology, energy, water recycling, and waste management advantages of regional utility service far exceed any benefits derived from reliance on numerous, concentrated individual wastewater systems, and the impact on water quality will be substantially less. These factors, when taken in conjunction with the associated increase in waste constituents, are consistent with the maximum benefit to the people of the state. Accordingly, the discharge, as authorized, is consistent with the antidegradation provisions of Resolution 68-16 and applicable water quality objectives.

Stormwater

39. Federal regulations for stormwater discharges were promulgated by the U.S. Environmental Protection Agency on November 16, 1990 (40 C.F.R. parts 122, 123, and 124) to implement the Clean Water Act's stormwater program set forth in Clean Water Act section 402, subdivision (p) (33 U.S.C. § 1342(p)). In relevant part, the regulations require specific categories of facilities that discharge stormwater associated with industrial activity to "waters of the United States" to obtain National Pollutant Discharge Elimination System (NPDES) permits and to require control of such pollutant discharges using Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to prevent and reduce pollutants and any more stringent controls necessary to meet water quality standards.

40. The State Water Board adopted Order 2014-0057-DWQ (NPDES No. CAS000001), *General Permit for Storm Water Discharges Associated with Industrial Activities* (Industrial General Permit) on July 1, 2015. Facilities used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage with a design flow of one million gallons per day or more, or that are required to have an approved pretreatment program under 40 Code of Federal Regulations part 403, are required to enroll under the Industrial General Permit, unless there is no discharge of industrial stormwater to waters of the United States.

CEQA and Public Participation

41. Pursuant to California Code of Regulations, title 14, section 15301, the issuance of these WDRs, which govern the operation of an existing facility involving negligible or no expansion of use beyond that previously existing, is exempt from the provisions of the California Environmental Quality Act (CEQA), Public Resources Code section 21000 et seq.

42. The Regional Water Board has notified the Discharger and all known interested agencies and persons of its intent to issue WDRs for this discharge, and has provided them with an opportunity for a public meeting and to submit comments.

43. The Regional Water Board, in a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED that Order R7-2016-0026 is rescinded upon the effective date of this Order, except for enforcement purposes, and, in order to meet the provisions contained in division 7 of the Water Code, and regulations adopted thereunder, the Discharger shall comply with the following:

A. Effluent Limitations

1. Effluent used for irrigation in the recycled use area or discharged into the overflow evaporation/percolation ponds for disposal shall not exceed the following effluent limits:

Table 3. Effluent Limitations

Constituent	Units	Monthly Average	Weekly Average	Daily Maximum
20°C BOD_5	mg/L	30	45	--
Total Suspended Solids	mg/L	30	45	--
Chloride	mg/L	60	--	80

Constituent	Units	Monthly Average	Weekly Average	Daily Maximum
Sulfate	mg/L	60	--	80
Boron	mg/L	--	--	0.75
Total Nitrogen	mg/L	10	--	--

2. The 30-day average daily dry weather discharge for irrigation shall not exceed 4.8 MGD.

3. The hydrogen ion concentration (pH) in the effluent discharge for irrigation shall be maintained within the limits of 6.0 to 9.0 standard units.

4. The TDS concentration of the effluent shall not exceed a 12-month average effluent limit of 550 mg/L. The reported concentration shall be determined by the arithmetic mean of the last twelve months of monitoring.

5. The overflow evaporation/percolation ponds shall be maintained so that they continuously operate in aerobic conditions. The dissolved oxygen content in the upper zone (one foot) of the infiltration basins shall be equal to or greater than 1.0 mg/L.

B. Receiving Water Limitations

1. The discharge of wastewater from the Facility shall not cause groundwater to: exceed applicable water quality objectives; acquire taste, odor, toxicity, or color that create nuisance conditions; impair beneficial uses; or contain constituents in excess of California Maximum Contaminant Levels (MCLs), as set forth in title 22 of the California Code of Regulations (including, but not limited to, section 64426.1 for bacteriological constituents; section 64431 for inorganic chemicals; section 64444 for organic chemicals; and section 64678 for lead and copper).

C. Discharge Prohibitions

1. Discharge of waste classified as “hazardous,” as defined in California Code of Regulations, title 27, section 20164, or “designated,” as defined in Water Code section 13173 and California Code of Regulations, title 27, section 20164, is prohibited.

2. The discharge of treated wastewater at a location other than the designated disposal areas or as recycled water used for irrigation at approved use areas, is prohibited.

3. The discharge of wastewater and/or recycled water to surface waters or surface drainage courses is prohibited.

4. The Discharger shall not accept waste in excess of the design treatment capacity of the Facility's disposal system.

5. Surfacing or ponding of wastewater outside of the designated disposal locations is prohibited.

6. Application of treated wastewater for irrigation in excess of agronomic rates is prohibited.

7. Bypass or overflow of untreated or partially-treated waste is prohibited, except as permitted in Standard Provision E.13.

8. The discharge of wastewater to a location or in a manner different from that described in this Order is prohibited.

9. The discharge of wastewater to land not owned or controlled by the Discharger, or not authorized for such use, is prohibited.

10. The storage, treatment, or disposal of wastes from the Facility shall not cause contamination, pollution, or nuisance as defined in Water Code section 13050, subdivisions (k), (l), and (m).

D. Discharge Specifications

1. The Discharger shall maintain sufficient freeboard in the overflow evaporation/percolation ponds to accommodate seasonal precipitation and to contain a 100-year storm event, but in no case no less than two (2) feet of freeboard (measured vertically). Freeboard shall be utilized for wake and waves of fluid motion and emergency or natural disaster purposes only.

2. All treatment, storage, and disposal areas shall be designed, constructed, operated and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

3. Evaporation/percolation ponds shall have sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, ancillary inflow, and infiltration. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.

4. The evaporation/percolation ponds shall be managed to prevent breeding of mosquitoes. In particular:

a. An erosion control program should ensure that small coves and irregularities are not created around the perimeter of the water surface.

b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.

c. Dead algae, vegetation, and debris shall not accumulate on the water surface.

5. Public contact with wastewater shall be precluded through such means as fences, signs, or other acceptable alternatives.

6. Objectionable odors originating at the Facility shall not be perceivable beyond the property boundary.

7. The evaporation/percolation ponds shall be maintained and operated so as to maximize infiltration and minimize the increase of salinity in the groundwater.

8. Onsite wastes, including windblown spray from recycled water application, shall be strictly confined to the lands specifically designated for the disposal operation, and onsite irrigation practices shall be managed so there is no runoff of effluent from irrigated areas.

9. No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

10. No spray irrigation of any recycled water shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground or schoolyard.

11. Except as allowed under California Code of Regulations, title 17, section 7604, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

12. Undisinfected secondary recycled water, as defined in California Code of Regulations, title 22, section 60301.900, may only be used for irrigation in the following applications:

a. Orchards where the recycled water does not come into contact with the edible portion of the crop;

b. Vineyards where the recycled water does not come into contact with the edible portion of the crop;

c. Non-food bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public);

d. Fodder and fiber crops and pasture for animal not producing milk for human consumption;

e. Seed crops not eaten by humans;

f. Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans; and

g. Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

13. No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with edible portions of food crops eaten raw by humans.

14. The delivery or use of recycled water shall conform with the reclamation criteria contained in California Code of Regulations, title 22 or amendments thereto, for the irrigation of food crops, irrigation of fodder, fiber, and seed crops, landscape irrigation, supply of recreational impoundments, and groundwater recharge.

15. Prior to delivering recycled water to any new user, the Discharger shall submit to the Regional Water Board a report discussing any new distribution system being constructed by the Discharger to provide service to the new user.

16. Recycled water shall not be delivered to any new user who has not first received a discharge permit from the Regional Water Board and approval from the State Water Board’s Division of Drinking Water.

17. Treated or untreated sludge or similar solid waste materials shall be disposed of at locations approved by the Regional Water Board’s Executive Officer.

18. Grazing of sheep on the irrigation site is allowed only under the following conditions, unless otherwise approved by the Regional Water Board 's Executive Officer:

a. Grazing will only be conducted in October or November after the last cutting of hay has been baled;

b. Grazing animals will not be allowed into a portion of the site until 10 days after it was last irrigated;

c. Temporary fences will be erected to contain the grazing animals in an area of 40 acres or less;

d. Only ewes that are about to lamb or ewes with newly born will be grazed;

e. No animals will be sold for slaughter within 90 days after grazing; and

f. No milk produced by sheep that have grazed at the irrigation site shall be used for human consumption.

E. Standard Provisions

1. **Noncompliance.** The Discharger shall comply with all of the terms, requirements, and conditions of this Order and MRP R7-2021-0023. Noncompliance is a violation of the Porter-Cologne Water Quality Control Act (Water Code, § 13000 et seq.) and grounds for: (1) an enforcement action; (2) termination, revocation and reissuance, or modification of these waste discharge requirements; or (3) denial of an Order renewal application.

2. **Enforcement.** The Regional Water Board reserves the right to take any enforcement action authorized by law. Accordingly, failure to timely comply with any provisions of this Order may subject the Discharger to enforcement action. Such actions include, but are not limited to, the assessment of administrative civil liability pursuant to Water Code sections 13323, 13268, and 13350, a Time Schedule Order (TSO) issued pursuant to Water Code section 13308, or referral to the California Attorney General for recovery of judicial civil liability.

3. **Proper Operation and Maintenance.** The Discharger shall at all times properly operate and maintain all systems and components of collection, treatment, and control installed or used by the Discharger to achieve compliance with this Order. Proper operation and maintenance includes, but is not limited to, effective performance, adequate process controls, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities/systems when necessary to achieve compliance with this Order. All systems in service or reserved shall be inspected and maintained on a regular basis. Records of inspections and maintenance shall be retained and made available to the Regional Water Board on request.

4. **Reporting of Noncompliance.** The Discharger shall report any noncompliance that may endanger human health or the environment,

including spills in excess of one thousand (1,000) gallons occurring within the Facility or collection system. Information shall be provided orally to the Regional Water Board office and the Office of Emergency Services within twenty-four (24) hours of when the Discharger becomes aware of the incident. If noncompliance occurs outside of business hours, the Discharger shall leave a message on the Regional Water Board's office voicemail. A written report shall also be provided within five business days of the time the Discharger becomes aware of the incident. The written report shall contain a description of the noncompliance and its cause, the period of noncompliance, the anticipated time to achieve full compliance, and the steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. A final certified report must be submitted through the online GeoTracker system, within 15 calendar days of the conclusion of spill response and remediation. Additional information may be added to the certified report, in the form of an attachment, at any time. All other forms of noncompliance shall be reported with the Discharger's next scheduled Self-Monitoring Report (SMR), or earlier if requested by the Regional Water Board's Executive Officer or if required by an applicable standard for sludge use and disposal.

5. **Duty to Mitigate.** The Discharger shall take all reasonable steps to minimize or prevent any discharge in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment.

6. **Material Changes.** Prior to any modifications which would result in any material change in the quality or quantity of wastewater treated or discharged, or any material change in the location of discharge, the Discharger shall report all pertinent information in writing to the Regional Water Board, and if required by the Regional Water Board, obtain revised requirements before any modifications are implemented.

7. **Design Capacity Report.** The Discharger shall provide a report to the Regional Water Board when it determines that the Facility's average dry-weather flow rate for any month exceeds 80 percent of the design capacity. The report should indicate what steps, if any, the Discharger intends to take to provide for the expected wastewater treatment capacity necessary when the plant reaches design capacity.

8. **Operational Personnel.** The Facility shall be supervised and operated by persons possessing certification of appropriate grade pursuant to section 3680, chapter 26, division 3, title 23 of the California Code of Regulations.

9. **Familiarity with Order.** The Discharger shall ensure that all site-operating personnel are familiar with the content of this Order and maintain a copy of this Order at the site.

10. **Inspection and Entry.** The Discharger shall allow the Regional Water Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter the premises regulated by this Order, or the place where records are kept under the conditions of this Order;

    b. Have access to and copy, at reasonable times, records kept under the conditions of this Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

    d. Sample or monitor at reasonable times, for the purpose of assuring compliance with this Order or as otherwise authorized by the Water Code, any substances or parameters at this location.

11. **Records Retention.** The Discharger shall retain copies of all reports required by this Order and the associated MRP. Records shall be maintained for a minimum of five years from the date of the sample, measurement, report, or application. Records may be maintained electronically. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Regional Water Board's Executive Officer.

12. **Change in Ownership.** This Order is not transferable to any person without written approval by the Regional Water Board's Executive Officer. Prior to any change in ownership of this operation, the Discharger shall notify the Regional Water Board's Executive Officer in writing at least 30 days in advance. The notice must include a written transfer agreement between the existing owner and the new owner. At a minimum, the transfer agreement must contain a specific date for transfer of responsibility for compliance with this Order and an acknowledgment that the new owner or operator is liable for compliance with this Order from the date of transfer. The Regional Water Board may require modification or revocation and reissuance of this Order to change the name of the Discharger and incorporate other requirements as may be necessary under the Water Code.

13. **Bypass.** Bypass (i.e., the intentional diversion of waste streams from any portion of the treatment facilities, except diversions designed to meet variable effluent limits) is prohibited. The Regional Water Board may take enforcement action against the Discharger for bypass unless:

    a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment

facilities that causes them to be inoperable, or substantial and permanent loss of natural resources reasonably expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in fee collection; and

b. There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities or retention of untreated waste. This condition is not satisfied if adequate back-up equipment was not installed to prevent bypass occurring during equipment downtime, or preventative maintenance; or

c. Bypass is (1) required for essential maintenance to ensure efficient operation; (2) neither effluent nor receiving water limitations are exceeded and (3) the Discharger notifies the Regional Water Board ten (10) days in advance.

In the event of an unanticipated bypass, the Discharger shall immediately report the incident to the Regional Water Board. During non-business hours, the Discharger shall leave a message on the Regional Water Board's office voicemail. A written report shall be provided within five (5) business days after the Discharger is aware of the incident. The written report shall include a description of the bypass, any noncompliance, the cause, period of noncompliance, anticipated time to achieve full compliance, and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

14. **Backup Generators.** Standby, power generating facilities shall be available to operate the Facility during a commercial power failure.

15. **Format of Technical Reports.** The Discharger shall furnish, under penalty of perjury, technical monitoring program reports, and such reports shall be submitted in accordance with California Code of Regulations, title 23, division 3, chapter 30, as raw data uploads electronically over the Internet into the State Water Board's GeoTracker database. Documents that are normally mailed by the Discharger to the Regional Water Board, such as regulatory documents, narrative monitoring reports or materials, and correspondence, shall also be uploaded into GeoTracker in the appropriate Microsoft Office software application format, such as Word or Excel files, or as a Portable Document Format (PDF) file. Large documents must be split into appropriately-labelled, manageable file sizes and uploaded into GeoTracker.

16. **Qualified Professionals.** In accordance with Business and Professions Code sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of California registered professionals (i.e., civil engineer, engineering geologist, geologist, etc.) competent and proficient in the fields pertinent to

the required activities. All technical reports required under this Order that contain work plans, describe the conduct of investigations and studies, or contain technical conclusions and recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately-qualified professional(s), even if not explicitly stated. Each technical report submitted by the Discharger shall contain a statement of qualifications of the responsible licensed professional(s) as well as the professional's signature and/or stamp of the seal. Additionally, all field activities are to be conducted under the direct supervision of one or more of these professionals.

17. **Certification Under Penalty of Perjury.** All technical reports required in conjunction with this Order shall include a statement by the Discharger, or an authorized representative of the Discharger, certifying under penalty of perjury under the laws of the State of California, that the reports were prepared under his or her supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted, and that based on his or her inquiry of the person or persons who manage the system, the information submitted is, to the best of his or her knowledge and belief, true, complete, and accurate.

18. **Violation of Law.** This Order does not authorize violation of any federal, state, or local laws or regulations.

19. **Property Rights.** This Order does not convey property rights of any sort, or exclusive privileges, nor does it authorize injury to private property or invasion of personal rights.

20. **Modification, Revocation, Termination.** This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for an Order modification, rescission, or reissuance, or the Discharger’s notification of planned changes or anticipated noncompliance, does not stay any Order condition. Causes for modification include, but are not limited to, the violation of any term or condition contained in this Order, a material change in the character, location, or volume of discharge, a change in land application plans or sludge use/disposal practices, or the adoption of new regulations by the State Water Board, Regional Water Board (including revisions to the Basin Plan), or federal government.

21. **Severability.** The provisions of this Order are severable. If any provision of this Order is found invalid, the remainder of these requirements shall not be affected.

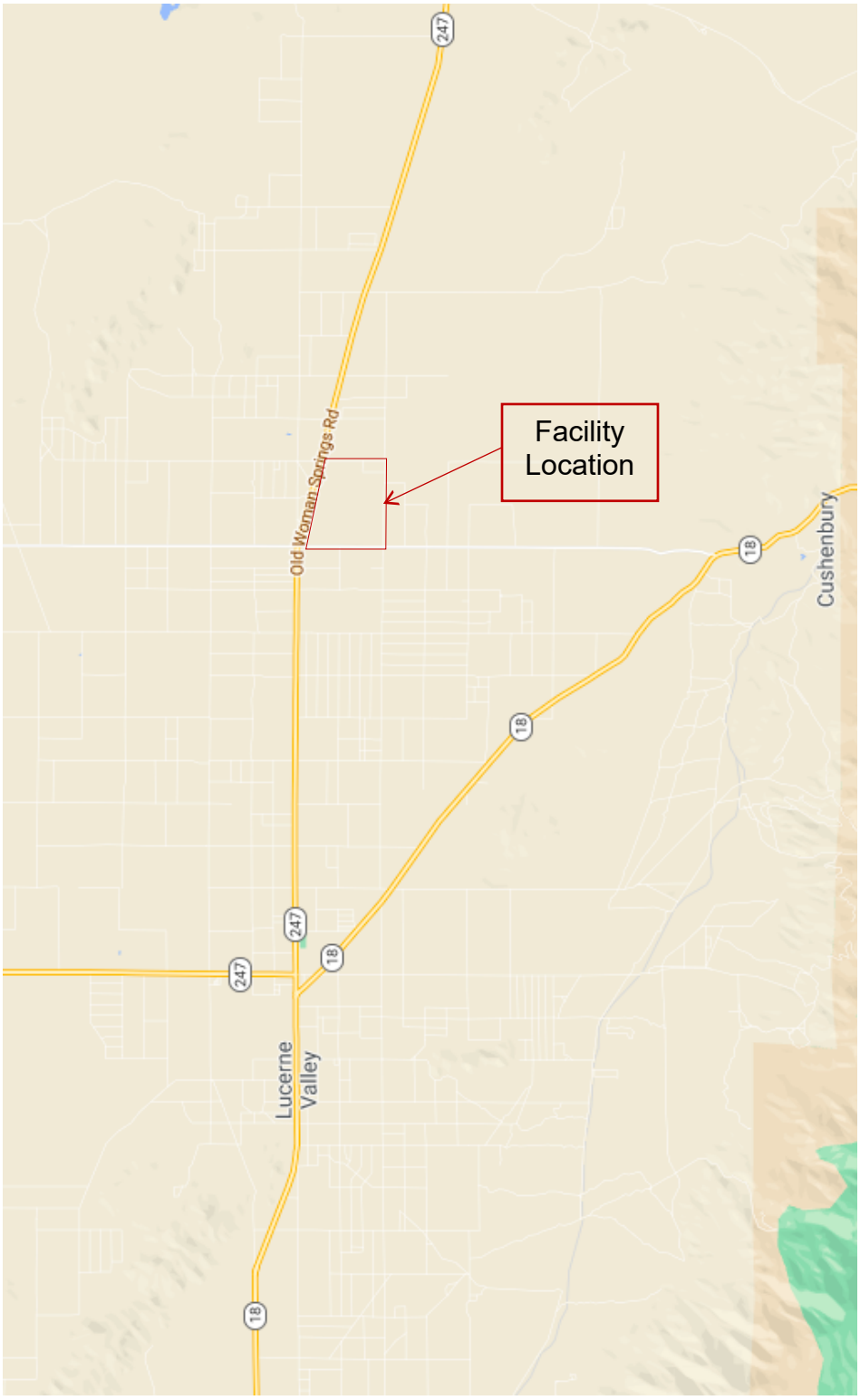
Any person aggrieved by this Regional Water Board action may petition the State Water Board for review in accordance with Water Code section 13320 and California Code of Regulations, title 23, section 2050 et seq. The State Water

Board must receive the petition by 5:00 p.m. on the 30th day after the date of this Order; if the 30th day falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the statutes and regulations applicable to filing petitions are available on the State Water Board's website and can be provided upon request.

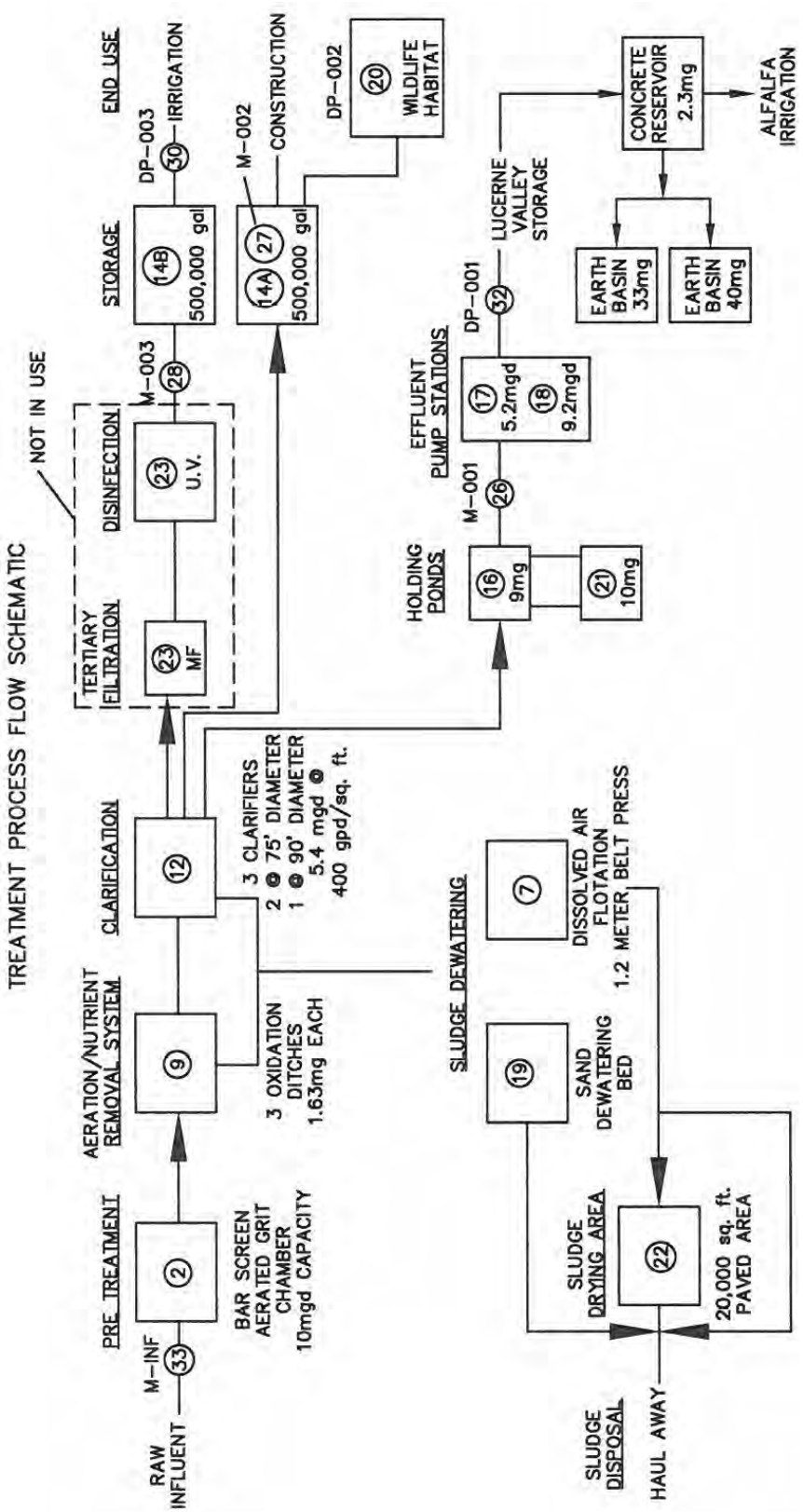
Order Attachments

Attachment A—Vicinity Map
Attachment B—Process Flow Diagram
Attachment C—Lucerne Valley Facility Layout
Monitoring and Reporting Program R7-2021-0023

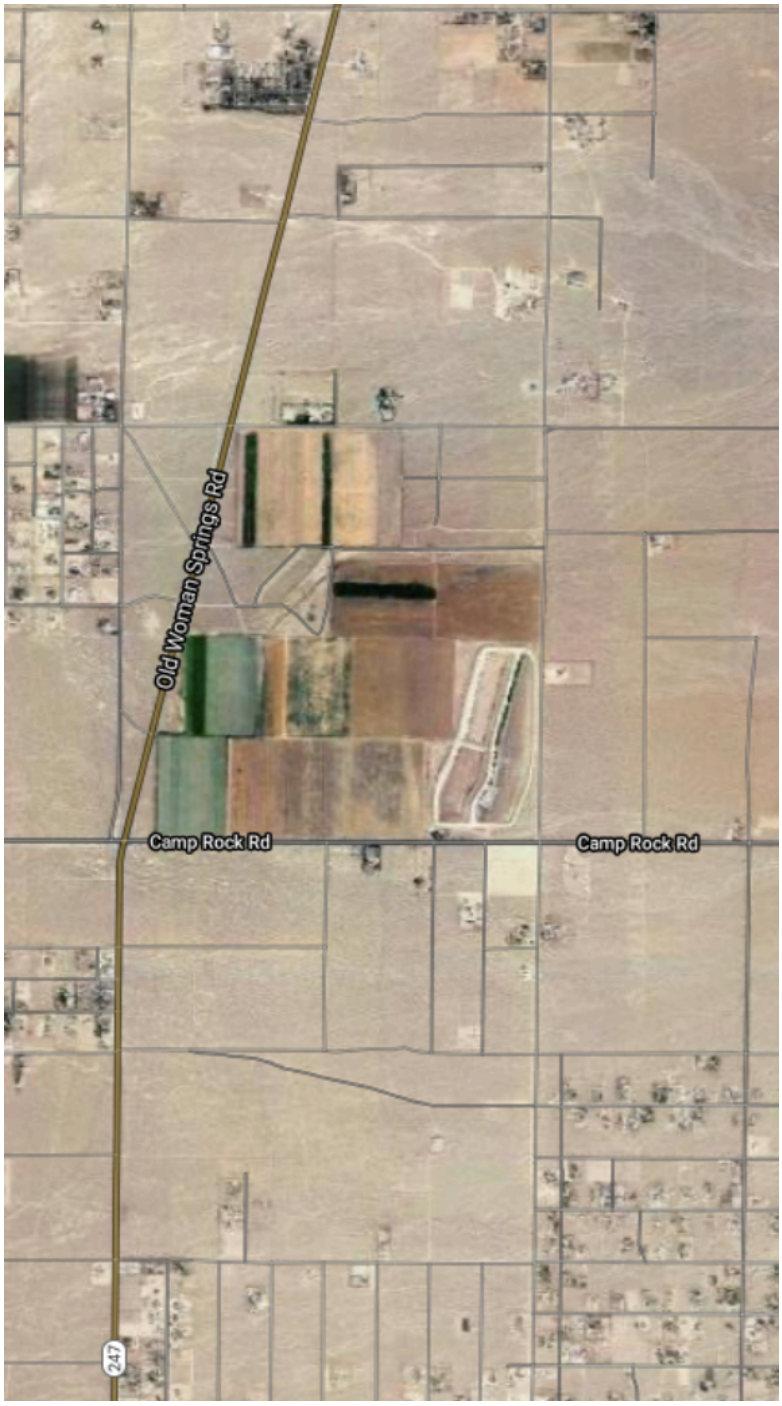
ATTACHMENT A—VICINITY MAP



ATTACHMENT B—PROCESS FLOW DIAGRAM



ATTACHMENT C—LUCERNE VALLEY FACILITY LAYOUT



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN

MONITORING AND REPORTING PROGRAM R7-2021-0023
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
LUCERNE VALLEY-SAN BERNARDINO COUNTY

This Monitoring and Reporting Program (MRP) is issued pursuant to Water Code section 13267 and describes requirements for monitoring the relevant wastewater system and groundwater quality. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Regional Water Board or its Executive Officer.

The Discharger owns and operates the wastewater treatment system that is subject to Order R7-2021-0023. The reports required herein are necessary to ensure that the Discharger complies with the Order. Pursuant to Water Code section 13267, the Discharger shall implement the MRP and shall submit monitoring reports described herein.

A. Sampling and Analysis General Requirements

1. **Testing and Analytical Methods.** The collection, preservation, and holding times of all samples shall be in accordance with U.S. Environmental Protection Agency (USEPA)-approved procedures. All analyses shall be conducted in accordance with the latest edition of either the USEPA's *Guidelines Establishing Test Procedures for Analysis of Pollutants Under the Clean Water Act* (40 C.F.R. part 136) or *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium* (SW-846), unless otherwise specified in the MRP or approved by the Regional Water Board's Executive Officer.

2. **Laboratory Certification.** All analyses shall be conducted by a laboratory certified by the State Water Board, Division of Drinking Water's Environmental Laboratory Accreditation Program (ELAP), unless otherwise approved by the Regional Water Board's Executive Officer.

3. **Reporting Levels.** All analytical data shall be reported with method detection limits (MDLs) and with either the reporting level or limits of quantitation (LOQs) according to 40 Code of Federal Regulations part 136, Appendix B. The laboratory reporting limit for all reported monitoring data shall be no greater than the practical quantitation limit (PQL).

4. **Sampling Location(s).** Samples shall be collected at the location(s) specified in the WDRs. If no location is specified, sampling shall be conducted at the most representative sampling point available.

5. **Representative Sampling.** All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the chain of custody form for the sample. If composite samples are collected, the basis for sampling (time or flow weighted) shall be approved by Regional Water Board staff.

6. **Instrumentation and Calibration.** All monitoring instruments and devices used by the Discharger shall be properly maintained and calibrated to ensure their continued accuracy. Any flow measurement devices shall be calibrated at least once per year to ensure continued accuracy of the devices. In the event that continuous monitoring equipment is out of service for a period greater than 24 hours, the Discharger shall obtain representative grab samples each day the equipment is out of service. The Discharger shall correct the cause(s) of failure of the continuous monitoring equipment as soon as practicable. The Discharger shall report the period(s) during which the equipment was out of service and if the problem has not been corrected, shall identify the steps which the Discharger is taking or proposes to take to bring the equipment back into service and the schedule for these actions.

7. **Field Test Instruments.** Field test instruments (such as those used to test pH, dissolved oxygen, and electrical conductivity) may be used provided that:

    a. The user is trained in proper use and maintenance of the instruments;

    b. The instruments are field calibrated prior to monitoring events at the frequency recommended by the manufacturer;

    c. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and

    d. Field calibration reports are submitted.

8. **Records Retention.** The Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, for a minimum of five (5) years from the date of the sampling or measurement. This period may be extended by request of the Regional Water Board's Executive Officer at any time. Records of monitoring information shall include:

a. The date, exact place, and time of sampling or measurement(s);

b. The individual(s) who performed the sampling or measurement(s);

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or method used; and

f. All sampling and analytical results, including:

i. units of measurement used;

ii. minimum reporting limit for the analyses;

iii. results less than the reporting limit but above the method detection limit (MDL);

iv. data qualifiers and a description of the qualifiers;

v. quality control test results (and a written copy of the laboratory quality assurance plan);

vi. dilution factors, if used; and

vii. sample matrix type.

9. **Inoperative Facility.** If the Facility is not in operation, or there is no discharge during a required reporting period, the Discharger shall forward a letter to the Regional Water Board indicating that there has been no activity during the required reporting period.

B. Effluent Monitoring

1. Representative samples of the undisinfected secondary recycled water shall be taken at the WWTP. The samples shall be analyzed for the following constituents and according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Irrigation Flow	MGD	Flow Meter Reading	Daily	Monthly

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
20°C BOD_5[8]	mg/L	24 Hr. Composite	2x/Month	Monthly
Total Suspended Solids (TSS)	mg/L	24 Hr. Composite	2x/Month	Monthly
pH	s.u.[9]	Grab	Daily	Monthly
Dissolved Oxygen[10]	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids (TDS)	mg/L	24 Hr. Composite	Monthly	Monthly
Sulfate	mg/L	24 Hr. Composite	Monthly	Monthly
Chloride	mg/L	24 Hr. Composite	2x/Month	Monthly
Fluoride	mg/L	24 Hr. Composite	Monthly	Monthly
Nitrate as N	mg/L	24 Hr. Composite	Monthly	Monthly
Total Nitrogen	mg/L	24 Hr. Composite	Monthly	Monthly
E. Coli	MPN/100mL[11]	Grab	Monthly	Monthly
Volatile Organic Compounds (VOCs)	µg/L[12]	24 Hr. Composite	Annually	Annually

[8] 5-Day Biochemical Oxygen Demand at 20 degrees Celsius.

[9] Standard pH units

[10] Dissolved Oxygen shall be monitored at the upper one-foot layer of the storage or percolation ponds.

[11] Most Probable Number per 100 milliliters.

[12] Micrograms per liter

C. Overflow Pond Monitoring

1. During months when the overflow evaporation/percolation ponds are not used, the Discharger shall report that there has been no activity. During months when the overflow evaporation/percolation ponds are in use, the ponds shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Flow	MGD	Flow Measurement	Daily	Monthly
Dissolved Oxygen	mg/L	Grab	2x/Month	Monthly
pH	s.u.	Grab	2x/Month	Monthly
Total Dissolved Solids	mg/L	Grab	2x/Month	Monthly
Freeboard	ft	Measurement	2x/Month	Monthly

D. Domestic Water Supply Monitoring

1. The domestic water supply shall be a flow weighted composite sample monitored at the water supply production wells in Big Bear Valley and include notations of which wells are non-operating for a reporting period and monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Total Dissolved Solids	mg/L	Grab	Quarterly	Quarterly
General Minerals[13]	mg/L	Grab	Annually	Annually

[13] General Minerals shall include: total dissolved solids, calcium, chloride, fluoride, iron, magnesium, manganese, nitrate, potassium, sodium, sulfate, barium, total alkalinity (including alkalinity series), and hardness.

E. Groundwater Monitoring

1. The groundwater monitoring wells shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Depth to Groundwater	ft (msl)[14]	Measurement	Quarterly	Quarterly
Groundwater Gradient[15]	NA	Direction	Quarterly	Quarterly
Total Nitrogen	mg/L	Grab	Quarterly	Quarterly
Nitrate as N	mg/L	Grab	Quarterly	Quarterly
Chloride	mg/L	Grab	Quarterly	Quarterly
Fluoride	mg/L	Grab	Quarterly	Quarterly
Sulfate	mg/L	Grab	Quarterly	Quarterly
E. Coli	MPN/100mL	Grab	Quarterly[16]	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly	Quarterly
Boron	mg/L	Grab	Quarterly	Quarterly
VOCs	μg/L	Grab	Annually	Annually

F. Reporting Requirements

1. Daily, weekly, and monthly monitoring shall be included in the Monthly Self-Monitoring Reports (SMRs). Monthly SMRs shall be submitted by the **15th day of the following month.** Quarterly SMRs shall be submitted by

[14] Above mean sea level.

[15] Groundwater flow direction.

[16] After two years of groundwater monitoring that show consistent negligible impacts to groundwater, the Discharger may request to have the monitoring schedule revised with Executive Officer approval.

January 15th, April 15th, July 15th, and October 15th. Annual SMRs shall be submitted by **January 31st** of the following year.

2. SMRs shall include, at a minimum, the following:

   a. **Cover Letter.** A transmittal letter summarizing the essential points in the report.

   b. **Maps.** Maps depicting the Facility layout and the location of sampling points.

   c. **Summary of Monitoring Data.** Tables of the data collected. The tables shall include all of the data collected to-date at each monitoring point, organized in chronological order, with the oldest data in the top row and progressively newer data in rows below the top row. Each row shall be a monitoring event and each column shall be a separate parameter at a single location (or a single average, as appropriate).

   d. **Graphical Display.** Graphs depicting monitoring parameters through time, with the concentrations being the y-axis and time being the x-axis. Logarithmic scales can be used for values that vary by orders of magnitude. Individual graphs can combine multiple locations or multiple chemicals if that allows the data to be compared more easily.

   e. **Compliance Summary.** Identification of any violations found since the last report was submitted, and actions taken or planned for correcting each violation. If the Discharger previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. If no violations have occurred since the last submittal, this shall be stated.

3. SMRs shall be certified under penalty of perjury to be true and correct. Each SMR submitted to the Regional Water Board shall contain the following completed declaration:

   “I declare under the penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

   Executed on the _____day of _____ at _____

_____(Signature)

_____(Title)"

4. The SMRs and any other information requested by the Regional Water Board shall be signed by a principal executive officer or ranking elected official. A duly authorized representative of the Discharger may sign the documents if:

    a. The authorization is made in writing by the person described above;

    b. The authorization specified an individual or person having responsibility for the overall operation of the regulated disposal system; and

    c. The written authorization is submitted to the Regional Water Board's Executive Officer.

5. The results of any analysis taken more frequently than required at the locations specified in this MRP shall be reported to the Regional Water Board.

6. As specified in Standard Provision F.15, technical reports shall be prepared by or under the direction of appropriately qualified professional(s). Each technical report submitted shall contain a statement of qualification of the responsible licensed professional(s) as well as the professional's signature and/or stamp of the seal.

7. As specified in Standard Provision F.14, the Discharger shall comply with Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under MRP R7-2021-0023 and any future revision(s) hereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and PDF monitoring reports to the State Water Board's Geotracker database. Documents too large to be uploaded into Geotracker should be broken down into smaller electronic files and labelled properly prior to uploading into Geotracker.

APPENDIX B: BIG BEAR LAKE ANALYSIS: REPLENISH BIG BEAR

BIG BEAR LAKE ANALYSIS: REPLENISH BIG BEAR
FINAL REPORT

Michael A. Anderson, Ph.D.
Riverside, CA

January 21, 2021

Acknowledgement of Credit

This report is financed under the Water Quality, Supply and Infrastructure Improvement Act of 2014, administered by State of California, Department of Water Resources.

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EXECUTIVE SUMMARY

Big Bear Lake is an important natural resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland Southern California region. As with all other natural and man-made lakes in Southern California, the lake is subject to dramatic variability in water surface elevation; surface elevations reached as low as -48.5 feet (ft) relative to dam crest (72.33 ft maximum depth) in November 1961, corresponding to a volume of less than 1,000 acre-feet (af) and a lake surface area on the order of 200-300 acres during the extended drought in the late 1950's and early 1960's. Big Bear Municipal Water District (BBMWD) was subsequently formed in 1964 to manage and help stabilize the water level in Big Bear Lake. The region's natural hydrology includes severe protracted droughts and is influenced by the Pacific Decadal Oscillation (PDO) and El Nino-La Nina climate systems, which makes lake level stabilization a tremendous challenge. This wide variability in lake level, in turn, can have significant impacts on beneficial uses of the lake. Monitoring data collected primarily by the Big Bear City Community Services District (BBCCSD), BBMWD, and the Big Bear Lake Nutrient Total Maximum Daily Load (TMDL) group over the past decade underscore both the variability in regional hydrology and lake levels, and the consequences of extended periods of low runoff on water quality conditions. To minimize the impacts of frequent droughts, Replenish Big Bear was developed to recover and use a water resource currently discharged outside of the watershed.

This study assessed the overall conditions, ecological health and water quality in Big Bear Lake, and evaluated the potential influence on lake health of Replenish Big Bear. Three treatment alternative strategies (Treatment Alternatives), composed of advanced nutrient removal and reverse osmosis (RO) technologies, were evaluated:

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO (in addition to TIN & TP Removal)
(iii) Alternative 3: 100% RO (in addition to TIN & TP Removal)

This study included an analysis of available water quality data, development of a 2-D hydrodynamic-water quality model (CE-QUAL-W2), and application of the model to evaluate lake conditions with Replenish Big Bear that focused on the period from 2009-2019. This period was selected based upon a number of factors, including the wide range of hydrologic and water quality conditions in the lake, and availability of extensive lake monitoring and meteorological data, as well as some watershed monitoring data. Model simulations from 2020-2050 were also conducted to assess possible future conditions in Big Bear Lake under different hydrologic scenarios and Replenish Big Bear discharge alternatives. The routing of Replenish Big Bear water through Stanfield Marsh was also explored in greater detail to provide better understanding of the possible role of the marsh in nutrient attenuation.

Analysis of Water Quality Data

To augment the water quality information provided in the TMDL annual reports, additional conventional statistical and advanced machine learning analyses were conducted. Analyses focused on chlorophyll-a as the key response variable. The ratio of total nitrogen (total N) to total phosphorus (total P), often used to identify nutrient limitation, confirm P-limitation principally in place regulating algal production. Correlations developed between total P, total N, total inorganic N (TIN) and chlorophyll-a for each of the 4 TMDL sampling stations (n=150 for each station) indicate relatively weak correlations with nutrient concentrations (e.g., R^2-values of 0.08, 0.19, 0.21 and 0.31 between chlorophyll-a and total P for TMDL stations #1, 2, 6 and 9, respectively). R^2 values quantify the variance in dependent variable (chlorophyll-a) captured with the independent variable (e.g. total P), so it is clear that phytoplankton levels are a more complex function of conditions in the lake. Slightly higher R^2 values were in fact noted with total N (R^2=0.22-0.53), while chlorophyll-a was uncorrelated with TIN. Concentration of chlorophyll-a was also relatively weakly correlated with TDS and lake level; multiple linear regression (MLR) using all these variables yielded R^2-values of 0.31-0.55 depending upon TMDL sampling station.

Since significant portions of variance in observed chlorophyll-a concentrations remained uncaptured using MLR, machine learning was also evaluated. Machine learning, which is starting to be used in water quality applications, is often able to more effectively elucidate trends in complex datasets. Random forest and gradient-boosted regressor algorithms applied to TMDL station #1 data using day of year, lake level, TDS concentration and windspeed were able to capture most (0.92-0.96) of the observed variance in chlorophyll-a for the 10-yr 2009-2018 training set, notably without considering concentrations of total N or total P. For comparison, MLR using this same set of independent variables captured 0.43 of variance in observed chlorophyll-a concentrations. The gradient-boosted regressor model also demonstrated strong forecasting power, capturing 0.73 of variance in predicted chlorophyll-a concentrations of the 2019 data set (compared with 0.36 for the equivalent MLR model). Statistical analyses highlighted that multiple factors regulate chlorophyll-a concentrations in complex ways; machine learning was able to identify relationships and develop regressor models that reproduced and forecasted concentrations of chlorophyll-a with considerable accuracy.

Water column profile data were also used to quantify rates of internal nutrient recycling and areal hypolimnetic oxygen demand (AHOD). Internal nutrient recycling rates have been measured on a limited number of dates since 2002 using the laboratory core-flux method, while AHOD has not previously been measured at the lake. The *in situ* hypolimnetic mass balance approach using measured water column concentrations of ammonium as N (NH_4-N) and orthophosphate as P (PO_4-P) yielded recycling rates for 2010-2011 and 2015-2017 that were similar to previously measured values confirming the importance of nutrient recycling in lake biogeochemistry and nutrient budgets, and establishing the reliability of alum treatments in suppressing PO_4-P release. The analysis also yielded *in situ* estimates of early summer AHOD rates at TMDL station #1 of approximately 0.5 $g/m^2/d$.

Development of 2-D Hydrodynamic-Water Quality Model

A 2-D (longitudinal-vertical) hydrodynamic -water quality model for Big Bear Lake was developed using CE-QUAL-W2. The model quantifies heat and water budgets, 2-D hydrodynamics, and predicts concentrations of nutrients, dissolved oxygen (DO), chlorophyll-a and other parameters. The 2-D (longitudinal-vertical) representation assumes the primary gradients in water column properties and water quality are in the vertical and longitudinal directions, and well-mixed in the lateral direction; model branches were added for embayments that allow a quasi-3-D representation of the lake. The model requires extensive bathymetric, hydrologic, meteorological, water quality, and other data. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006). Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Big Bear Water Master reports. Hourly meteorological conditions were taken from Big Bear Airport and California Irrigation Management Information System (CIMIS) Station #199 located at the golf course. Data included solar shortwave radiation, air temperature, dewpoint temperature, windspeed, wind direction and cloud cover. Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and DO, and laboratory analyses of water samples collected at the lake for 2009-2019. The model was first developed and calibrated for lake level, water column temperature profiles and TDS, where generally very good agreement was achieved (mean absolute errors of 3.6 cm, 0.79-0.89 °C, and 11.9 mg/L, respectively).

Following this, model calibration to water quality data was conducted. The model included external nutrient loading from the watershed, atmospheric deposition, internal nutrient recycling, and nutrient uptake and release associated with macrophyte and epiphyton growth, senescence and death. Two algal groups were simulated, included one representing cyanobacteria capable of N_2-fixation. The 1st-order dynamic sediment model was combined with the 0th-order SOD model to simulate nutrient recycling and DO uptake in the surficial bottom sediments. Relative root mean square error was 17.7% for total P, 18.0% for total N, 29.5% for TIN, and 24.0 % for chlorophyll-a. Mean absolute errors for DO ranged from 1.02 – 1.40 mg/L for the 4 TMDL sampling stations.

Application of Model to Evaluate Conditions with Replenish Big Bear

The model was then used to predict conditions in Big Bear Lake from 2009-2019 that would reasonably be expected with water from Replenish Big Bear delivered to the lake. Supplementation of natural flows with 1,920 af/yr of Replenish Big Bear water adds about 0.2 meter (m) annually to the lake relative to levels observed in 2009-2019 (baseline), and which accrues over time such that the lake was predicted to be 1.7 m higher in late 2018 compared to the level present at that time. Supplementation also increased predicted lake volumes and surface areas, with lake area about 300 acres (16%) larger in late 2018 compared with actual area (approximately 2,200 acres vs 1,900 acres, respectively). TDS levels in the lake were strongly influenced by level of treatment and TDS concentrations in the Replenish Big Bear water; Alternative 1 water with TIN and total P removal was projected to have a TDS of 450 mg/L, while addition of RO to further treat 70% and 100% of the water (Alternatives 2 and 3) was assumed

to reduce effluent TDS to 150 and 50 mg/L, respectively. Addition of 1,920 af/yr of Alternative 1 water significantly increased TDS levels in the lake, increasing average predicted TDS from 251 mg/L for the baseline (natural) condition for 2009-2019 to 300 mg/L, while Alternatives 2 and 3 were predicted to yield lower average TDS concentrations of 244 and 226 mg/L, respectively. Exceedance of the TDS water quality objective of 175 mg/L was predicted to occur 97.6% of the time for both the baseline condition and for Alternative 2, while exceedance frequency increased to 100% for Alternative 1 and was reduced to 93.3% for Alternative 3.

Nutrient concentrations in the Replenish Big Bear water also varied markedly with treatment, with total N and total P concentrations in Alternative 1 effluent being about 6-9 times higher than median watershed concentrations, while effluent concentrations in Alternative 2 were projected to be 1.8-2.3 times larger and Alternative 3 being about 0.4-0.8 times that of median watershed values. The increased nutrient loading from Alternative 1 had a strongly detrimental effect on water quality, increasing average concentrations over 2009-2019 baseline of total N by about 50%, total P by 70%, and chlorophyll-a by 300%. In comparison, further treatment of effluent with RO yielded average concentrations comparable to (Alternative 2) or slightly improved (Alternative 3) relative to the baseline (natural no-project) condition.

Predicted Long-Term Future Conditions with Replenish Big Bear

Simulations for 2009-2019 were extended to 2050 to evaluate possible long-term conditions in the lake under natural hydrologic variability with and without supplemental water from Replenish Big Bear. Since detailed meteorological and hydrological conditions for the future are not known *a priori*, existing meteorological and flow data for 2009-2019 were used as the basis for forecasts. 2009-2019 included extreme ranges in rainfall, runoff and air temperatures; assuming this range is broadly representative of likely future meteorological and hydrologic conditions, Monte Carlo techniques were used to randomly select 100 different 30 year annual records from this set of data. From these 100 different hydrologic scenarios, the 5th-, 50th- and 95th-percentile 30 year average annual flow records and corresponding meteorological conditions were used as temporal boundary conditions for predictions of future conditions in the lake. The 5th-percentile corresponds to an average inflow rate of 8,646 af/yr and represents extended drought, while the 50th-percentile (median) corresponds to intervals of high runoff and drought (average annual inflow of 10,595 af/yr) comparable to 2009-2019, and the 95th-percentile represents a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr). (Note that since precipitation and runoff are log-normally distributed, the above arithmetic mean values understate the range in runoff within the simulation intervals; that is, a single high runoff year can significantly skew upward average values during a period of protracted drought.)

Supplementation with Replenish Big Bear was also predicted to increase average long-term (2009-2050) conditions in the lake that varied under the 3 hydrologic scenarios. Under the 50th-percentile hydrologic scenario, Replenish Big Bear was predicted to increase average lake level by 1.5 m, lake volume by nearly 13,000 af, and lake area by 260 acres relative to the predicted long-term baseline (no-project) condition. Water quality varied with level of treatment, with Alternative 1 nearly doubling predicted long-term average concentrations of TDS, total P and

total N and quadrupling average predicted chlorophyll-a levels. Long-term simulations indicate slight increases in average TDS, total P and total N and modest increase in chlorophyll-a for Alternative 2, and generally slight reductions or no significant change in concentrations with Alternative 3. Supplementation was predicted to have more substantial effects under the 5th-percentile runoff scenario, with increased average lake level of 3.4 m, increased volume of 16,104 af, and an additional average 638 surface acres (about 40% increase) relative to baseline. As with the median runoff scenario, supplementation with Alternative 1 effluent substantially degraded water quality, while further treatment (Alternatives 2 and 3) was predicted to result in comparable or slightly improved water quality in the lake. Effects of Replenish Big Bear were more muted at the 95th-percentile runoff scenario, when supplementation is less important, owing to the lower overall contributions of water and TDS and nutrients relative to the watershed.

Routing of Supplemental Water Through Stanfield Marsh

Simulations with Replenish Big Bear involved routing of effluent through Stanfield Marsh, where some nutrient uptake could be expected. Simulations indicate net removal of total P through the Marsh with Alternative 1 and Alternative 2 effluent, while simulations predicted that the Marsh would be a modest source of total P to Alternative 3 water with very low influent concentrations. Interestingly, the Marsh was predicted to be a source of total N across all levels of treatment, due to sediment decay, and some N_2-fixation and subsequent decay in response high PO_4-P concentrations and high TN:TP ratios in the effluent. Further work is needed, however, to better understand the role of the Marsh as a net sink and/or source for nutrients.

Summary

Lake conditions and water quality in Big Bear Lake varied significantly over 2009-2019, with wide variations in lake level, volume and surface area, as well as concentrations of TDS, nutrients and chlorophyll-a. Statistical, machine learning and hypolimnetic mass balance analyses provided valuable new information about water quality in Big Bear Lake, while CE-QUAL-W2 was able to reproduce observed trends in lake conditions. Supplementation of natural runoff with Replenish Big Bear water significantly increased lake levels, volumes and surface areas, especially during periods of drought, with resulting recreational, aesthetic, community and related benefits. The level of treatment had dramatic effects on water quality, however. Nutrient removal (Alternative 1) was not sufficient to protect water quality, although nutrient removal with further treatment (Alternatives 2 and 3) was predicted to yield water quality comparable to or slightly improved relative to baseline conditions.

I. INTRODUCTION AND STUDY OBJECTIVES

The Replenish Big Bear Team, a collaborative regional water resources program being implemented by Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD) and the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), engaged Professor Emeritus Michael A. Anderson (Dr. Anderson), who has in-depth knowledge of the Big Bear Lake (Lake), to evaluate the Lake water quality conditions and assess the potential impacts of the Replenish Big Bear project. This study was prepared in response to the Santa Ana Regional Water Quality Control Board (Santa Ana Water Board) staff's need to have a better understanding of the Lake's health to consider approving a discharge above current Basin Plan water quality objectives (WQOs) or the Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions.

This study assesses the overall conditions, ecological health, and water quality in Lake, and evaluates the potential influence on lake health of three treatment alternative strategies (Treatment Alternatives) to supplement the natural water supply to the lake. These Treatment Alternatives are composed of advanced nutrient removal and reverse osmosis (RO) technologies:

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO(70% RO + 30% TIN & TP Removal)
(iii) Alternative 3: 100% RO

A. Project Background

Replenish Big Bear was developed in an effort to help protect Big Bear Valley (Valley) and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. Replenish Big Bear is comprised of three independent projects, which will be implemented separately in the following progression, as practicable:

- Effluent discharge to Stanfield Marsh (and subsequently to the Lake) and Shay Pond;
- Use of Lake water for landscape irrigation of the local golf course; and
- Use of Lake water for groundwater recharge in Sand Canyon.

The first project, and primary regulatory driver, includes treatment upgrades at the BBARWA wastewater treatment plant (WWTP) to produce highly treated effluent for discharge to Shay Pond and Stanfield Marsh, which flows into the lake. This study evaluates the water quality in the lake and assesses impacts of discharge through Stanfield Marsh. For redundancy purposes, BBARWA is also seeking to maintain its current discharge location in Lucerne Valley, where undisinfected secondary effluent is currently conveyed to irrigate crops used for livestock feed. These new discharge points will allow BBARWA to minimize discharge of treated effluent outside of the watershed, which will increase Lake levels to better support beneficial uses including recreation and habitat, particularly in times of drought. Additionally, discharge to Shay Pond will replace potable water currently discharged to maintain the water flow through the pond. Figure

1 shows the project components for this first project, which is referred to as the effluent discharge project.

The other two projects will utilize lake water for (i) landscape irrigation at the local golf course to achieve in lieu recharge of the groundwater basin and (ii) direct groundwater recharge in Sand Canyon. These projects are not planned for any time soon.

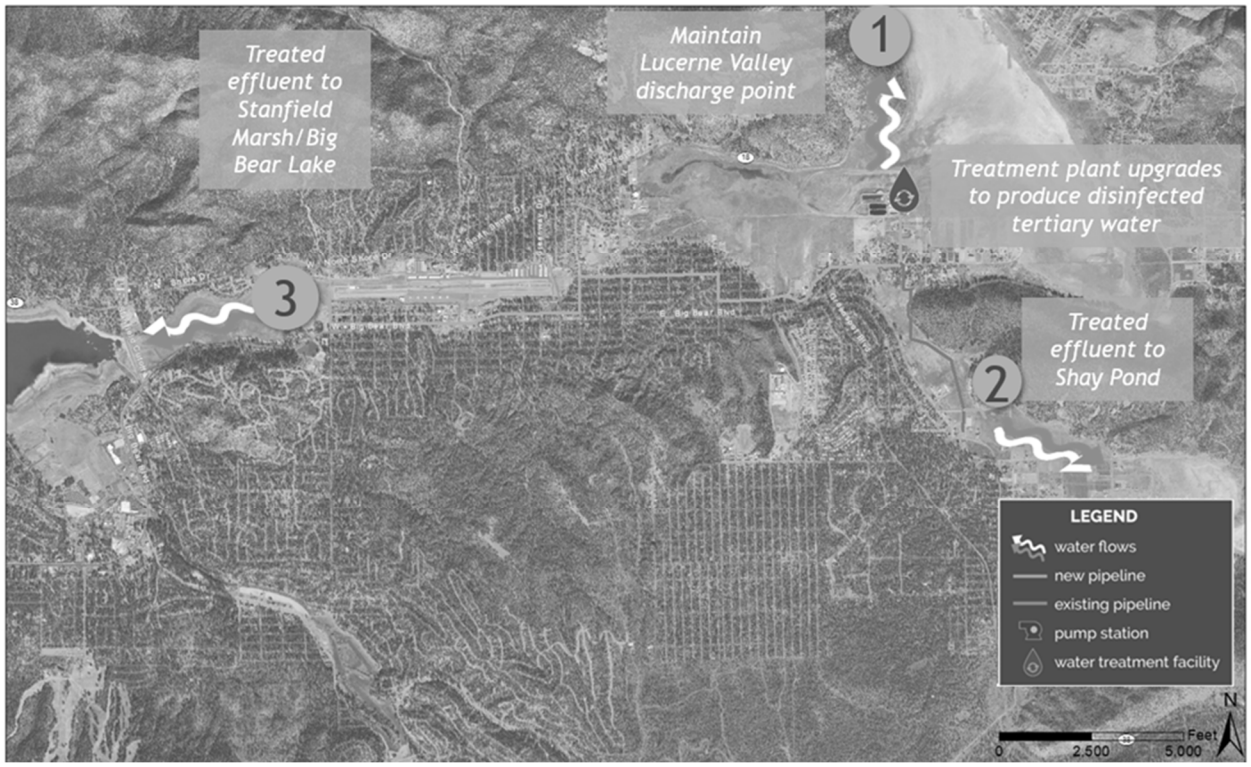

Figure 1. Effluent discharge project components and overview of discharge locations

B. Lake Background

Big Bear Lake is an important resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland southern California region. Together, Stanfield Marsh and the Lake have a surface area of nearly 3,000 acres, a storage capacity of 73,320 af, and an average depth of 32 feet (ft). Stanfield Marsh and the Lake are both waters of the State of California (State) and United States (U.S.), which have several designated beneficial uses. For reference, Table 1 shows the designated beneficial uses of the Lake and Stanfield Marsh per the 1995 Water Quality Control Plan for the Santa Ana Basin Plan (Basin Plan), as amended in 2008, 2011, 2016, and 2019. In addition, the Nutrient TMDL was adopted to address concerns with phosphorus and nitrogen impacts on the lake. Table 2 presents the Lake regulatory limits set to protect the Lake benefits.

Table 1. Beneficial uses of Big Bear Lake and Stanfield Marsh		
Beneficial Uses	**Big Bear Lake**	**Stanfield Marsh**
AGR - Agricultural Supply	✓	
COLD - Cold Freshwater Habitat	✓	✓
GWR - Groundwater Recharge	✓	
MUN - Municipal and Domestic Supply	✓	✓
RARE - Rare, Threatened, or Endangered Species	✓	✓
REC1 - Water Contact Recreation	✓	✓
REC2 - Non-Contact Water Recreation	✓	✓
SPWN - Spawning, Reproduction, and/or Early Development	✓	
WARM - Warm Freshwater Habitat	✓	
WILD - Wildlife Habitat	✓	✓

Table 2. Lake Regulatory Limits for Constituents of Interest		
Constituent	**Basin Plan WQO (mg/L)**	**Nutrient TMDL (mg/L)**
Total Dissolved Solids (TDS)	**175**	
Hardness	125	
Sodium	20	
Chloride	10	
Total Inorganic Nitrogen (TIN) (mg/L-N)	**0.15**	
Sulfate	10	
Total Phosphorus (TP) (mg/L-P)	**0.15**	**0.035**
Total Nitrogen (TN) (mg/L-N)		1
Chlorophyll-a (µg/L)		14
Note: **Bolded** constituents were identified as priority in previous regulatory meetings and are specifically evaluated in this study.		

The Lake is located about 6,743 ft (2,055 m) above mean sea level (MSL) in the San Bernardino Mountains in San Bernardino County. The Lake was formed following construction of the Bear Valley Dam in 1883-1884 to serve as an irrigation supply for the citrus industry in the downstream Redlands-San Bernardino communities. Since that time, the Lake has served as a vital engine for economic growth in the Valley, and the region has developed into a year-round destination with extensive recreational and commercial activities, primary and secondary residences, vacation properties and hospitality, and other services.

As with all other natural and man-made lakes in Southern California, the Lake is subject to dramatic variability in water surface elevation; surface elevations reached as low as -48.5 ft relative to dam crest (72.33 ft maximum depth) in November 1961, corresponding to a volume of less than 1,000 af and a lake surface area on the order of 200-300 acres during the extended drought in the late 1950's and early 1960's. BBMWD was subsequently formed in 1964 to manage and help stabilize the water level in the Lake. The region's natural hydrology includes severe protracted droughts and is influenced by the Pacific Decadal Oscillation (PDO) and El Nino-La Nina climate systems (Kirby, 2010), which makes lake level stabilization a tremendous challenge.

This wide variability in Lake level, in turn, can have dramatic impacts on recreational, economic, and aesthetic values of the Lake, as well as ecological conditions and Lake water quality.

Monitoring data collected over the past decade underscore both the variability in regional hydrology and Lake levels, and the consequences of extended periods of low runoff for water quality conditions in the Lake.

C. Objectives

This study (i) analyzed available historical data on Lake conditions to improve quantitative understanding of water quality in the Lake and the interactions and relationships of key causal and response parameters through statistical and advanced machine learning approaches; (ii) developed and calibrated a 2-D hydrodynamic-water quality model using available historical data to develop an improved process-level understanding of water quality; (iii) assessed conditions in the Lake under natural variable hydrology and climate change through the application of the 2-D hydrodynamic water quality model; and (iv) evaluated, through model simulations, Lake conditions with different treatment alternatives for the proposed Replenish Big Bear project. Phosphorus, nitrogen and total dissolved solids (TDS) are the primary constituents of interest with respect to impacts to the Lake and its beneficial uses.

II. ANALYSIS OF AVAILABLE WATER QUALITY DATA

As illustrated in the Baseline Assessment Tech Memo (WSC, 2020), the Lake is subject to widely varying lake volumes and wide ranges in nutrient, TDS, and chlorophyll-a concentrations. Extension of the analysis provided in the Baseline Assessment Tech Memo (WSC, 2020) was conducted to include additional calculations, regressions, and machine learning to better understand the factors, relationships, and interactions governing water quality. Field and laboratory data for TMDL stations #1 (Dam), #2 (Gilner Point), #6 (Mid-lake) and #9 (Stanfield) over the 2009-2019 time period formed the basis for the analyses. These monitoring stations are shown in Figure 2.

Linear regressions and other statistical analyses are commonly used to identify factors affecting water quality in lakes. Machine learning is now starting to be used for water quality assessments (Chou et al., 2018; Ahmed et al., 2019), including short-term forecasting of algal blooms (Park et al., 2015), owing its ability to often elucidate relationships within complex datasets. Supervised machine learning requires a robust dataset on which to train and validate models. BBMWD has developed and maintained a high quality Lake monitoring program, and has an excellent dataset that was used to train and test different supervised machine learning models. This dataset provides an empirical, data-based approach to identifying and understanding relationships between causal and response variables and predicting water quality in the Lake.

Data were also used where possible to quantify rates of important processes operating within the Lake. For example, increases in total P and total inorganic nitrogen (TIN) concentrations are routinely recorded in late summer/early fall that are thought to be associated with lake mixing (WSC, 2020). Hypolimnetic and/or water column mass balance calculations often allow calculation of internal nutrient recycling rates from bottom sediments (Cooke et al., 2005). Such calculations also provide comparisons with previous laboratory core-flux measurements (Anderson and Dyal, 2003), and allow evaluation of effects of runoff, lake level, and other factors on internal nutrient loading, which is recognized as an important source of nutrients to the Lake (contributing, for example, an estimated 52% of total nitrogen and total P loading under a dry scenario) (Santa Ana Water Board, 2005).

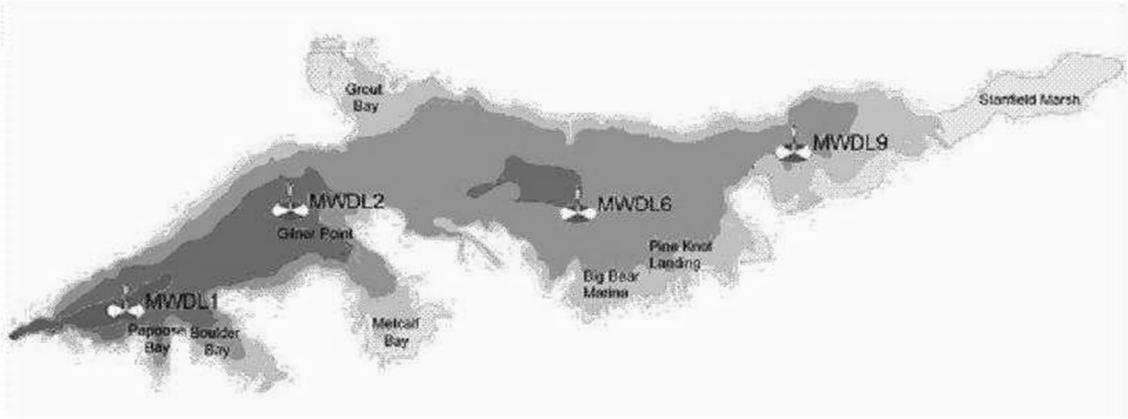

Figure 2. Big Bear Lake TMDL sampling station.

A. Factors Regulating Algal Productivity in Big Bear Lake

1. Statistical Analysis

The TMDL annual water quality reports provide water quality reports, time-series data, and summary statistics, so this section focuses on select statistical analyses of TMDL water quality data. The Lake is generally considered to be P-limited; the ratio of TN to TP concentrations (TN:TP ratio) is reflective of the elemental composition of phytoplankton, with P-limitation generally recognized at TN:TP ratios >20, and N-limitation at TN:TP ratio <5 (Thomann and Mueller, 1998). Photic zone TN and TP concentrations for the 2009-2019 time period were used to calculate TN:TP ratios at the four stations to confirm that P-limitation typically exists in the Lake. Median TN:TP ratios were 27-28 at the Dam, Gilner Point, and Mid-lake stations, but somewhat lower (21.1) at the Stanfield station (Table 3). The TN:TP ratios exhibited considerable variability, so values have been plotted as cumulative distribution functions (Figure 3). Based on these data, the Lake can be considered to be P-limited about 70% of the time and co-limited about 30% of the time. By this measure, N-limitation was present only 1-2% of the time, thus supporting efforts to constrain external loading and internal recycling of P in the Lake.

Table 3. Summary statistics for total nutrients and chlorophyll-a concentrations at the four TMDL sampling stations for 2009-2019 (photic zone).

Parameter	Value	Dam	Gilner Point	Mid-Lake	Stanfield
Total P	Median	0.036	0.040	0.040	0.051
	25-75%	0.024 – 0.050	0.024 – 0.060	0.026 – 0.068	0.033 – 0.088
	Min-Max	0.005 – 0.150	0.005 – 0.210	0.005 – 0.200	0.008 – 0.400
Total N	Median	1.12	1.10	1.16	1.22
	25-75%	0.92 – 1.26	0.93 – 1.27	0.94 – 1.33	0.96 – 1.53
	Min-Max	0.028 – 2.14	0.19 – 3.25	0.17 – 2.43	0.28 – 2.89
Chlorophyll-a	Median	9.4	10.9	11.7	15.1
	25-75%	6.1 – 14.6	6.7 – 16.0	7.5 – 16.5	8.8 – 27.0
	Min-Max	0.9 – 51	0.5 – 205	2.0 – 106	1.8 – 150
TN:TP	Median	28.2	27.3	27.2	21.2
	25-75%	19.1 – 40.4	18.9 – 38.2	17.4 – 39.0	14.8 – 30.8
	Min-Max	7.3 – 162	3.4 – 244	4.0 – 284	3.5 – 147

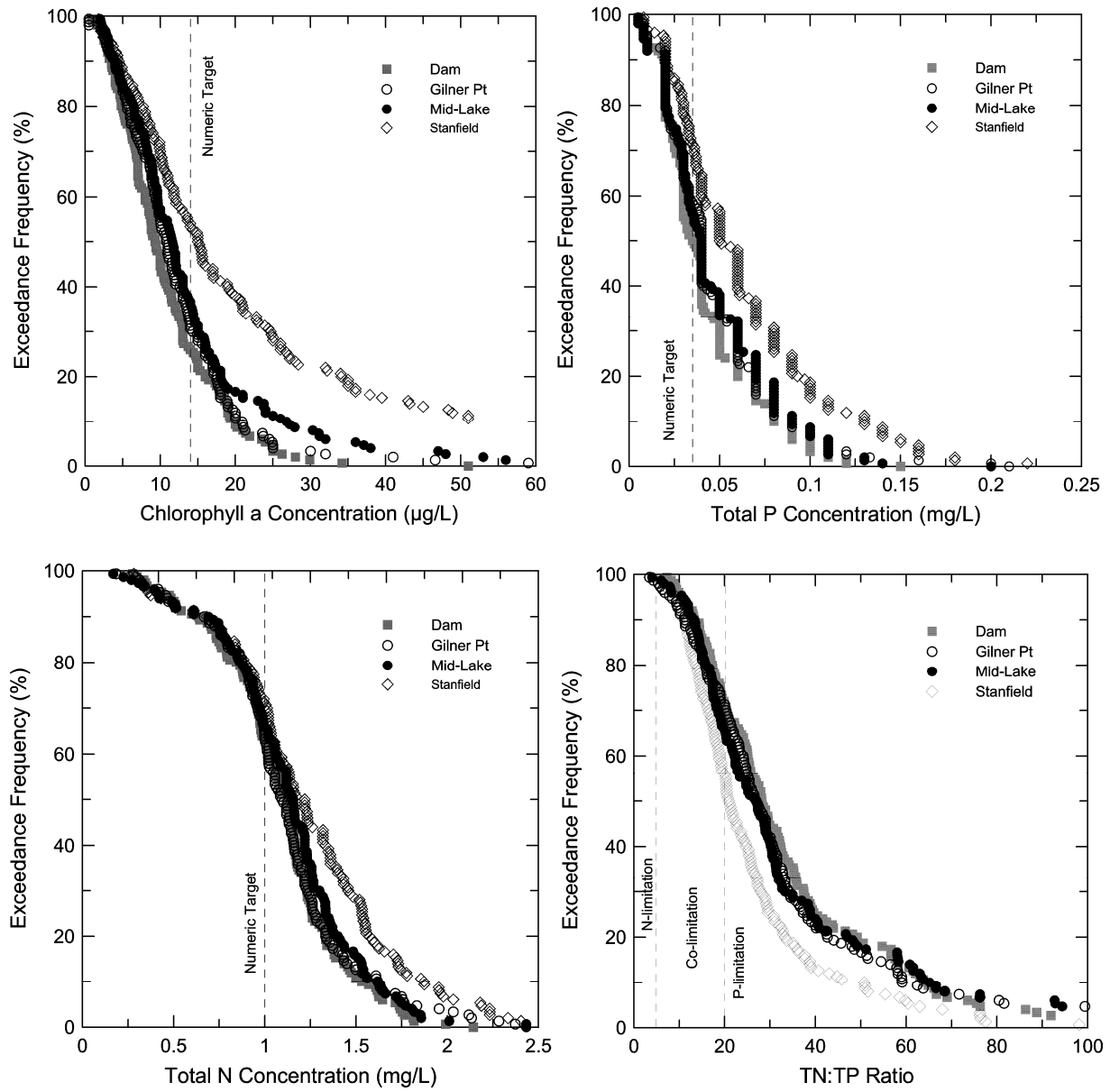

Figure 3. Cumulative distribution functions for a) chlorophyll-a, b) total P, c) total N and d) TN:TP ratios for the 4 TMDL sampling stations.

Correlations between chlorophyll-a concentrations and selected water column properties indicate that no single property captures a substantial amount of the variance in observed chlorophyll-a concentration for all four sampling stations, although the Stanfield station was somewhat more responsive to nutrient concentrations than the other stations (Table 4). Interestingly, TP concentration captured a smaller fraction of observed chlorophyll-a variance than TN (0.08-0.31 vs 0.22-0.53, respectively). Depth below full pool appears to be a useful attribute that integrates across a number of lake conditions and captured, on average, slightly more of the variance (larger R^2) in chlorophyll-a concentrations across all sites (R^2 = 0.22) compared with TP (R^2=0.21) (Table 4). Multiple linear regression using all of these parameters yielded limited improvements in R^2 values compared with single values, indicating that a substantial amount of variance in chlorophyll-a concentration is unaccounted for using basic water quality (and lake level) information (Table 4). Results are very similar when considering only summer months (Jun-Sep) (data not shown). In general, there was no strong correlation between chlorophyll-a and the parameters evaluated.

Table 4. R^2-values for correlations between selected water column properties and chlorophyll-a concentrations (Zrel full represents depth below full pool) (n=150).

Station	**TN**	**TP**	**TIN**	**TDS**	**$Z_{rel\ full}$**	**All**
Dam	0.22	0.08	0.05	0.17	0.29	0.31
Gilner Pt	0.31	0.19	0.00	0.25	0.32	0.43
Mid-Lake	0.34	0.21	0.00	0.19	0.25	0.40
Stanfield	0.53	0.31	0.04	0.18	0.22	0.55

Plots for Gilner Point highlight the variability in chlorophyll-a concentrations as a function of TP, TN, and TDS concentrations and depth below full pool ($Z_{ref\ full}$) across the wide ranging conditions present in the Lake over the 2009-2019 period (Figure 4).

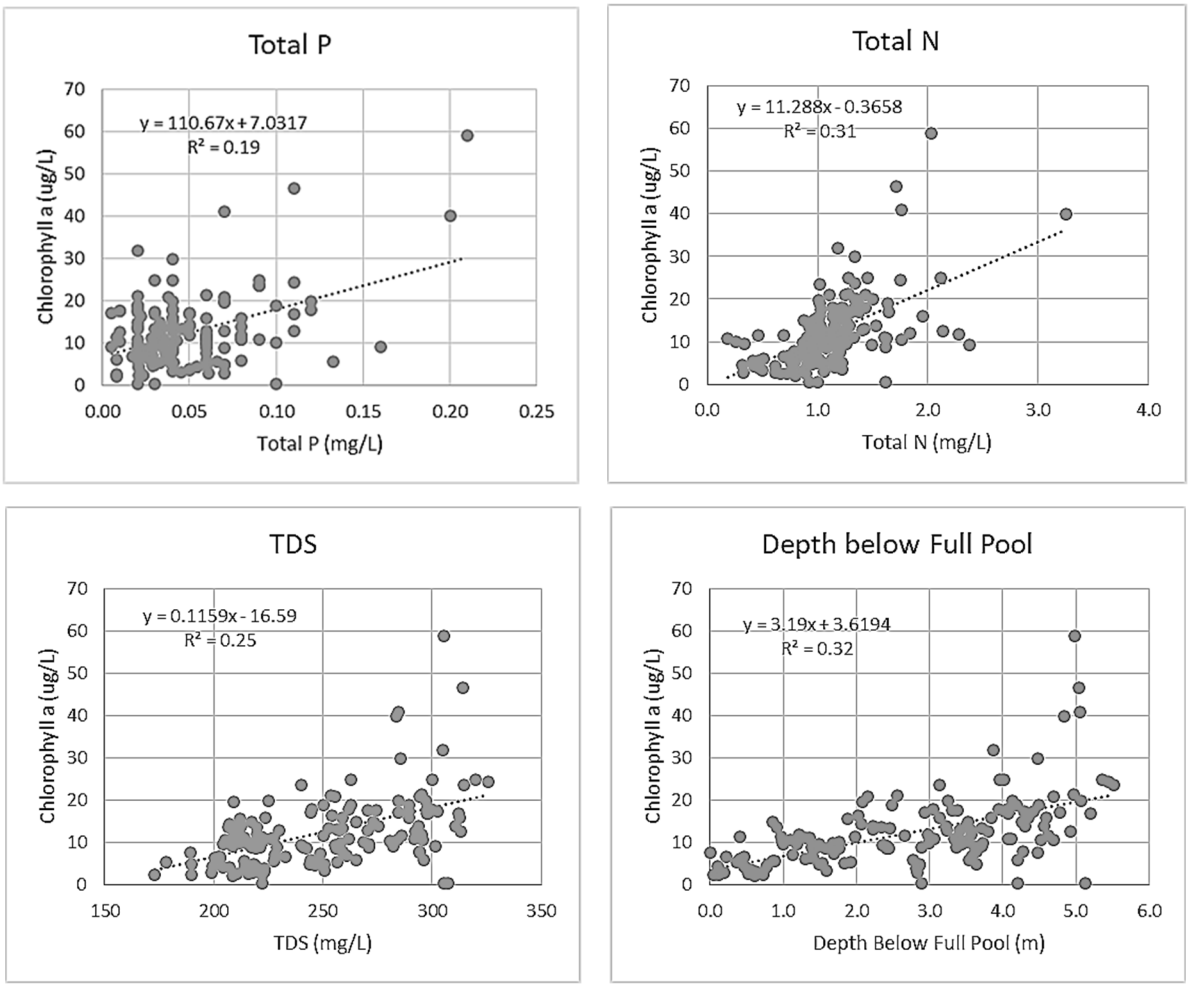

Figure 4. Plots and regression lines between chlorophyll-a and a) total P, b) total N, c) TDS and d) depth below full pool (TMDL station #2, Gilner Point).

2. Machine Learning

Linear regression equations reflected general trends indicating increases in chlorophyll-a in response to increased concentrations of nutrients, TDS, and decreasing lake level, but only captured a relatively small proportion of the variability in measured chlorophyll-a concentrations. Machine learning is often able to more effectively elucidate trends in complex datasets. Random forest and gradient boosted regression trees, k-nearest neighbor, and neural net models were developed using Python 3.7 scikit-learn (e.g., Mueller and Guido, 2017). The machine learning algorithms were trained on the 10-yr record from 2009-2018 (inclusive) and then used to predict water quality for 2019 for comparison with observed conditions.

Chlorophyll-a was the target variable in the machine learning analysis since it represents the key response variable for water quality in the Lake. Independent variables ("features") evaluated included total and dissolved N and P concentrations, water temperature, day of year, lake level

(depth below full pool), TDS concentration, and wind speed (U_w). Model goodness-of-fit was determined based on mean absolute error (MAE) and variance captured. Interestingly, nutrient concentrations and water temperature contained less value in predicting chlorophyll-a concentrations than day of year, lake level, TDS, and average wind speed. The relationships between these features and chlorophyll-a concentration at TMDL Station #1 (dam) in the training data are graphically represented in Figure 5.

The lowest set of panels in the following matrix diagram are scatter plots of chlorophyll-a (Chl) as a function of day of the year (Day), lake level below full pool (Level), TDS, and average windspeed (Uw). Visually one notes that chlorophyll-a exhibits trends of increased concentrations with increasing depth below full pool and increased TDS, although extremely large variability in chlorophyll-a concentrations exists at any given value of lake level or TDS. The final panel on the lower right side of the figure represents a frequency histogram, illustrating that most chlorophyll-a values were around 5-10 µg/L (*i.e.*, below the TMDL target of 14 µg/L), with very few observations at this station >25 µg/L (Figure 5).

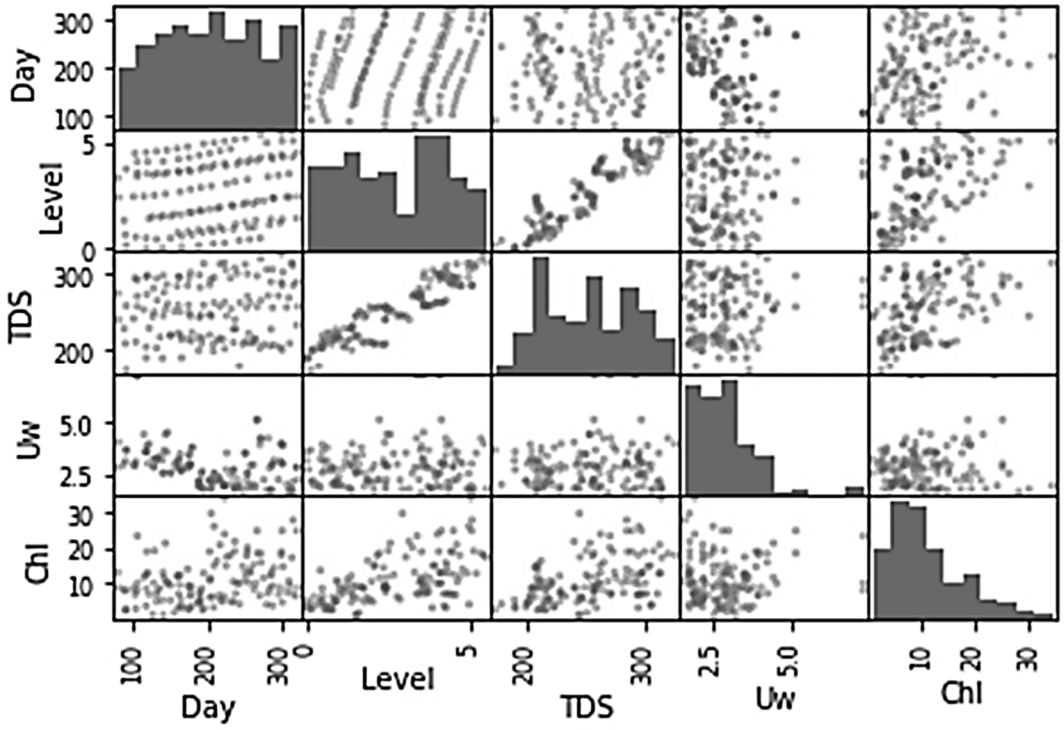

Figure 5. Matrix diagram showing scatter plots between selected parameters at TMDL station #1 (dam).

Application of the random forest regressor (RFR) and gradient-boosted regressor (GBR) using Day-Level-TDS-Windspeed as features yielded models that much more accurately reproduced observed chlorophyll-a concentrations and captured more than 90% of the variance (Figure 6, Table 5). Multiple linear regression using an expanded parameter set yielded a model that was

only better than the multi-layer perceptron (MLP) model, which actually generated excess variance.

Table 5. Mean absolute error between predicted and observed chlorophyll-a concentration and variance captured by machine learning and multiple linear regression models (2009-2018 training set).

Model (TMDL station #1)	**MAE (µg/L)**	**Variance Captured**
K-Nearest Neighbor (KNR)	3.4	0.52
Random Forest Regressor (RFR)	1.4	0.92
Gradient-Boosted Regressor (GBR)	1.0	0.96
Multi-Layer Perceptron (MLP)	14.8	-3.2
Multiple Linear Regression	3.3	0.43

The RFR and GBR models captured >90% of the variance in observed chlorophyll-a concentrations without incorporation of nutrient data (using only Day-Level-TDS-Uw), and mean absolute error (MAE) values were only about 30-40% that of the multiple linear regression model (Table 6).

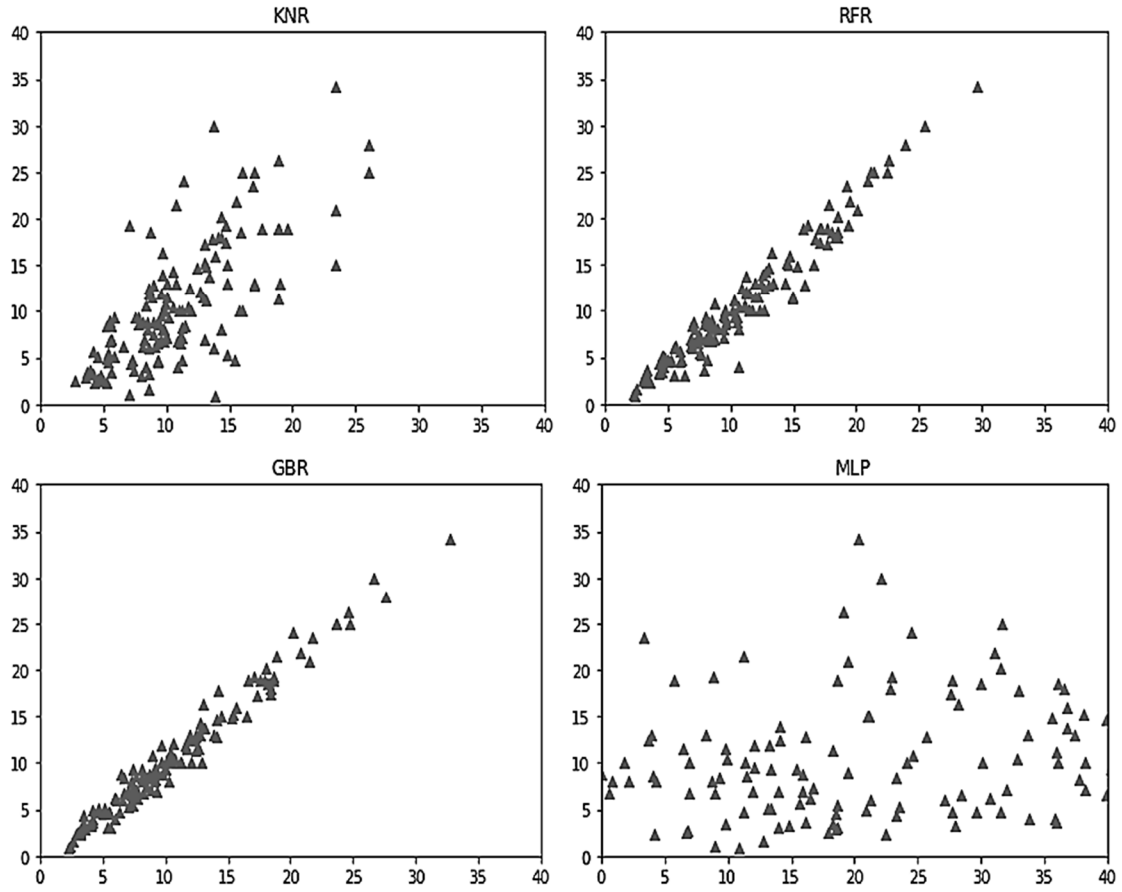

Figure 6. Scatter plots comparing predicted (x-axis) and observed (y-axis) chlorophyll-a concentrations using a) k-nearest neighbor regressor (KNR), b) random forest regressor (RFR), c) gradient-boosted regressor (GBR), and d) multi-layer perceptron (MLP) algorithms.

The RFR and GBR models had significant predictive power for 2019, capturing 58% and 73% of the variance in observed chlorophyll-a (compared with only 36% for the multiple linear regression model), although MAE values were much higher than the 2009-2018 training set. (For reference, a temperature-nutrient model captured <10% of variance in observed chlorophyll-a, underscoring the complex relationships governing algal productivity in the Lake.)

Table 6. Mean absolute error between predicted and observed chlorophyll-a concentrations and variance captured by machine learning and multiple linear regression models (2019 validation set).

Model (TMDL #1)	MAE (µg/L)	Variance Captured
Random Forest Regressor (RFR)	4.5	0.58
Gradient-Boosted Regressor (GBR)	5.9	0.73
Multiple Linear Regression	6.3	0.36

B. Internal Recycling and Hypolimnetic Mass Balance

Internal nutrient recycling is recognized as an important part of the nutrient budget of the Lake (Santa Ana Water Board, 2005). Ortho-phosphate-P (PO_4-P), sometimes also referred to as soluble reactive P (SRP), is released from bottom sediments via reductive dissolution of ferric iron-bound phosphate phases under anoxic conditions and through microbially-mediated dephosphorylation of organic matter. Similarly, NH_4-N is released from bottom sediments by deamination of organic matter. Under stratified conditions, PO_4-P and NH_4-N accumulate in the hypolimnion and their increase in concentrations allows calculation of *in situ* recycling rates.

Station #1 nearest the dam is the deepest of the four main sampling stations and is often observed to exhibit some thermal stratification during the spring through early-mid summer. One consequence of the development of thermal stratification is that nutrients released from sediments accumulate in the bottom waters and their concentrations increase over time, with NH_4-N and PO_4-P reaching, *e.g.,* up to 0.8 mg/L and 0.2 mg/L in the summer of 2010 (Figure 7).

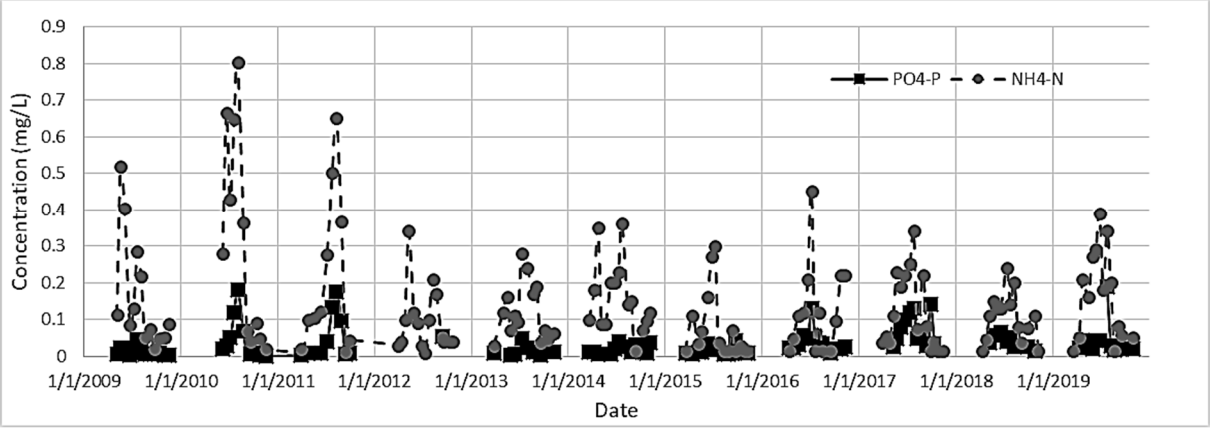

Figure 7. Concentrations of PO4-P and NH4-N in bottom water samples at TMDL station #1 (dam).

The concentrations in bottom waters tracked quite closely the magnitude of stratification, represented by △T (the difference in temperature between the 1 m and bottom depths) (e.g., Figure 8). That is, concentrations tended to increase with increasing △T, while mixing of the water column (△T near 0°C) was associated with sharp reductions in dissolved nutrients due to their mixing throughout the water column.

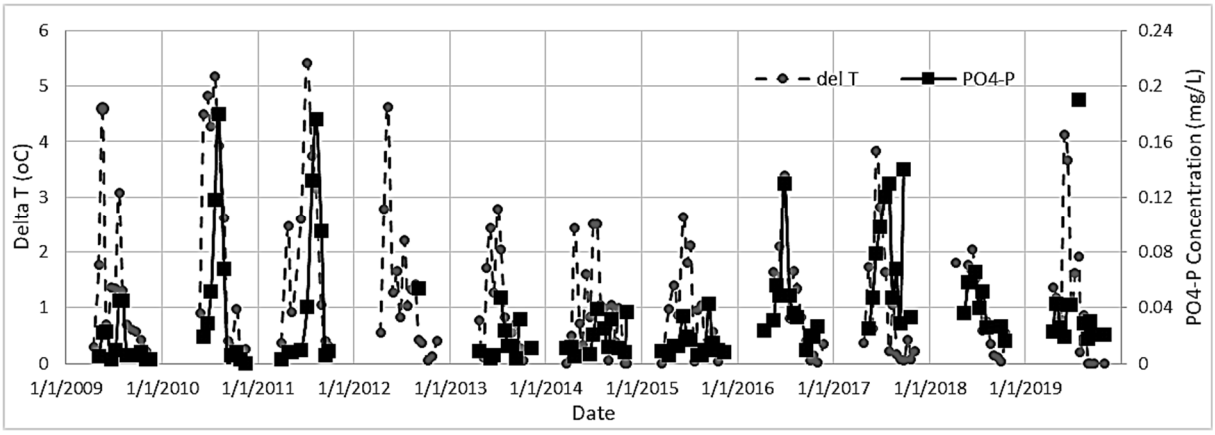

Figure 8. Relationship between bottom water PO_4-P concentrations and temperature difference between 1 m and bottom depths (△T or del T).

Stratification also results in widely-recognized loss of dissolved oxygen (DO), as aerobic bacteria consume DO; with DO unable to be replenished through exchange with the upper well-aerated mixed portion of the water column (epilimnion), oxygen demand quickly depletes DO in the hypolimnion, and is restored when the water column mixes later in the summer (Figure 9).

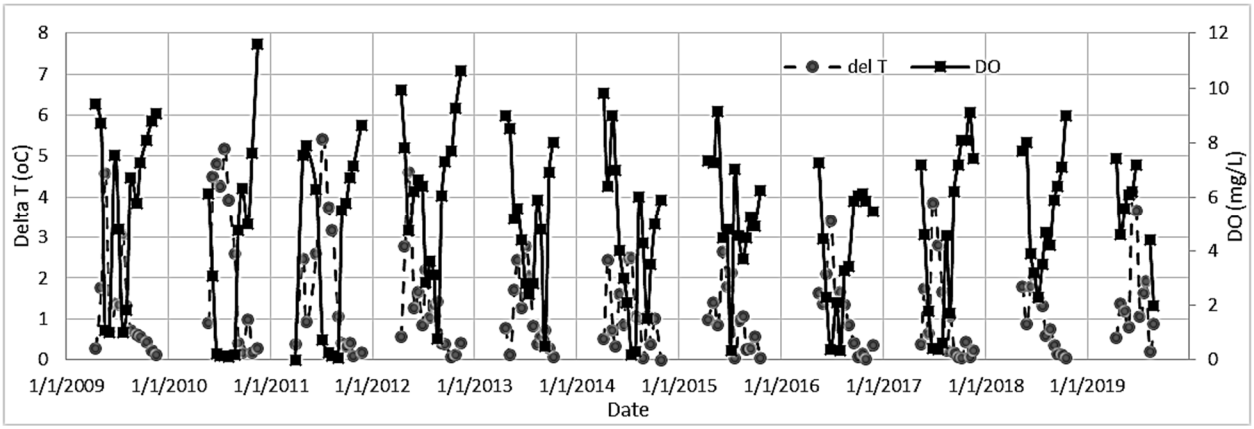

Figure 9. Relationship between bottom water DO concentrations and temperature difference between 1 m and bottom depths (△T or del T).

The increases over time in NH_4-N and PO_4-P and loss of DO (Figures 7-9) during periods of stratification (△T > 0.5 - 1°C) were used to calculate *in situ* internal recycling and areal hypolimnetic oxygen deficit (AHOD) at TMDL station #1 (Table 7). Included in this table are results from laboratory core-flux measurements in 2002-03 and following alum applications in 2004-06 and 2015 in which intact sediment cores were collected from the lake and incubated in the lab at temperature and DO conditions present at the time of sampling. Good agreement was found between 2002-03 laboratory and 2010-11 *in situ* PO_4-P flux values, while lower *in situ* values were found for NH_4-N flux. *In situ* estimates of PO_4-P flux preceding and following the 2015 alum application were in good agreement with pre- and post-laboratory core-flux incubations. AHOD

rates have not previously been measured in the Lake, so *in situ* calculations provide valuable new information about this important process. Moreover, i*n situ* AHOD values are consistent with the trophic state of the lake, and were reduced following the 2015 alum treatment. It should also be noted that similar PO_4-P and NH_4-N flux rates were measured in lab core-flux incubations following 2004 and 2015 alum treatments, indicating general reliability of alum treatments to inhibit PO_4-P release.

Table 7. Internal nutrient loading and areal hypolimnetic oxygen demand (AHOD) rates measured in laboratory and estimated from in situ hypolimnetic mass balance approach.

	Lab			*In Situ*	
Parameter	2002-03	2004-06 (post-alum)	2015 (post-alum)	2010-11	2015-17 (post-alum)
PO_4-P Flux ($mg/m^2/d$)	13.0 ± 2.8	3.3 ± 2.2	0.7 ± 0.2	15.9 ± 0.1	3.2 ± 1.0
NH_4-N Flux ($mg/m^2/d$)	92.6 ± 19.7	38.7 ± 2.7	40.3 ± 6.3	50.9 ± 10.4	26.0 ± 13.3
AHOD ($g/m^2/d$)	NA	NA	NA	0.46 ± 0.04	0.31 ± 0.05

Summary

To augment the water quality summaries provided in the TMDL annual reports, additional statistical and advanced machine learning analyses were conducted. Analyses focused on chlorophyll-a as the key response variable. The ratio of total N to total P), often used to identify nutrient limitation, confirm P-limitation principally in place regulating algal production. Correlations developed between total P, total N, TIN and chlorophyll-a for each of the 4 TMDL sampling stations (n=150 for each station) indicate relatively weak correlations with nutrient concentrations, so it is clear that phytoplankton levels are a more complex function of conditions in the lake. Multiple linear regression (MLR) using TN, TP, TIN, TDS and lake level yielded R^2-values of 0.31-0.55 depending upon TMDL sampling station.

Since significant portions of variance in observed chlorophyll-a concentrations remained uncaptured using MLR, machine learning was also evaluated. Random forest and gradient-boosted regressor algorithms applied to TMDL station #1 data using day of year, lake level, TDS concentration and windspeed were able to capture most (0.92-0.96) of the observed variance in chlorophyll-a for the 2009-2018 training set, notably without considering concentrations of total N or total P. For comparison, MLR using this same set of independent variables captured 0.43 of variance. The gradient-boosted regressor model also demonstrated strong forecasting power, capturing 0.73 of variance in predicted chlorophyll-a concentrations of the 2019 data set (compared with 0.36 for the equivalent MLR model). Machine learning was thus able to identify relationships and develop regressor models that reproduce and forecast concentrations with considerable accuracy.

Water column profile data were also used to quantify rates of internal nutrient recycling and AHOD. Internal nutrient recycling rates have been measured on a limited number of dates since 2002 using the laboratory core-flux method, while AHOD rates have not previously been measured at the lake. The *in situ* hypolimnetic mass balance approach using measured water

column concentrations of ammonium as N (NH_4-N) and orthophosphate as P (PO_4-P) yielded recycling rates for 2010-2011 and 2015-2017 that were similar to previously measured values confirming the importance of nutrient recycling in lake biogeochemistry and nutrient budgets, and establishing the reliability of alum treatments in suppressing PO_4-P release. The analysis also yielded *in situ* estimates of late spring-early summer AHOD rates at TMDL station #1 of approximately 0.5 $g/m^2/d$.

III. DEVELOPMENT OF 2-D HYDRODYNAMIC- WATER QUALITY MODEL FOR BIG BEAR LAKE

Numerical modeling with process-based models is routinely used to simulate historical/baseline and future conditions in lakes and reservoirs. Water quality models represent lake properties and processes through mathematical equations that can vary widely in their complexity, from simple 0-D models such as BATHTUB that involves basic mass balance calculations combined with empirical chlorophyll-a-nutrient responses (Walker, 1987), to highly complex 2-D models such as CE-QUAL-W2 (Wells, 2020) and 3-D hydrodynamic water quality models such as AEM3D (Hodges and Dallimore, 2014; Hipsey, 2014) that solve the Navier-Stokes equation and have highly complex sets of mathematical equations describing ecological interactions and water quality. Nonetheless, even with the most complex models, such models are inherently simplifications of lake ecosystems. The complexity of the model developed and its parameterization is also dependent upon the information available about the lake ecosystem. Big Bear Lake exhibits significant horizontal and vertical gradients in water quality and hydrodynamics, indicating that a 2-D laterally-averaged or 3-D representation of the lake is appropriate. Solution to the Navier-Stokes equation in 3-D is computationally extremely demanding, so 3-D hydrodynamic-water quality models are generally limited to relatively short-term simulation periods, often just months to a few years in duration, making calibration to and simulation of longer time periods often impractical. A 2-D laterally-averaged hydrodynamic-water quality model often provides sufficient resolution to capture longitudinal and vertical gradients in conditions, including local effects of inflows and outflows, while allowing for multi-year calibration of complex biogeochemical processes and simulations of decade-plus time scales.

A 2-D (longitudinal-vertical) hydrodynamic water quality model for Big Bear Lake was developed using CE-QUAL-W2 (Wells, 2018). The model was originally developed at the U.S. Army Corps of Engineers Waterways Experiment Station, extensively refined over time, and has been used for over 450 lakes and reservoirs, nearly 300 rivers, and numerous estuaries and other waterbodies (Wells, 2018). The model quantifies heat and water budgets, 2-D hydrodynamics, and predicts concentrations of nutrients, DO, chlorophyll-a, turbidity, and other parameters. The 2-D (longitudinal-vertical) representation assumes the primary gradients in water column properties and water quality are in the vertical and longitudinal directions, and well-mixed in the lateral direction; model branches can be added for embayments that allow a quasi-3-D representation of the lake. Advantages of CE-QUAL-W2 over the WASP model, which was used in early TMDL work (RWQCB, 2005), include the better spatial representation of the lake, hydrodynamic and water quality models are incorporated into a single model within CE-QUAL-W2, and it allows for multiple algal, macrophyte, and epiphyte species simulating their growth, respiration and mortality, and corresponding influence on nutrient cycling and other processes. CE-QUAL-W2 was recommended to replace the use of WASP in the 2010 TMDL Action Plan (Big Bear Lake TMDL Task Force, 2010).

A. Approach

Development and application of the model requires extensive bathymetric, hydrologic, meteorological, water quality, and other data. The model was developed focusing on the 2009-2019 time period. This period was selected based upon a number of factors, including the wide range of hydrologic and water quality conditions in the lake, and availability of extensive lake monitoring and meteorological data, as well as some watershed monitoring data. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006), including the original dam, which was represented as an internal weir within the model. The model grid included 85 segments with 1 m vertical layers and 5 branches: branch 1, with 58 segments representing the main Lake spanning Stanfield Marsh to the Dam; and branches 2-5 representing Kidd Bay, Boulder Bay, Metcalf Bay and Grout Bay, respectively (Figure 10). Good agreement was in place between model-derived and survey-derived elevation-volume curves, with 0.36% difference in volumes at full pool (Figure 10). The model grid includes Stanfield Marsh, which was not included in original WASP simulation, and allows simulation of supplemental water through the marsh to the main lake.

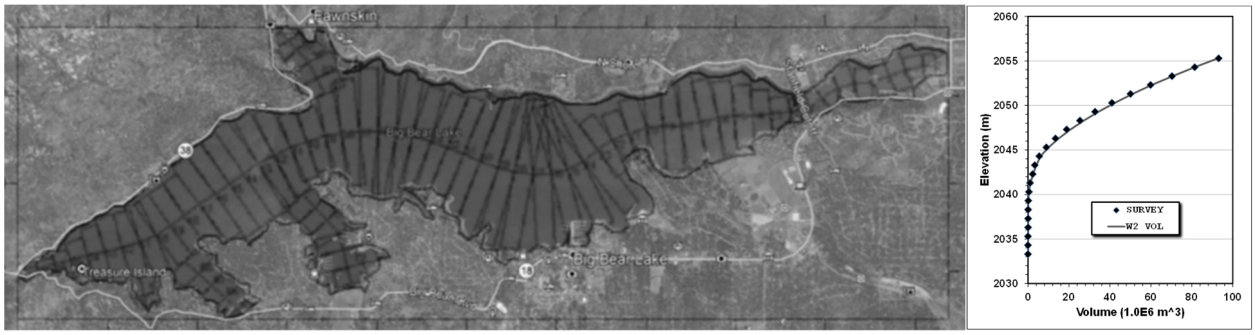

Figure 10. CE-QUAL-W2 model grid developed for Big Bear Lake. Inset depicts agreement between model and measured volume-elevation relationships.

Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Water Master reports. The annual Water Master reports use measured outflows at the dam and water withdrawals by Bear Mountain Ski Resort, evaporative losses estimated using the Blaney Criddle equation, and measured lake surface elevations to derive monthly inflows to the lake. Hourly meteorological conditions were taken from Big Bear Airport and CIMIS Station #199 located at the golf course. Data included solar shortwave radiation (W/m^2), air temperature (°C), dewpoint temperature (°C), windspeed (m/s), wind direction (°) and cloud cover (%). Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and dissolved oxygen (DO), and laboratory analyses of water samples collected at the lake.

1. Initial calibration and simulations of lake level, temperature and TDS

The initial model calibration efforts focused on reproducing observed lake levels (water balance) and water column temperatures (heat budget). Surface heat exchange was calculated term-by-term (shortwave, longwave, evaporative, and convective heat flux) with ice cover algorithm and fetch correction active. Vertical eddy viscosity was determined using the turbulent kinetic energy (TKE) formulation, with the Chezy bottom friction solution. Default heat exchange and hydraulic coefficients were generally used in simulations and are summarized in Appendix A.

Evaporation plays a dominant role in both water budget and heat budget calculations. As noted above, the Watermaster uses the Blaney Criddle equation, which is a very simple relationship that uses monthly average temperature and mean daily fraction of annual daylight hours (based on site latitude), to estimate monthly average reference evapotranspiration rate (ET_0) and evaporation rate. In contrast, CE-QUAL-W2 uses local windspeed and the vapor pressure gradient between water surface (based on water surface temperature) and overlying atmosphere (based on air temperature-relative humidity-dewpoint temperature) to determine evaporative heat and water flux on a sub-hourly basis, similar to approaches described in Chapra (2008) and Martin and McCutcheon (1999). The Blaney Criddle equation has been replaced in most applications by more sophisticated models, such as that described above for evaporation from free water surface, or the Penman-Montieth equation for reference ET_0 for estimated water demand for crops. One consequence of the use of a more accurate approach to calculating evaporation from the Lake is that inflows, which were calculated as residuals of water balance equation based upon monthly evaporation from Blaney Criddle equation, were not consistent with the improved evaporative flux rates in CE-QUAL-W2, resulting in over-estimates of water level (not shown). Thus, consistent with the Water Master approach, inflows were calculated from water balance with known lake levels, volumes and losses (with improved evaporative losses) using the CE-QUAL-W2 water balance utility. Also, as noted, the Blaney Criddle equation calculates monthly average evaporative loss, so the Water Master reports present monthly average inflows. Since weekly water surface elevation data was available, the water balance utility was able to provide finer resolution to the computed inflow data (Figure 11a). Outflow and seasonal withdrawals by the ski resort were used as reported in the Water Master Reports (Figure 11b). The severe storms and runoff generated in early 2011 represented the only substantial outflows from the lake beyond the in-stream flow requirements for Bear Creek downstream of the dam (Figure 11b). For initial water balance and TDS simulations, the distributed tributary approach was used. Allocations for specific creek discharges were used in water quality simulations and are described in more detail below.

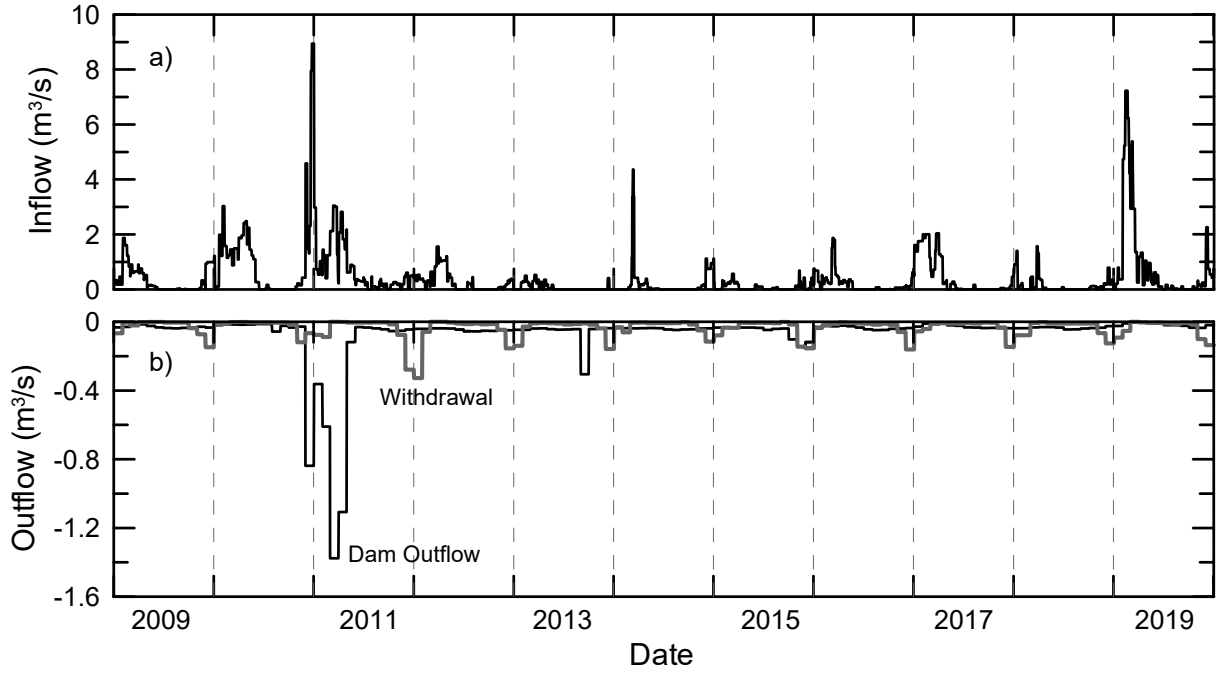

Figure 11. Hydrologic temporal boundary conditions for model calibration (2009-2019): a) total inflow and b) outflows due to withdrawals and dam outflow (from Water Master reports).

The outcome of the water balance calculations was an accurate prediction of lake level over the 2009-2019 calibration period (Figure 12). With the fitting of inflows, mean absolute error (MAE) between predicted and observed lake surface elevation was 3.6 cm.

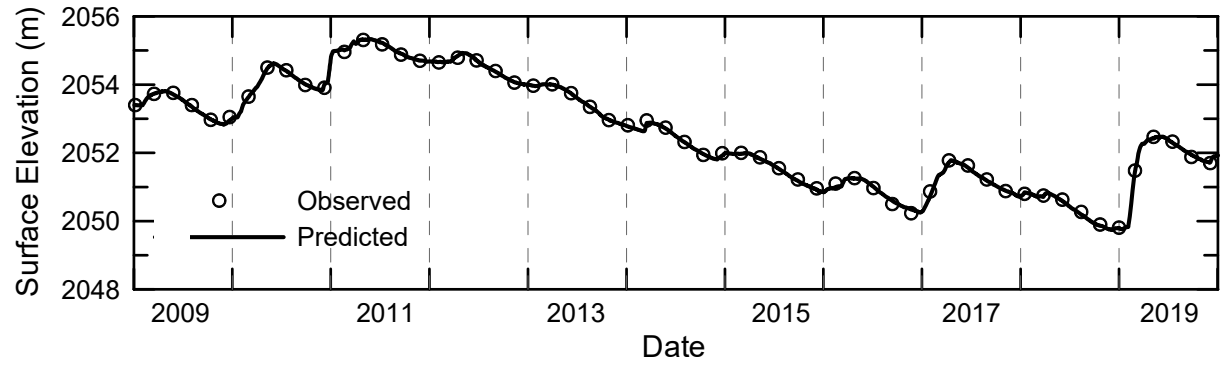

Figure 12. Predicted and observed water surface elevations.

Agreement between predicted and observed water levels is only partial confirmation of the suitability of the model for predicting water balance, since heat flux associated with evaporation is also a key component of the heat budget of lakes (Martin and McCutcheon, 1999). That is, water budgets and heat budgets are explicitly linked through the specific heat of vaporization of water. This is especially important for Big Bear Lake, where evaporation represents the principal mechanism for water loss from the lake (Santa Ana Water Board, 2005). The model quite

accurately reproduced temperature profiles in the lake (Figure 13). (Additional profile calibration figures are provided in Appendix B.)

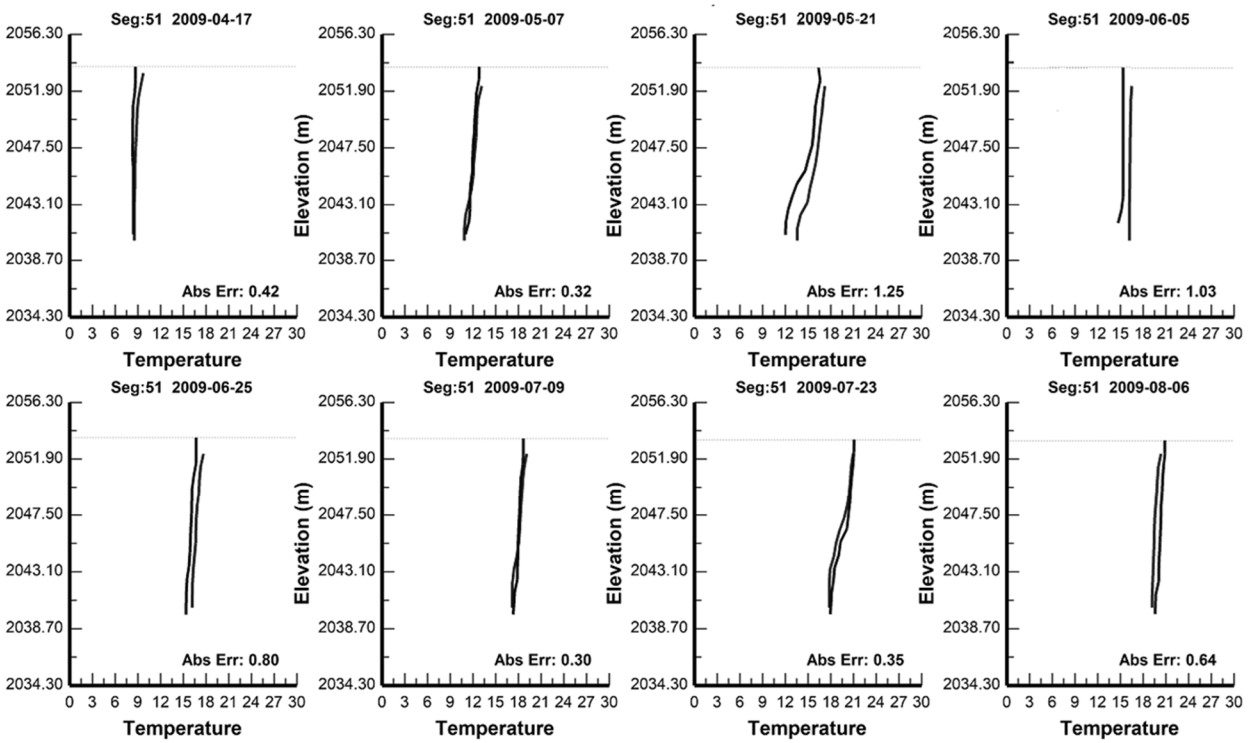

Figure 13. Model predicted and observed water column temperature profiles at station #1 (April 17 – August 6, 2009).

Mean absolute error (MAE) for temperature for profiles collected at the four TMDL sampling stations ranged from 0.95 – 1.14 °C (145 profiles, with 858-1974 discrete temperature measurements depending upon station) (Table 8).

Table 8. Mean absolute error for model predictions of water column temperatures at the four TMDL sampling stations (145 profiles; 858-1974 discrete measurements in each profile).

	#1 (Dam)	#2 (Gilner Pt)	#6 (Mid-lake)	#9 (Stanfield)
MAE (°C)	1.14	0.99	0.95	1.02

TDS concentrations were also simulated in the preliminary phase of model development and calibration. TDS concentration (g/L) was calculated from *in situ* specific conductance (mS/cm) in profile measurements with a proportionality constant of 0.65. Information about TDS (conductivity) of inflowing water was available only for very limited points in time, generally under low-moderate flow conditions. It was thus not feasible to develop comprehensive discharge-TDS relationships from available data. As an alternative, a general form of the discharge-TDS relation (inverse power law) developed from USGS gage #10260500 at Deep Creek was fitted to the Big Bear watershed of the form:

$$TDS\ (mg/L) = 36 * Q\ (m^3/s)^{-0.26} \qquad (1)$$

where Q represents the total flow to the lake derived from water budget calculations described previously. The relationship yielded a MAE of 13.3 mg/L (relative error of 15.4%) when applied to Metcalf and Summit Creek data.

Application of the TDS-flow equation to lake inflows, and simulation with CE-QUAL-W2 captured main features and trends in measured lake TDS (from conductivity) for 2009-19 (Figure 14). The MAE between predicted and observed lake TDS concentrations was 11.9 mg/L (4.8% relative error).

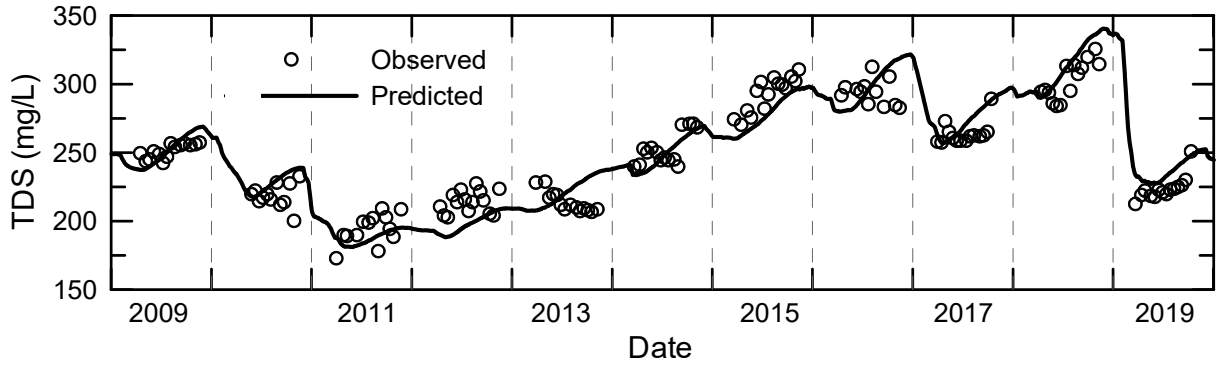

Figure 14. Predicted and observed TDS concentrations.

With the model reasonably representing lake level, water column temperature and TDS concentrations over the wide range of conditions present during 2009-2019, attention was then turned to water quality, focusing on nutrient and chlorophyll-a concentrations.

2. Calibration to Water Quality Data for Big Bear Lake

Lakes are recognized as complex ecosystems influenced by complicated physical, chemical, and biological properties, processes, and inter-relationships. Through the well-designed and high quality lake monitoring program conducted in support of the TMDL at Big Bear Lake, an excellent record of water column conditions and water quality is available with which to calibrate the CE-QUAL-W2 model. Watershed sampling has also been incorporated into the monitoring program, thus providing more extensive empirical information about nutrient and sediment contributions to the lake that were not available in earlier work, which chiefly relied on HSPF simulations of watershed runoff and loading to the lake.

As thoroughly described in the TMDL staff report, loading of nutrients to Big Bear Lake is from (i) external loading from point and nonpoint sources within the watershed, (ii) atmospheric deposition, (ii) internal recycling from bottom sediments, and (iv) macrophyte growth, senescence and death (Santa Ana Water Board, 2005). These processes were integral to the development and application of the CE-QUAL-W2 model for the lake, and are discussed in some detail below.

(i) External loading from the watershed

External loading (EL) (kg/d) from the watershed is the product of inflow rate Q_i (m^3/d) and influent concentrations C_i (kg/m^3) for each source i:

$$EL = \sum_{i=1}^{n} Q_i \, C_i \qquad (2)$$

Runoff rates from specific source areas were derived in previous modeling from HSPF simulations (Figure 15) and linked to WASP model segmentation, which excluded Stanfield Marsh (Figure 16) (Tetra Tech, 2004).

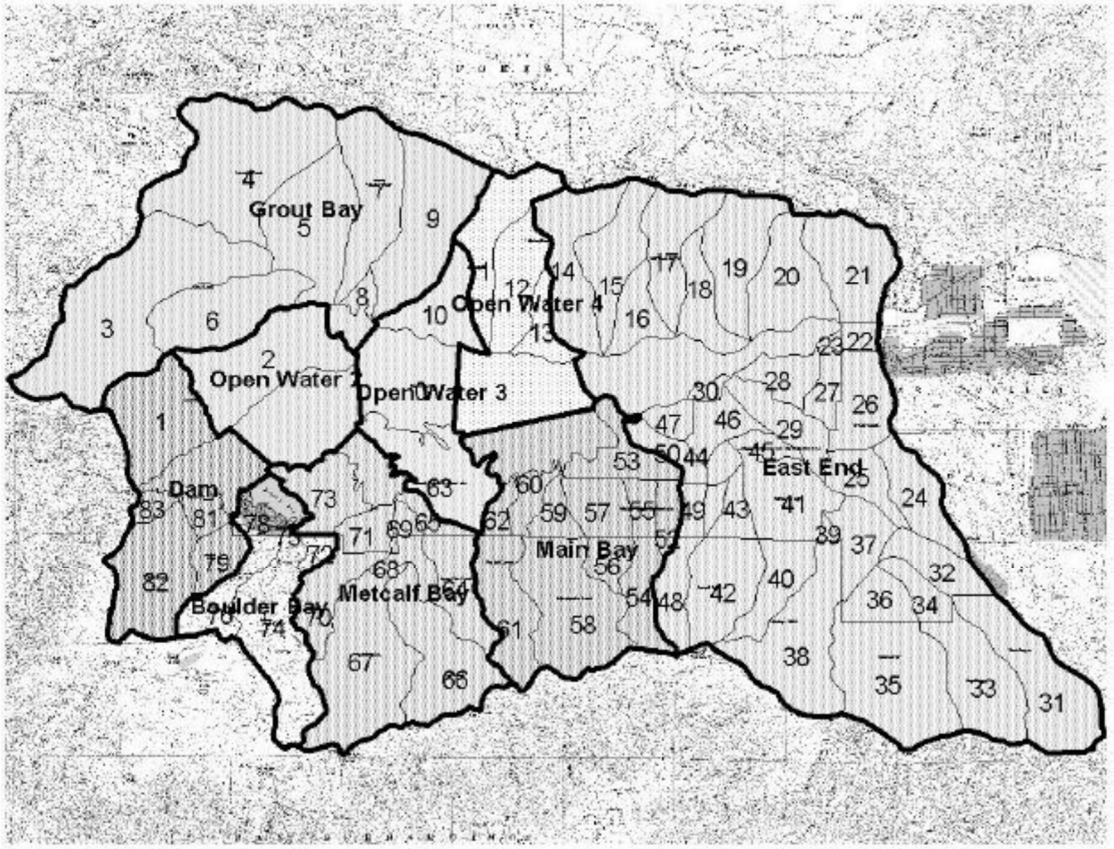

Figure 15. Contributing watershed areas to WASP segments developed from HSPF watershed model (Tetra Tech, 2004).

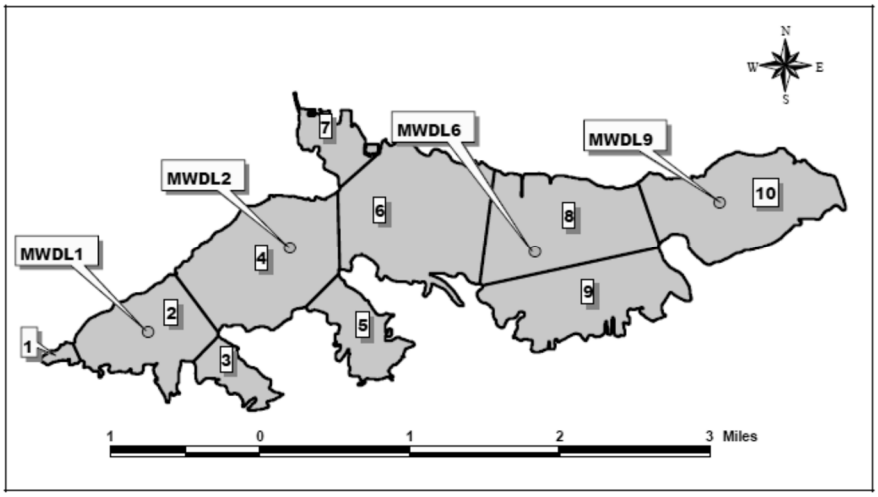

Figure 16. Model segmentation in previous WASP model simulations (Tetra Tech, 2004).

Total inflows, derived from water balance calculations described above, were allocated to regions of the lake following the approach used in the original WASP model. Total inflows (Figure 11a) were allocated to Boulder Bay, Metcalf Bay, Grout Bay and Rathbun Creek (Figure 17), based upon median % flows from prior HSPF simulation results. One difference with the earlier HSPF-WASP model approach is that the WASP model included flows to WASP segment 9 (Figure 16) as a distinct input; the coarse level segmentation in WASP does not map onto the 2-D laterally averaged grid of the CE-QUAL-W2 model, so distributed flow was used to represent both flows to segment 9 and from additional non-point sources (e.g., WASP segments 8 and 4 on the north side of the lake) (Figure 17). Distributed and Rathbun Creek flows in the CE-QUAL-W2 model collectively comprised over 65% of the total inflows to the lake.

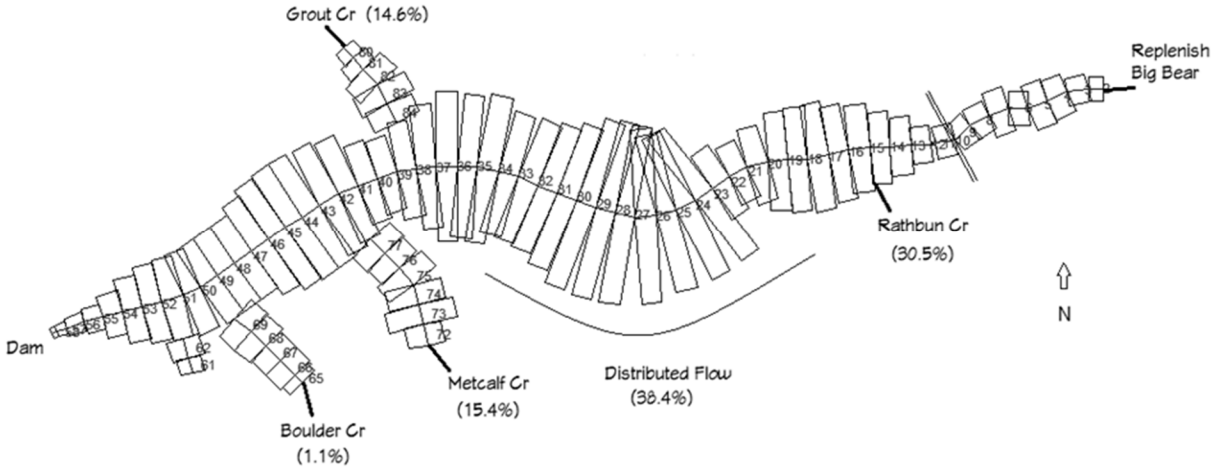

Figure 17. CE-QUAL-W2 model segmentation showing branch, tributary and distributed inflows.

Concentrations of nutrients within these different inflows over time were determined from available watershed monitoring data, rather than HSPF simulations as done in the initial WASP

model (More recent HSPF simulations have apparently been conducted, but results were unavailable.) Median concentrations based upon available data are provided in Table 9, while concentration ranges are presented in Table 10. A very limited set of measurements were identified for Boulder Creek and Grout Creek based on sampling in 2010-2011 (n=7 and 12, respectively). More extensive sampling was conducted for Knickerbocker, Rathbun, and Summit Creeks over 2010-2011 and 2016-2019 (n=53, 28 and 27, respectively). Although complete laboratory analyses on all samples were not always available. For example, laboratory measurements of total Kjeldahl N (TKN), dissolved Kjeldahl N (DKN), total organic carbon (TOC) and dissolved organic carbon (DOC) were only available for samples collected since 2016.

Table 9. Median concentrations (mg/L) of nutrients and organic C in creek water samples.

Creek	**TP**	**o-P**	**TN**	**TKN**	**DKN**	**NH_4-N**	**NO_3-N**	**TOC**	**DOC**
Boulder (n=7)	0.009	0.007	0.184	-	-	0.011	0.022	-	-
Grout (n=12)	0.024	0.015	0.282	-	-	0.008	0.121	-	-
Knickerbocker(n=53)	0.055	0.038	0.374	0.34	0.22	0.130	0.130	2.9	2.7
Rathbun (n=28)	0.055	0.038	0.786	0.46	0.36	0.419	0.419	5.1	4.9
Summit (n=27	0.069	0.021	0.530	0.52	0.25	0.180	0.180	6.0	3.6

Concentrations of total and dissolved forms of N and P varied widely, often by an order of magnitude or more, within the sampling conducted at the creeks (Table 8).

Table 10. Range in concentrations (mg/L) of nutrients and organic C in creek water samples.

Creek	**TP**	**o-PO_4-P**	**TN**	**NH_4-N**	**NO_3-N**
Boulder	0.005 - 0.017	0.005 - 0.009	0.130 - 1.103	0.007 - 0.040	0.002 - 0.042
Grout	0.010 - 0.037	0.010 - 0.026	0.083 - 1.263	0.005 - 0.057	0.011 - 1.054
Knickerbocker	0.020 - 0.320	0.010 - 0.160	0.142 - 1.770	0.005 - 0.290	0.021 - 1.200
Rathbun	0.020 - 0.180	0.010 - 0.100	0.270 - 1.890	0.008 - 0.300	0.005 - 1.190
Summit	0.020 - 0.378	0.003 - 0.155	0.023 - 1.300	0.007 - 0.220	0.003 - 0.602

Table 10 (contd). TOC and DOC values not reported for Boulder or Grout Creek.

Creek	**TKN**	**DKN**	**TOC**	**DOC**
Knickerbocker	0.12 - 1.20	0.012 - 0.67	1.3 - 12.0	1.4 - 8.8
Rathbun	0.077 - 1.40	0.21 - 0.77	2.9 - 7.7	2.6 - 7.1
Summit	0.10 - 0.95	0.00 - 0.78	2.8 - 7.5	2.2 - 7.0

Water quality in runoff can vary strongly depending upon characteristics of the basin, including land use, land cover, amount of impervious surfaces and other factors, and are reflected in the higher concentrations of nutrients in Knickerbocker, Rathbun, and Summit Creeks compared with Boulder and Grout Creeks (Tables 9, 10). The nature and intensity of storms (rain, snow, rain-on-snow), meteorological, and antecedent watershed conditions influence discharge and also influence water quality, contributing to the wide range in concentrations observed at the creeks (Table 10). Since a very limited number of point estimates of flow were available, it was not feasible to develop reach-specific discharge-water quality relationships, but total flows to the lake were known from water balance considerations. Measured nutrient concentration were statistically evaluated for possible correlations with total flow rates (Table 11). Sample sizes varied by creek, with only 7 and 12 samples collected from Boulder Creek and Grout Creek, respectively, while Knickerbocker, Rathbun, and Summit Creeks were sampled 53, 28 and 27

times, respectively. Weak correlations with total flow were observed for most variables, although total flow accounted for a meaningful fraction of the total variance in NO_3-N concentrations (up to R-value of 0.62, or R^2 of 0.38, representing 38% of observed variance in NO_3-N concentration for Rathbun Creek). Nonetheless, regressions even for NO_3-N had modest predictive power (Table 11, Figure 18). Assumptions about inflows and influent concentrations were necessitated by the limited amount of data and thus represent a significant source of uncertainty in model predictions.

Table 11. Correlation coefficients between flow and constituent concentrations.

Creek	**TP**	**o-P**	**TN**	**TKN**	**DKN**	**NH_4-N**	**NO_3-N**	**TOC**	**DOC**
Boulder	0.41	0.31	-0.13	-	-	0.29	-	-	-
Grout	0.52	0.61	0.52	-	-	0.42	0.48	-	-
Knickerbocker	0.00	0.06	-0.03	0.01	0.00	-0.14	0.19	0.13	0.34
Rathbun	-0.21	-0.20	0.28	0.04	0.38	-0.12	0.62	0.43	0.53
Summit	-0.05	0.04	0.08	0.21	0.66	-0.02	0.52	0.18	0.38

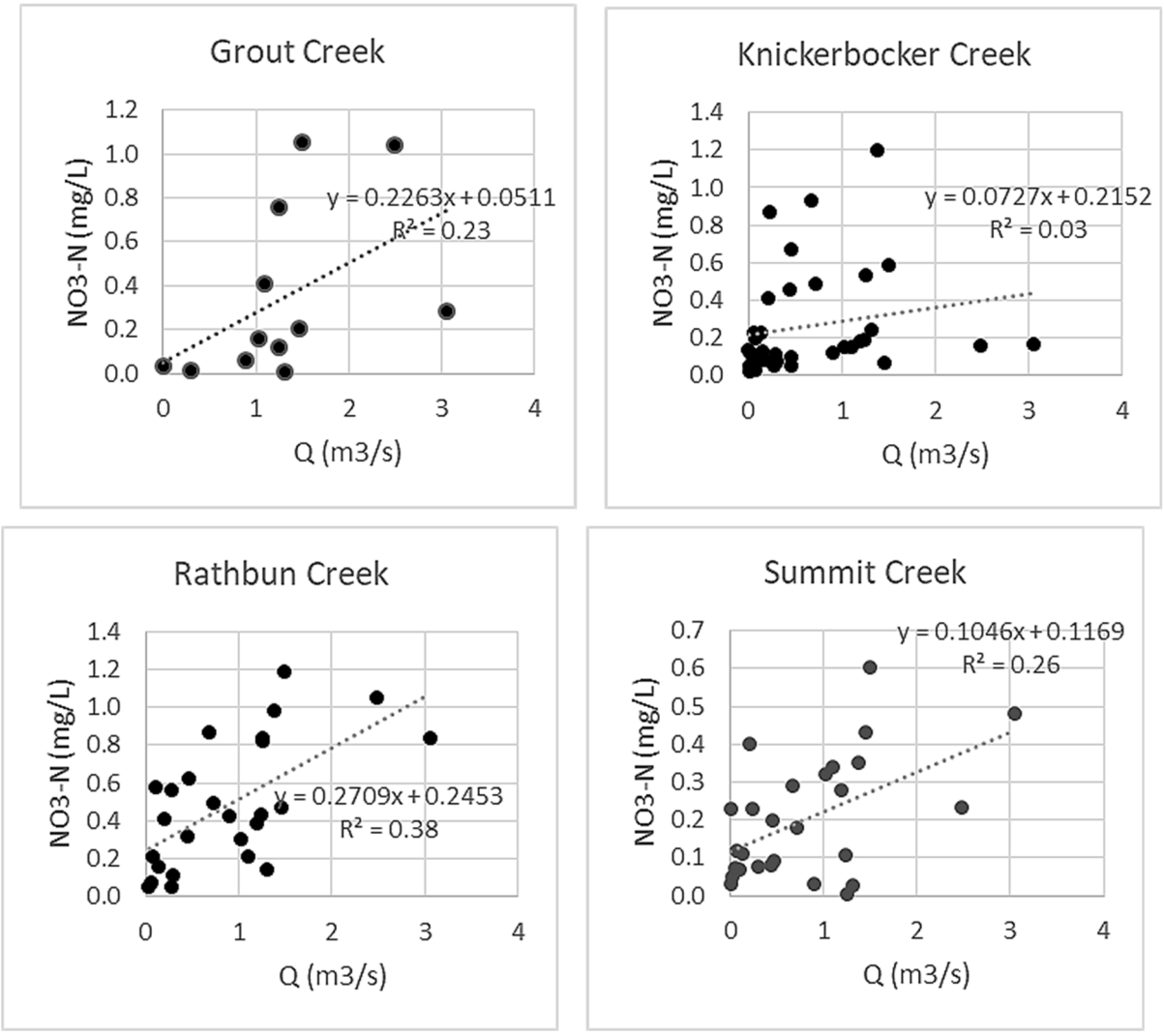

Figure 18. Plots and regression lines between NO3-N concentrations and total (lakewide) flow for a) Grout Creek, b) Knickerbocker Creek, c) Rathbun Creek, and d) Summit Creek.

Measured nitrogen and phosphorus concentrations were used when available and assumed to represent influent concentrations for the entire month in which the measurements were made; for time periods when measured values were not available, median values were used, except as follows: NO_3-N (all creeks except Boulder) and PO_4-P (Grout and Knickerbocker only), when concentrations were estimated from regressions with total flow for that date. The incorporation of measured, median, and regression-based influent concentrations into model input time-series is illustrated for Rathbun Creek (Figure 19).

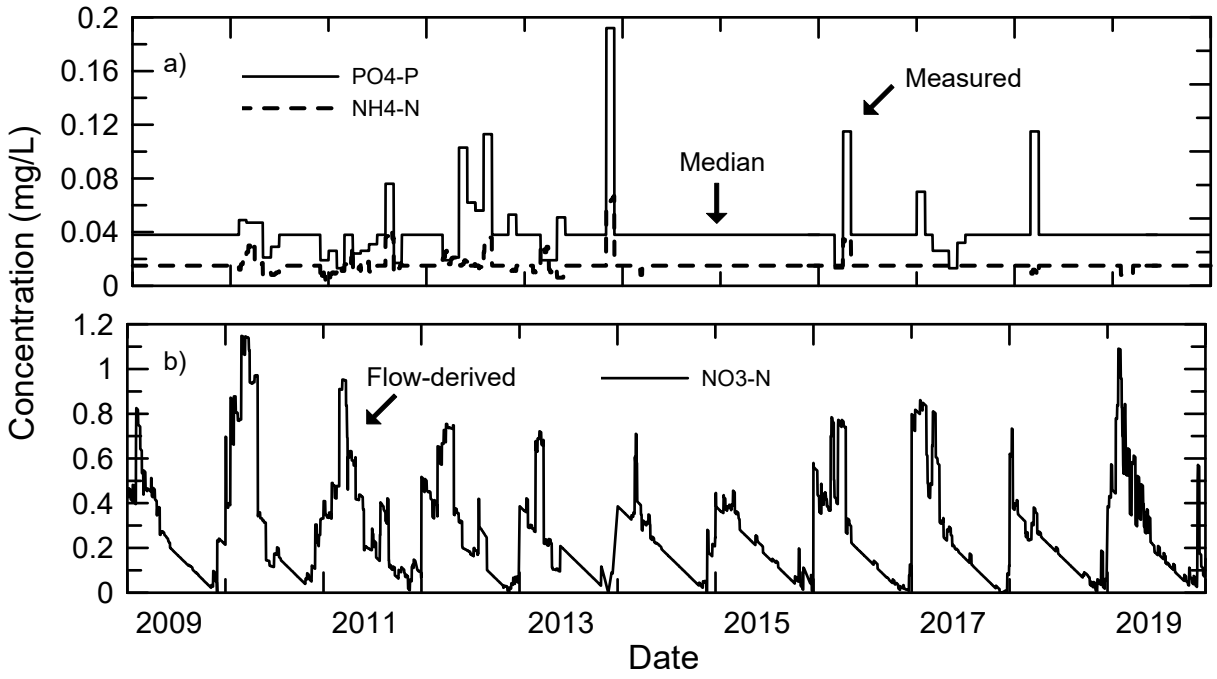

Figure 19. Modeled input nutrient concentrations in Rathbun Creek: a) PO4-P and NH4-N illustrating use of measured values when available and median values when not, and b) NO3-N concentrations derived from regression with total flow rate.

Particulate forms of N, P, and C were calculated by difference between total and dissolved forms. Following White et al. (2010) and Wetzel (1984), organic matter was further partitioned into labile and refractory forms (approximately 25 and 75%, respectively).

(ii) Atmospheric deposition

In addition to external loading from the watershed, atmospheric deposition is also an important source of N and P to Big Bear Lake. Based upon available studies by Mark Fenn and others in the San Bernardino Mountains, direct deposition of N onto the lake (assumed for modeling purposes to be equimolar NH_4 and NO_3) was estimated to be approximately 10 kg/ha/yr, while direct deposition of total P was assumed to be $1/20^{th}$ that of N, or 0.5 kg/ha/yr (Santa Ana Water Board, 2005). The CE-QUAL-W2 model does not simulate transformations and release of P bound to inorganic particles, so it was assumed that 40% of the total P (chiefly as fine inorganic dust particles) was in a bioavailable form and deposited as PO_4-P.

(iii) Internal recycling from bottom sediments

Release from bottom sediments through mineralization of organic matter and reductive dissolution of ferric oxyhydroxides was simulated in CE-QUAL-W2 using the dynamic 1st-order sediment decay model combined with the 0-order SOD model. The 1st-order sediment model uses a sediment compartment to accumulate organic sediments as a result of settling of algae and particulate organic matter, and allow their decay, releasing NH_4-N and PO_4-P back to the water column (Figure 20).

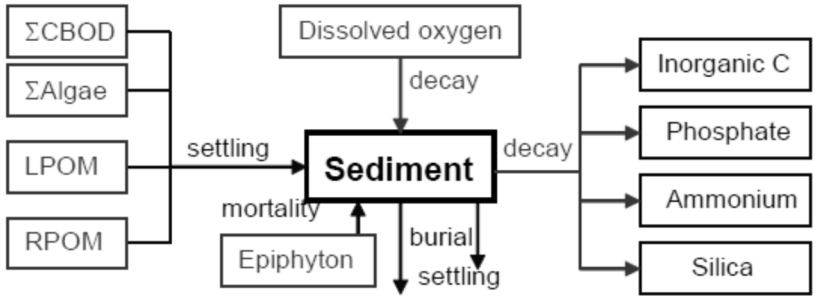

Figure 20. Schematic of 1st-order sediment subroutine in CE-QUAL-W2.

As a 1st-order process, the greater the amount of organic matter settling to the sediment compartment results in greater amounts of organic matter decayed, and N and P mineralized and released back to water column (i.e., recycled). Simulation values are provided in Table 12.

Table 12. 1st-order sediment model parameter values used in simulations. Default W2 values from Wells (2019).

Parameter	Default	Value	Description
SEDCI	0	4.4	Initial reactive sediment concentration (g/m^3)
SEDS	0.1	0.08	Sediment settling rate (m/d)
SEDK	0.1	0.1	Sediment decay rate (d^{-1})
FSOD	1	0.23	Fraction of 0-order SOD rate used
FSED	1	1	Fraction of 1st-order sediment concentration used
SEDBR	0.01	0.01	Sediment burial rate (d^{-1})

The 1st-order model simulates aerobic decomposition reactions, so sediment oxygen demand is also dynamically calculated based upon amount and type of organic matter and temperature, and depletion of DO in turn reduces rates of organic matter mineralization and deamination-dephosphorylation reactions. The 1st-order sediment model thus doesn't simulate nutrient release under anaerobic conditions, although, anaerobic decomposition and reductive dissolution reactions can be important processes within nutrient cycling. As a result, the 0-order SOD model (Figure 21) was used to simulate N and P nutrient release during anaerobic conditions. Maximum values for SOD were varied from 0.1 for shallow low organic matter sediments to 1.0 $g/m^2/d$ at TMDL station #1 and 1.2 $g/m^2/d$ for deepest high organic sediments adjacent to the dam; rates were assumed to vary linearly with temperature between 4 and 30°C, corresponding to a maximum summer 0-order SOD rate of about 0.6 $g/m^2/d$ at TMDL station #1.

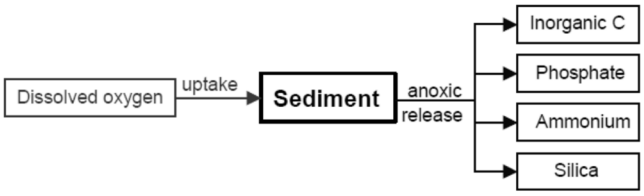

Figure 21. Schematic of 0th-order sediment oxygen demand subroutine in CE-QUAL-W2.

(iv) Macrophyte growth, senescence, and death

Macrophytes are an important component of Big Bear Lake's ecosystem, providing habitat for fish, zooplankton, larval aquatic insects, a variety of benthic animals, and epiphytic periphyton. Aquatic vegetation surveys have periodically been conducted, with coontail, common waterweed, and Eurasian watermilfoil often comprising much of the total macrophyte biomass. Macrophyte growth, senescence, and death are also important features of the nutrient cycle of the lake. Harvesting and herbicide applications have helped control macrophyte growth, with harvesting also serving as strategy to export nutrients from the lake. CE-QUAL-W2 includes macrophyte subroutines that simulate plant life cycles and their effect on hydrodynamics, nutrients, light, and other factors.

Since detailed information about the species composition, density, and distribution of macrophytes over the 2009-2019 timeframe was not available, a composite macrophyte group was incorporated into the model. CE-QUAL-W2 modeling conducted by the USGS (2013) for the Klamath River upstream of Keno Dam, Oregon served as the basis for macrophyte submodel parameterization (Table 13). The composite macrophyte extracted nutrients from the water column, as coontail and to a slightly lesser extent milfoil do, and from bottom sediments, as typical rooted aquatic vascular plants do.

Table 13. Macrophyte model parameter values used in simulations.

Parameter	USGS[a]	Value	Description
MG	0.34	0.3	Maximum macrophyte growth rate (d^{-1})
MR	0.09	0.09	Maximum macrophyte respiration rate (d^{-1})
MM	0.06	0.06	Maximum macrophyte mortality rate (d^{-1})
MSAT	5	10	Light saturation intensity at max photosynthesis rate (W/m^2)
MPOM	0.7	0.7	Fraction of macrophyte biomass converted to POM upon death
LRPMAC	0.2	0.2	Fraction of POM that becomes labile POM
PSED	0.4	0.27	Fraction of P uptake from sediments
NSED	0.4	0.27	Fraction of N uptake from sediments
MBMP	40	40	Threshold concentration when growth to next layer (g/m^3)
MMAX	108	1000	Maximum macrophyte concentration (g/m^3) (W2 default = 500 g/m^3)
CDDRAG	0	1	Macrophyte drag coefficient
MT1	14	14	Lower temperature for rising growth rate function (°C)
MT2	24	24	Upper temperature for rising growth rate function (°C)
MP	0.004	0.005	Stoichiometric ratio between P and biomass (g/g)
MN	0.054	0.05	Stoichiometric ratio between N and biomass (g/g)
MC	0.51	0.5	Stoichiometric ratio between C and biomass (g/g)

[a]composite macrophyte based on average of values for Coontail and Common Waterweed. USGS (2013).

v. Epiphyton dynamics

A vast majority of algal species can colonize surfaces, including macrophytes, and can approach or exceed primary production of macrophytes (*e.g.,* Jones, 1984). Given the relatively shallow depths in the embayments and eastern end of the lake and relatively high water clarity much of the year, epiphyton were also included in the model. Epiphyton are subject to the same

environmental factors and processes as phytoplankton with the exception of settling loss from the water column (Table 14).

Table 14. Epiphyton model parameter values used in simulations. Default W2 values from Wells (2019).			
Parameter	Default	Value	Description
EG	2	2	Maximum epiphyton growth rate (d^{-1})
ER	0.04	0.045	Maximum epiphyton respiration rate (d^{-1})
EE	0.04	0.045	Maximum epiphyton excretion rate (d^{-1})
EM	0.1	0.1	Maximum epiphyton mortality rate (d^{-1})
EB	0.001	0.001	Epiphyton burial rate (d^{-1})
EHSP	0.003	0.003	Epiphyton half-saturation for P-limited growth (g/m^3)
EHSN	0.014	0.014	Epiphyton half-saturation for N-limited growth (g/m^3)
EHSSI	0	0	Epiphyton half-saturation for Si-limited growth (g/m^3)
ESAT	75	75	Light saturation intensity at max photosynthesis rate (W/m^2)
EHS	35	82	Biomass limitation factor (g/m^2)
ENEQN	2	2	Ammonia preference factor equation (1 or 2)
ENPR	0.001	0.001	N-half saturation preference constant (g/m^3)
EP	0.005	0.003	Stoichiometric ratio between P and biomass (g/g)
EN	0.08	0.082	Stoichiometric ratio between N and biomass (g/g)
EC	0.45	0.45	Stoichiometric ratio between C and biomass (g/g)

vi. Phytoplankton dynamics

With information about external nutrient loading from the watershed, atmospheric deposition, internal nutrient recycling, and role of macrophytes and epiphyton, attention was then turned to parameterization of the model to reproduce seasonal and interannual phytoplankton dynamics as expressed through trends in chlorophyll-a. Algal levels are governed by the availability of nutrients and light, and regulated by a complex set of processes, including respiration, settling, grazing, and mortality (Figure 22):

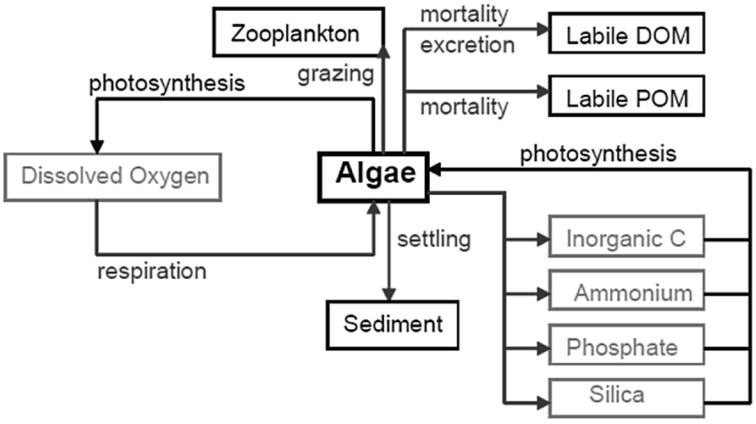

Figure 22. Schematic of phytoplankton subroutine in CE-QUAL-W2.

No specific genus or species was simulated and parameter values at or near CE-QUAL-W2 default values were used (Table 15). Two phytoplankton groups were simulated, with algal group #2 capable of N_2-fixation.

Table 15. Phytoplankton model parameter values used in simulations. Default W2 values from Wells (2019).

Parameter	Default	Algae 1	Algae 2	Description
AG	2	2	1.7	Maximum algal growth rate (d^{-1})
AR	0.04	0.04	0.05	Maximum algal respiration rate (d^{-1})
AE	0.04	0.04	0.05	Maximum algal excretion rate (d^{-1})
AM	0.1	0.1	0.1	Maximum algal mortality rate (d^{-1})
AS	0.1	0.1	0.1	Algal settling rate (d^{-1})
AHSP	0.003	0.003	0.005	Algal half-saturation for P-limited growth (g/m^3)
AHSN	0.014	0.03	0	Algal half-saturation for N-limited growth (g/m^3)
AHSSI	0	0	0	Algal half-saturation for Si-limited growth (g/m^3)
ASAT	100	90	100	Light saturation intensity at max photosynthesis (W/m^2)
ALPOM	0.8	0.8	0.8	Fraction of algae lost by mortality to POM
ANEQN	2	1	1	Ammonia preference factor equation (1 or 2)
ANPR	0.001	0.001	0.001	N-half saturation preference constant (g/m^3)
AP	0.005	0.003	0.0031	Stoichiometric ratio between P and biomass (g/g)
AN	0.08	0.09	0.09	Stoichiometric ratio between N and biomass (g/g)
AEC	0.45	0.45	0.45	Stoichiometric ratio between C and biomass (g/g)

3. Model Calibration Results

As previously noted, water quality in Big Bear Lake varied widely over 2009-2019 (Table 1). The model reproduced seasonal and inter-annual variations in chlorophyll-a concentrations reasonably well, including increased concentrations in the latter half of the 2009-2019 study period associated with lower lake levels (Figure 23).

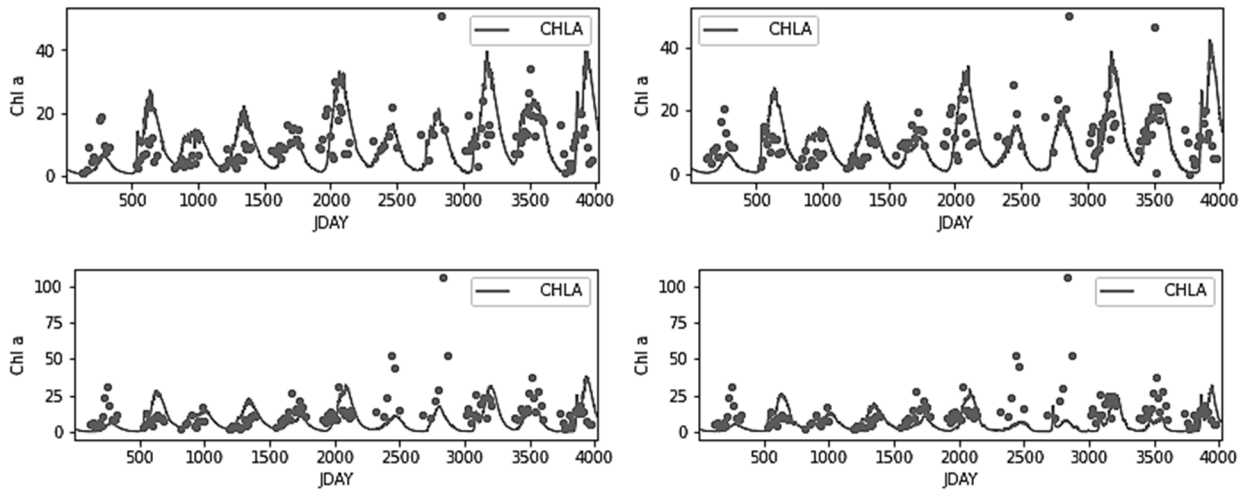

Figure 23. Predicted (line) and observed (circles) chlorophyll-a concentrations (µg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake), and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

The model also reproduced central tendencies present in measured TP concentrations, including seasonal variations and trends of increased concentrations in the latter half of the 2009-2019 study period, but predicted seasonal variations that were dampened relative to reported data (Figure 24). In particular, the model over-predicted total P around day 2300-2600 which corresponds to the alum application in 2015. CE-QUAL-W2 doesn't have subroutines specifically simulating an alum application, and after some effort, it was deemed not readily feasible to accurately simulate the flocculation, sorption, and settling of alum and sorbed P and N within CE-QUAL-W2. Some limitations to the macrophyte submodel were also identified (Appendix C).

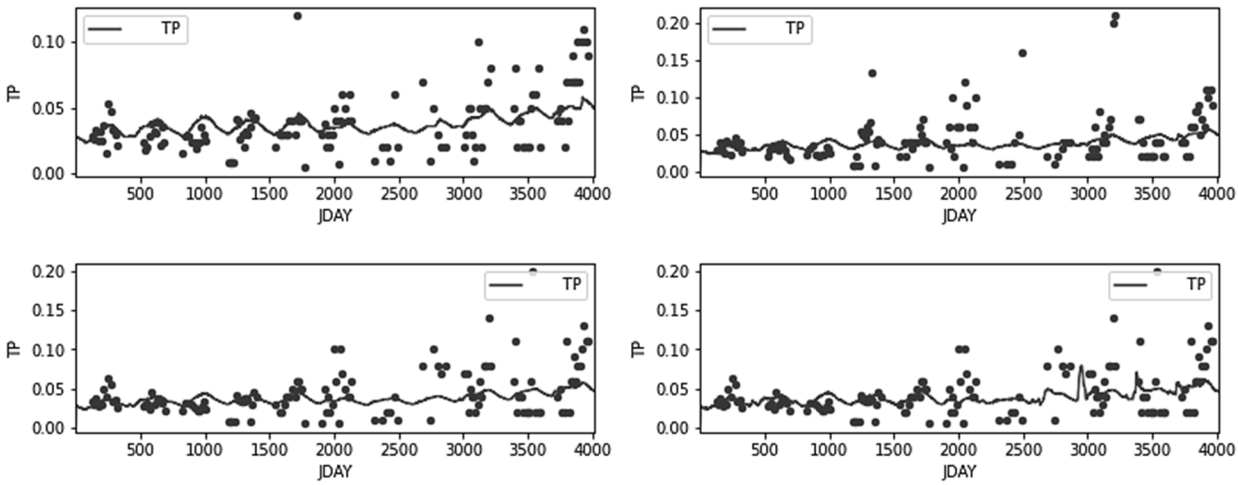

Figure 24. Predicted (line) and observed (circles) total P (TP) concentrations (mg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake) and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

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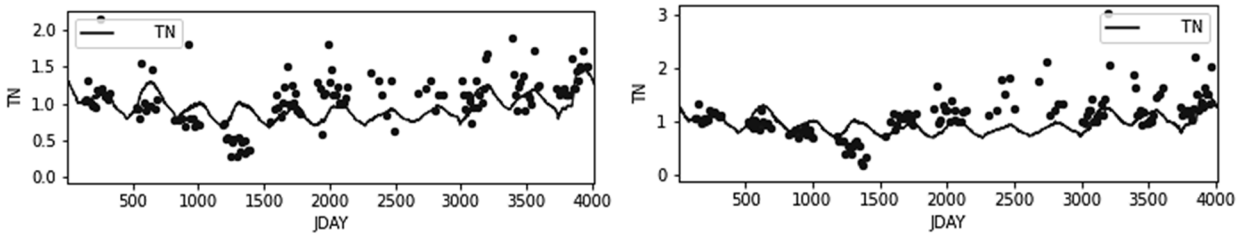
might be expected to increase N concentrations somewhat, as further P-limitation would restrict amount of N also incorporated into algal biomass.



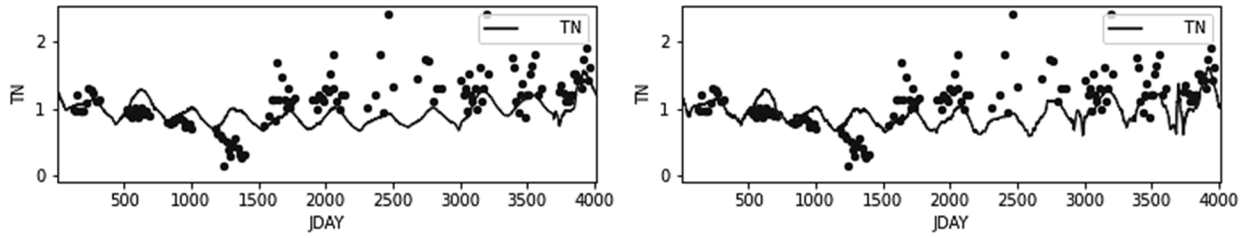


Figure 25. Predicted (line) and observed (circles) total N (TN) concentrations (mg/L) over 2009-2019 calibration period for TMDL sampling stations: a) #1 (dam), b) #2 (Gilner Point), c) #6 (Mid-lake) and d) #9 (Stanfield). JDAY represents simulation day (elapsed Julian day) since 1/1/2009.

As evident in Figures 23-25, very wide swings in reported total nutrient and chlorophyll-a concentrations were sometimes present, with sample concentrations occasionally up to 3-5 times higher than samples collected immediately prior to or immediately thereafter (e.g., Figure 24, TP concentration of 0.12 mg/L around day 1700 for TMDL station #1). While analytical error is present in all measured values, a Grubbs outlier test was used to identify outliers at $p<0.01$ prior to calculation of model error statistics. A total of 7/424 outliers were statistically identified for chlorophyll-a, 5/600 for total P, 2/600 for total N and 6/600 for total inorganic N. Outliers removed due to analytical, sample handling, or other errors thus constituted only 0.33-1.6% of total reported values. Even with removal of outliers at $p<0.01$, it nonetheless bears noting that model calibration errors have field and laboratory errors imbedded within them, as well as from other factors (Harmel et al., 2006). Model error statistics, including mean error, mean absolute error, and root mean square error, are summarized in Table 16.

Table 16. Model error results for nutrients and chlorophyll-a.

Property	N	Range	ME	MAE	RMSE	RRMSE (%)[a]
Chlorophyll-a (µg/L)	417	0.5 – 43.2	-1.3	7.9	10.3	24.0
Total P (mg/l)	595	0.005 - 0.180	-0.010	0.022	0.031	17.7
Total N (mg/L)	598	0.126 - 2.415	-0.148	0.310	0.413	18.0
Total Inorganic N (mg/L)	594	0.007 - 0.319	-0.049	0.050	0.092	29.5

[a]=(RMSE/Range)*100

Dissolved oxygen concentrations are influenced by, and also often regulate, the biogeochemical processes operating in the lake. It was previously shown that the model adequately reproduced water column temperatures (Figure 13, Table 8); the model was also generally successful in reproducing measured DO concentrations (*e.g.*, Figure 26, Table 17). (Additional profiles provided in Appendix D). While the lake was often relatively well-mixed vertically, low DO concentrations above the sediments were frequently present as a result of aerobic decomposition and respiration reactions.

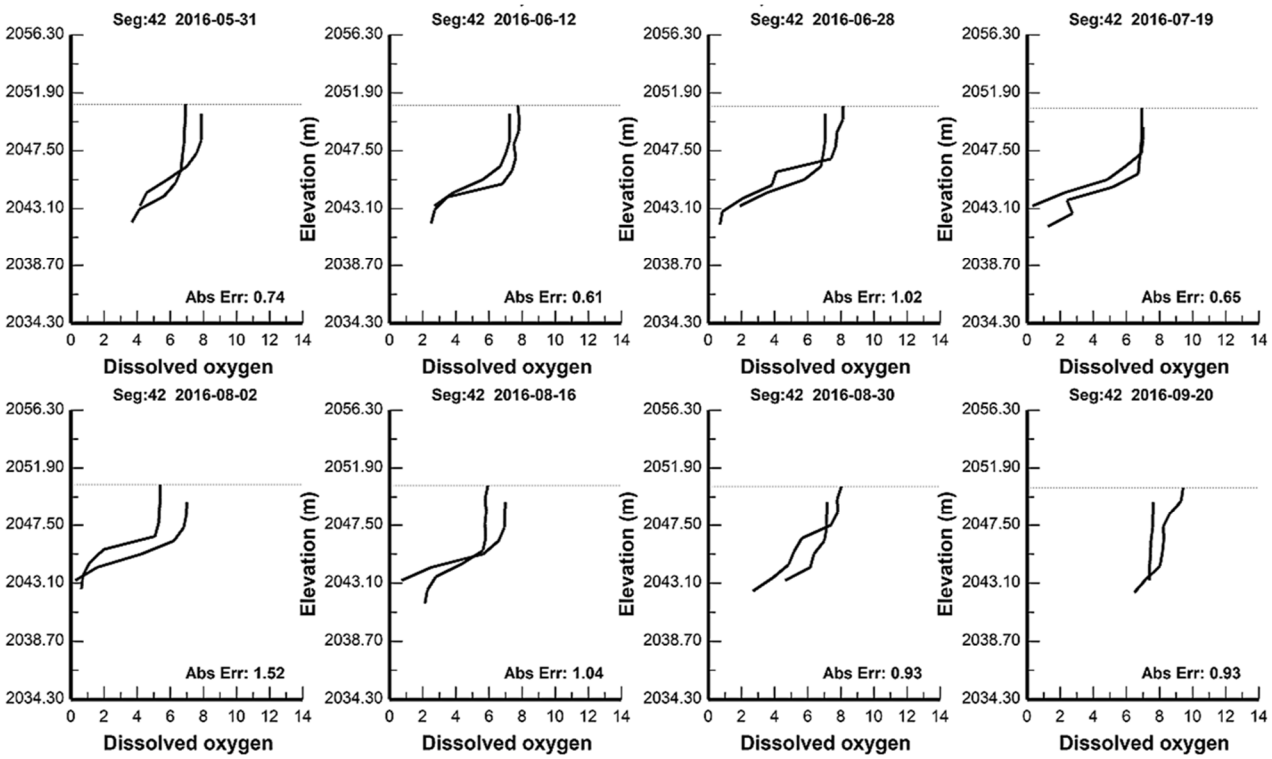


Figure 26. Example dissolved oxygen profiles at TMDL station #2 highlighting agreement between predicted and measured concentrations and periodic loss of DO in lower water column.

Table 17. Mean absolute error for model predictions of water column DO concentrations at the four TMDL sampling stations (145 profiles; 858-1974 discrete measurements in each profile).

	#1 (Dam)	#2 (Gilner Pt)	#6 (Mid-lake)	#9 (Stanfield)
MAE (mg/L)	1.40	1.25	1.16	1.02

Summary

A 2-D (longitudinal-vertical) hydrodynamic -water quality model for Big Bear Lake was developed using CE-QUAL-W2. The 2-D laterally-averaged model grid was developed from the bathymetric survey data collected by Fugro Pelagos Inc. (2006). Hydrologic data defining inflows, outflows, and withdrawals were developed from annual Big Bear Water Master reports. Hourly meteorological conditions were taken from Big Bear Airport and California Irrigation Management Information System (CIMIS) Station #199 located at the golf course. Data included solar shortwave radiation, air temperature, dewpoint temperature, windspeed, wind direction and cloud cover. Cloud cover was determined from sky cover conditions reported in METAR data for the airport. The model was calibrated against measured lake level, *in situ* profiles of temperature and DO, and laboratory analyses of water samples collected at the lake for 2009-2019. The model was first developed and calibrated for lake level, water column temperature profiles and TDS, where generally very good agreement was achieved (mean absolute errors of 3.6 cm, 0.79-0.89 °C, and 11.9 mg/L, respectively). Following this, model calibration to water quality data was conducted. The model included external nutrient loading from the watershed,

atmospheric deposition, internal nutrient recycling, and nutrient uptake and release associated with macrophyte and epiphyton growth, senescence and death. Two algal groups were simulated, included one representing cyanobacteria capable of N_2-fixation. The 1st-order dynamic sediment model was combined with the 0th-order SOD model to simulate nutrient recycling and DO uptake in the surficial bottom sediments. Relative root mean square error was 17.7% for total P, 18.0% for total N, 29.5% for TIN, and 24.0 % for chlorophyll-a. Mean absolute errors for DO ranged from 1.02 – 1.40 mg/L for the 4 TMDL sampling stations.

IV. APPLICATION OF MODEL TO EVALUATE CONDITIONS WITH REPLENISH BIG BEAR PROJECT

With some confidence that the model is able to reproduce trends in water quality over a wide range of conditions, the model was used to evaluate changes in lake level and water quality under selected Replenish Big Bear project treatment scenarios. For these simulations, 1,920 af of BBARWA WWTP effluent was delivered annually through Stanfield Marsh and subsequently to the Lake. Three progressive levels of treatment assuming advanced nutrient removal and reverse osmosis (RO) technologies were evaluated (Treatment Alternatives):

(i) Alternative 1: TIN & TP Removal
(ii) Alternative 2: 70% RO (70% RO + 30% TIN & TP Removal)
(iii) Alternative 3: 100% RO

The composition of the supplemental water used in simulations varied quite substantially depending upon level of treatment (Table 18).

Table 18. Water quality of supplemental water used in model simulations (WSC, 2020b).

Constituent (mg/L)	Alternative 1	Alternative 2	Alternative 3
TDS	450	150	50
NO_3-N	0.6	0.2	0.05
NH_4-N	0.2	0.1	0.05
PO_4-P	0.25	0.06	0.02
Dissolved Organic N	1.33	0.76	0.5
Dissolved Organic P	0.24	0.04	0.01
Particulate Organic N	0.07	0.04	0.00
Particulate Organic P	0.01	0.002	0.00

These three Treatment Alternatives, with varying concentrations of TDS, phosphorus, and nitrogen (Table 18), and a flow rate of 1,920 af/yr were simulated to evaluate effects of supplementation on lake levels and concentrations of TDS, nutrients and chlorophyll-a concentrations for comparisons with baseline (2009-2019) conditions. This analysis thus allows one to compare how different Replenish Big Bear Treatment Alternatives would have altered lake conditions over the past decade, which included extreme variations in lake level and water quality.

A. Lake Level

A simple water balance calculation indicates that 1,920 af/yr of water added to Big Bear Lake would add approximately 0.2 m/yr to lake level. This level of supplementation represents about a 20% increase in average total annual inflow on a calendar year basis, with substantially larger relative contributions during periods of drought (e.g., nearly doubling the very low inflow shown in Fig. 11a during 2013). Simulations confirm that supplemental water would have increased lake level substantially over the natural 2009-2019 period (Baseline scenario), up to 1.7 m by late 2018 relative to no project (Figure 27).

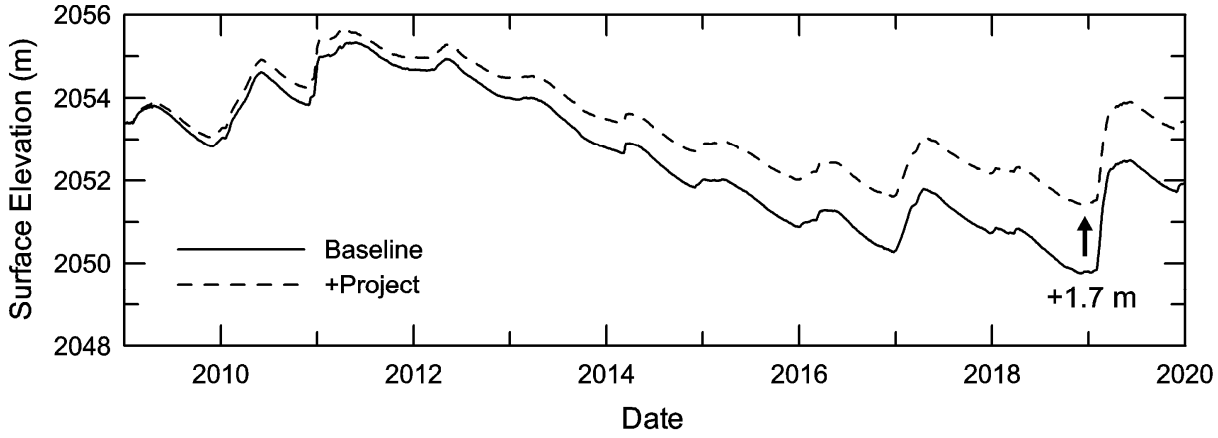


Figure 27. Predicted lake surface elevations over 2009-2019: baseline and with project.

B. Lake Area

The supplemental water also translates to increased lake surface area (Figure 28) that is a function of elevation-volume-area relationships for the Lake basin (Figure 9). Benefits of increased Lake area are especially evident during periods of drought, when Lake shoreline has substantially receded, limiting recreational and homeowner access, and resulting in extensive loss of the littoral community. For example, supplementation with project water would have increased lake area by about 300 acres, from less than 1,900 acres in 2018 to nearly 2,200 acres (Fig. 28). Moreover, the benefits of supplementation to Lake level and Lake surface area in terms of recreational access, aesthetics, ecological habitat, etc. accrue over time, especially evident during drought, until large inflows restore lake level and reset hydrologic conditions in the Lake.

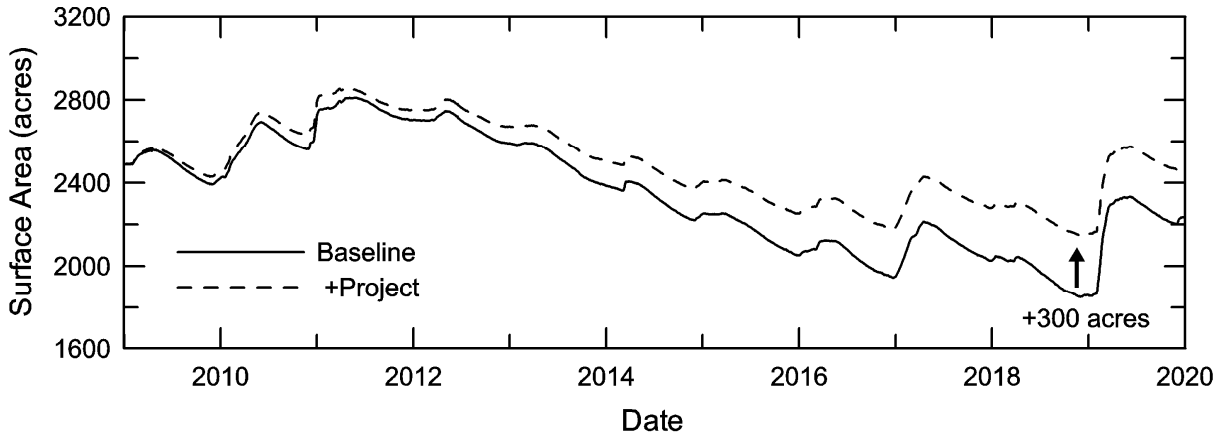


Figure 28. Predicted lake surface area over 2009-2019: baseline and with project.

C. TDS

Addition of 1,920 AFY of Alternative 1 effluent with a TDS of 450 mg/L, predictably increased TDS relative to the Baseline scenario, while Alternative 2 effluent yielded predicted TDS concentrations similar to those present in 2009-2019, and Alternative 3 effluent lowered TDS levels below the Baseline scenario (Figure 29; Table 19).

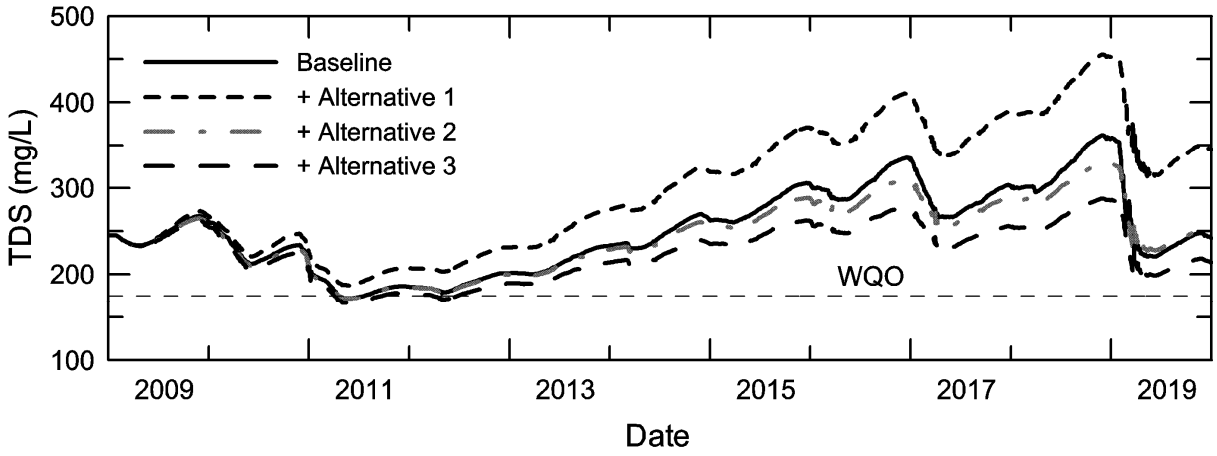


Figure 29. Predicted TDS concentrations over 2009-2019: baseline and with project.

Predicted TDS for the Baseline scenario exceeded the WQO of 175 mg/l (dashed line) 97.6% of the time over 2009-2019, a frequency equivalent to that of the Alternative 2 treatment scenario, and greater than that with Alternative 3 treatment scenario (Table 19).

Table 19. Summary of TDS concentrations for 2009-2019 under natural conditions and with project.

Scenario	Average TDS (mg/L)	Range TDS (mg/L)	WQO Exceedance Frequency (%)
Baseline	251	172-362	97.6
Alternative 1	300	187-455	100.0
Alternative 2	244	171-329	97.6
Alternative 3	226	166-287	93.3

D. Nutrients and Chlorophyll-a

Nutrients entering the lake add to the inventory of nutrients already present, which are subject to a wide array of biogeochemical processes. To help put nutrients derived from supplemental water of differing levels of treatment into context, it is useful to consider their composition and loading relative to watershed sources. Median watershed concentrations and concentrations in Alternative 1-3 effluents are provided in Table 20. Alternative 1 effluent substantially exceeds median watershed concentrations for virtually all nutrients, while addition of RO in Alternatives 2 and 3 lowers concentrations, often to levels comparable to or in some cases below median watershed levels.

Table 20. Comparison of nutrient concentrations in watershed runoff and supplemental water with the three Treatment Alternatives.

	Median Watershed Concentrations (mg/L)					Nutrient Concentrations (mg/L)		
Variable	Boulder Cr	Grout Cr	Knickerb Cr	Rathbun Cr	Summit Cr	Alt 1	Alt 2	Alt 3
NO_3-N	0.05	0.183	0.13	0.419	0.19	0.6	0.2	0.05
NH_4-N	0.011	0.01	0.015	0.015	0.015	0.2	0.1	0.05
PO_4-P	0.007	0.015	0.038	0.038	0.021	0.25	0.06	0.02
Total N	0.184	0.378	0.312	0.716	0.481	2.2	1.1	0.6
Total P	0.009	0.023	0.055	0.055	0.075	0.5	0.1	0.03
TN/TP	20.4	16.4	5.7	13.0	6.4	4.4	11	20

Normalizing project concentrations as ratios to median watershed concentrations allows comparison of relative enrichment factors for supplemental water (concentration basis) (Table 21):

Table 21. Concentration enrichment factors (supplemental/watershed).

	Concentration Enrichment Factor		
Variable	Alternative 1	Alternative 2	Alternative 3
NO_3-N	3.3	1.1	0.3
NH_4-N	13.3	6.7	3.3
PO_4-P	11.9	1.6	0.5
Total N	5.8	2.3	0.8
Total P	9.1	1.8	0.4

One thus recognizes that Alternative 1 (TIN & TP Removal) effluent represents about 6-times and 9-times greater concentrations of TN and TP, respectively, compared with the watershed, while Alternative 2 (70% RO) is on the order of about 1-2 times higher concentrations, and Alternative 3 (100% RO) is significantly lower than typical concentrations of most forms of nutrients delivered from the watershed (Table 21). Importantly, Alternative 1 effluent is not only much higher in nutrient concentrations, it also has a very low TN:TP ratio (Table 20), that could potentially favor N_2-fixing blue-green algae.

Simulations demonstrated that water quality in the Lake is broadly similar between the Baseline scenario and the Alternative 2 and 3 treatment scenarios, but is significantly degraded with Alternative 1 effluent, with marked predicted increases in TP, TN, and chlorophyll-a concentrations (Figure 30).

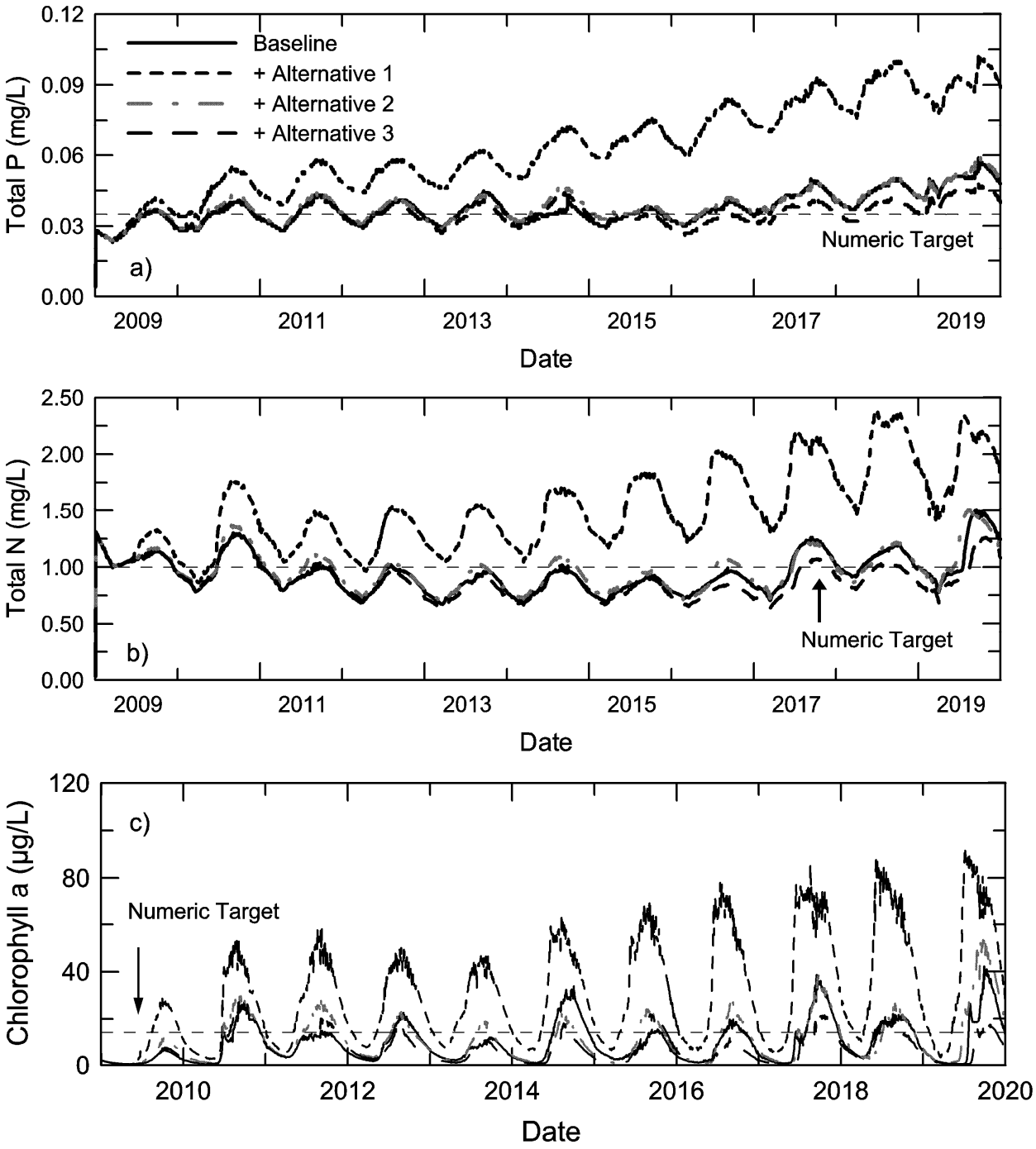


Figure 30. Predicted concentrations of a) total P, b) total N, and c) chlorophyll-a at TMDL station #2 (photic zone).

Supplementation with Alternative 1 effluent also significantly increased littoral plant production, often doubling peak values relative to that predicted under the Baseline scenario and with treatment alternatives 2 and 3 (Figure 31).

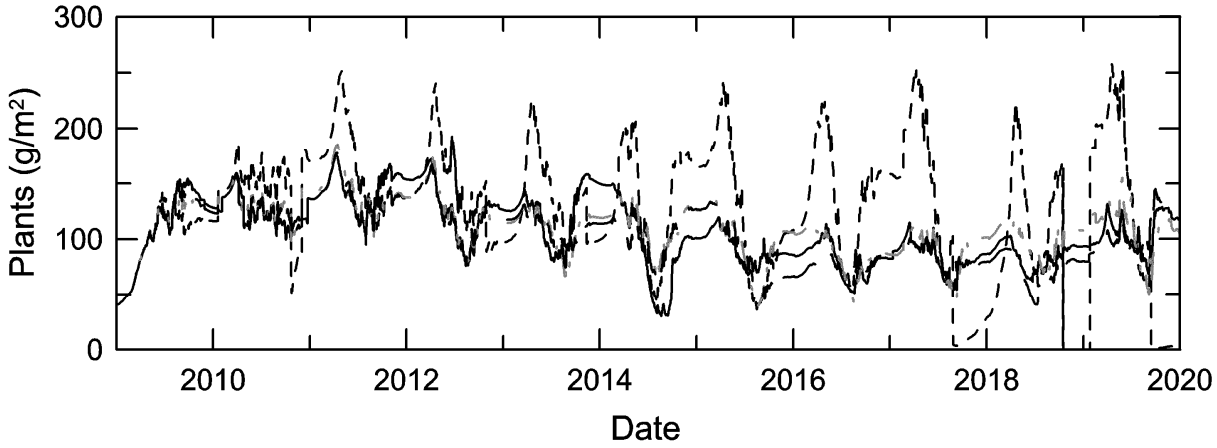


Figure 31. Predicted plant biomass at TMDL station #2 (photic zone). Legend shown in Fig. 30a.

Average concentrations at TMDL station #2 (Gilner Point) for the 11-yr simulation period highlight substantial predicted increases in total P, PO_4-P, and total N resulting from supplementation with Alternative 1 effluent (Table 20). The large increase in P concentrations also yielded a substantial increase in predicted average chlorophyll-a concentration (30.5 vs 9.3 µg/L). Supplementation with Alternative 1 effluent also increased TIN concentrations compared with the Baseline scenario and increased (non-phytoplankton) plant production. Supplementation with Alternative 2 effluent yielded predicted average water quality quite similar to the Baseline scenario, while supplementation with Alternative 3 effluent was predicted to improve average water quality somewhat (Table 22).

Table 22. Average concentrations of nutrients and chlorophyll-a for 2009-2019 period under the Baseline scenario and with supplementation with water from the three Treatment Alternatives.

Scenario	Total N (mg/L)	Total P (mg/L)	Chl a (µg/L)	PO_4-P (µg/L)	TIN (mg/L)	Plants (g/m^2)
Baseline	0.948	0.037	9.3	3.5	0.049	106.9
Alternative 1	1.511	0.063	30.5	7.8	0.120	126.3
Alternative 2	0.979	0.038	10.9	3.6	0.047	110.2
Alternative 3	0.894	0.035	7.1	3.3	0.046	103.1

Supplementation of treated effluent from the BBARWA WWTP is thus predicted to yield different water quality in Big Bear Lake depending upon effluent water quality. Supplementation with Alternative 1 effluent is predicted to substantially increase lake total P and PO_4-P concentrations, which may also increase N_2-fixing blue-green algae, as well as increase epiphyte and macrophyte production. Supplementation with Alternative 2 effluent is predicted to yield water quality conditions similar to natural conditions, while providing increased lake volume, lake surface area, and additional (non-planktonic) plant biomass. Further treatment of effluent in Alternative 3 was predicted to slightly improve water quality compared with that predicted for the 2009-2019 Baseline scenario.

Cumulative distribution functions for basin-wide volume-averaged concentrations of TP and TN highlight the substantial increase in nutrients that would result from the addition of Alternative

1 effluent, while also demonstrating that Alternative 2 effluent is predicted to yield nutrient levels similar to predicted 2009-2019 levels, while supplementation with Alternative 3 effluent is predicted to yield slightly improved (lower) concentrations (Figure 32).

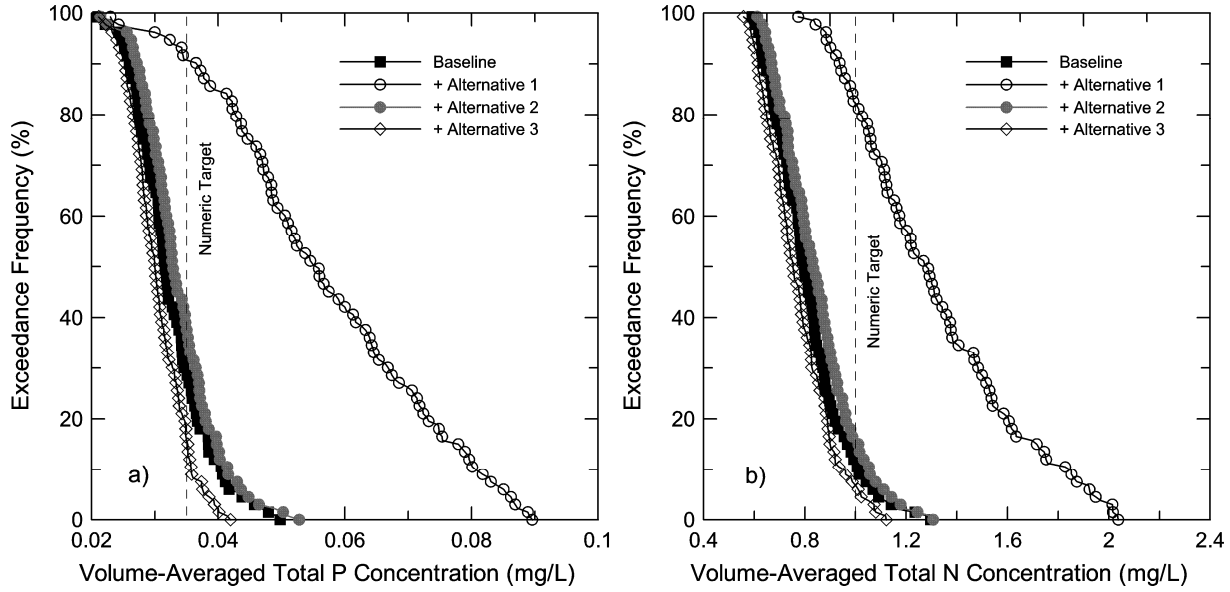


Figure 32. Cumulative distribution functions for predicted baseline and supplementation scenarios of volume-weighted concentrations of a) total P and b) total N.

Summary

Supplementation of natural flows with 1,920 af/yr of Replenish Big Bear water was predicted to add about 0.2 m annually to the lake relative to levels observed in 2009-2019 (baseline), and which accrued over time such that the lake was predicted to be 1.7 m higher in late 2018 compared to the level present at that time. Supplementation also increased lake volume and surface area, with lake area about 300 acres (16%) larger in late 2018 compared with actual area (approximately 2200 acres vs 1900 acres, respectively). Addition of 1,920 af/yr of Alternative 1 water significantly increased TDS levels in the lake, increasing average predicted TDS from 251 mg/L for the baseline (natural) condition for 2009-2019 to 300 mg/L, while Alternatives 2 and 3 were predicted to yield slightly lower average TDS concentrations of 244 and 226 mg/L, respectively. Exceedance of the TDS water quality objective of 175 mg/L was predicted to occur 97.6% of the time for both the baseline condition and for Alternative 2, while exceedance frequency increased to 100% for Alternative 1 and was reduced to 93.3% for Alternative 3.

Nutrient concentrations in the Replenish Big Bear water varied markedly with treatment, with total N and total P concentrations in Alternative 1 being about 6-9x higher than median watershed concentrations, while concentrations in Alternative 2 were projected to be 1.8-2.3x larger and Alternative 3 being about 0.4-0.8x that of median watershed values. The increased nutrient loading from Alternative 1 had a strongly detrimental effect on water quality, increasing average concentrations over 2009-2019 baseline of total N by about 50%, total P by 70%, and chlorophyll-a by 300%. In comparison, further treatment of effluent yielded average

concentrations comparable to (Alternative 2) or slightly improved (Alternative 3) relative to the baseline (natural no-project) condition.

V. PREDICTED LONG-TERM FUTURE CONDITIONS WITH REPLENISH BIG BEAR PROJECT

Simulations were extended from the reference period (2009-2019) to include 30 additional years, for a total of 41 simulation years that yielded potential trajectories for water level, area, TDS, and nutrients out to the beginning of 2050. As previously noted, the model requires extensive data for meteorological conditions (air temperature, dewpoint temperature, wind speed, wind direction, cloud cover, and solar radiation), as well as water inflows, outflows, and withdrawals. While hourly weather forecasts are available 7-10 days in advance from the National Weather Service (NWS) and 5-10 day flow forecasts are available for limited gaged stations from the NWS River Forecast Centers, we obviously do not know *a priori* these detailed meteorological and hydrological conditions for the next 30 years. Similarly, while downscaled global climate models provide some projections about trends in air temperature and precipitation, they do not provide information with sufficient resolution to allow direct use in our simulations.

Given these constraints, existing meteorological and flow data for 2009-2019 were used as the basis for forecasts. (An effort was made to expand the meteorological record to include additional years, but available weather data for the Big Bear Airport only go back to April 2007, thus providing only one additional full year of record, so existing data were used.) The 2009-2019 period included record or near record air temperatures and intervals of both extreme drought and very high precipitation/runoff that captured much of the anticipated inter-annual variability in meteorology and hydrology (e.g., Table 23). For example, average precipitation over 2009-2019 period was not statistically significantly different than that of the past 43 years (e.g., 31.7±15.6 vs 34.8±14.7 in/yr at Bear Valley Dam). Precipitation was better described as log-normally distributed; however, with geometric mean values very similar to median values, and both being slightly lower (reflecting increased prevalence of drought) but well-captured in the 2009-2019 dataset. Perhaps more importantly, minimum and maximum values for the 2009-2019 period were also similar to the larger 1977-2019 dataset (e.g., the highest annual precipitation at the Big Bear Community Services District (BBCCSD) was recorded in 2010, within the 2009-2019 record).

Table 23. Annual precipitation (calendar year) recorded at Bear Valley Dam and BBCCSD. (Water Master, 2019).

Precipitation (in/yr)	Bear Valley Dam		BBCCSD	
	1977-2019	2009-2019	1977-2019	2009-2019
Average	34.8	31.7	14.9	17.5
Geometric Mean	31.6	29.1	13.3	16.3
Median	31.8	27.8	14.1	14.8
Minimum	13.2	14.4	3.8	8.2
Maximum	73.8	64.1	33.2	33.2

Assuming that 2009-2019 is broadly representative of likely future meteorological and hydrologic conditions, Monte Carlo techniques were used to randomly select 100 different 30-year annual records from this set of data. Thus, any given future year was assumed to essentially have a 1-in-11 chance of looking like any one of the years from the 2009-2019 period in terms of meteorological conditions, inflows, withdrawals, and releases for downstream flow

requirements. Impacts of climate change were considered; air temperature increases would increase evaporation losses from lake, but also likely yield more rain and rain-on-snow events that would increase runoff and inflows to lake. Without detailed watershed modeling, it is not possible to resolve these conflicting impacts on the water budget for the lake, so for the purposes of this analysis, they were assumed to cancel out. The Monte Carlo analysis yielded 30-year average flow rates that ranged from 6,891 to 15,115 af/yr (Figure 33). Individual year flow rates varied more widely, ranging from 1,961 – 27,579 af/yr (not shown).

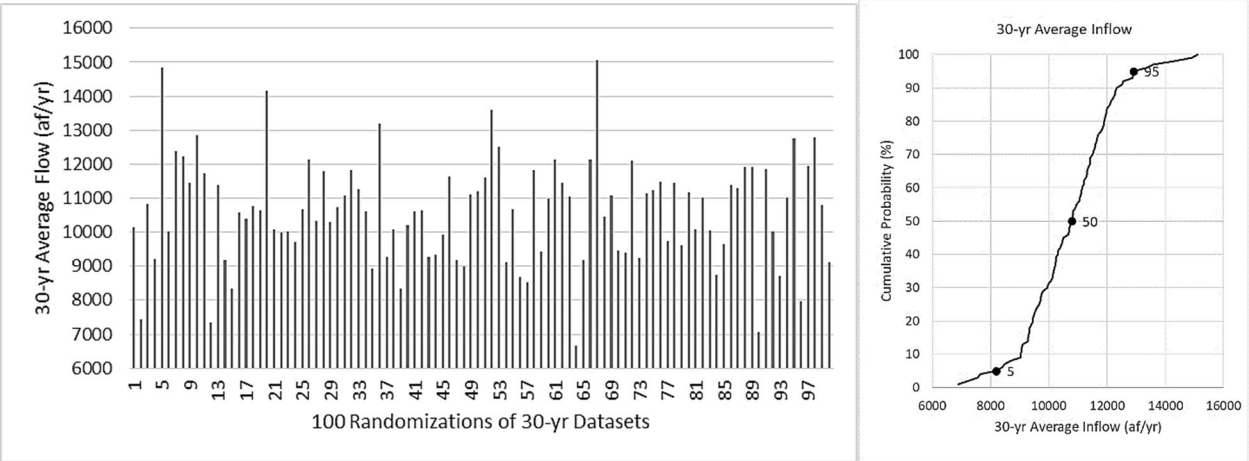


Figure 33. Thirty year average flow rates for 100 random datasets.

From this dataset (Figure 33), three hydrologic scenarios were selected for further analysis corresponding to the 5th-percentile, 50th-percentile (median), and 95th-percentile 30-yr average flow rates. The 5th-percentile corresponds to an average inflow rate of 8,646 af/yr and represents extended drought, not unlike that present in the 1950's-60's, while the 50th-percentile hydrologic scenario corresponds to intervals of both high runoff and drought, comparable to 2009-2019 (average annual inflow of 10,595 af/yr), and the 95th-percentile represents a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr). Cumulative inflows for these 3 hydrologic scenarios are presented in Figure 34. The corresponding meteorological, outflow and withdrawal conditions were used as input for CE-QUAL-W2 simulations. The 3 simulations represent forecasts of conditions subject to the temporal boundary conditions (inflows, meteorological conditions, etc.), and thus are not predictive of conditions at specific points of time in the future. On that basis, results are presented as cumulative distribution functions rather than time-series to convey information in a statistical-probabilistic framework rather than as strict forecasts in time. Lake properties are contrasted between baseline conditions under the 3 hydrologic scenarios and with implementation of the Replenish Big Bear project.

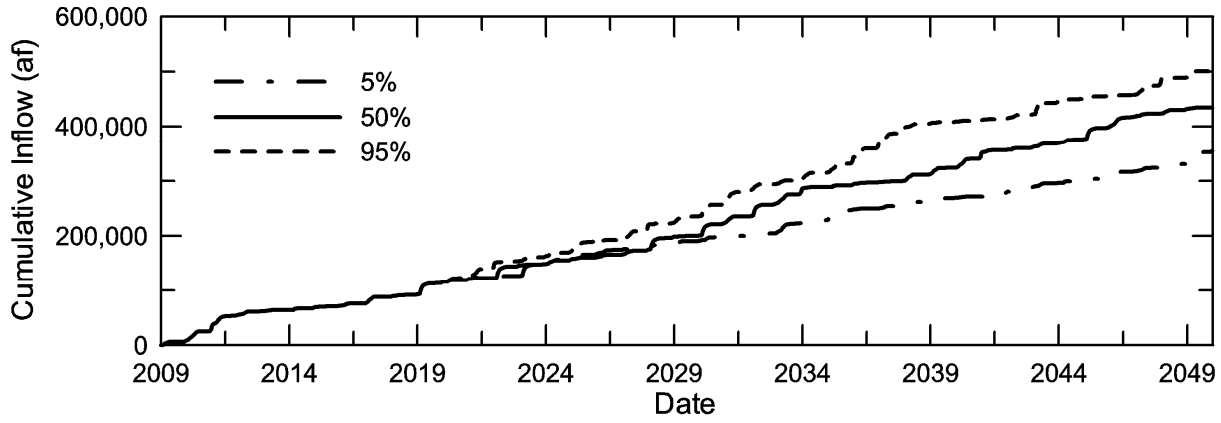


Figure 34. Cumulative inflows under 5th-, 50th- and 95th-percentile 30-yr average hydrologic scenarios.

A. Lake Surface Elevation

The 3 hydrologic scenarios had pronounced effects on predicted lake levels, with the 5th-percentile (chronic drought) scenario yielding elevations as low as 2044.9 m above MSL and a median elevation of 2048.8 m (Figure 35a). The 50th- and 95th-percentile hydrologic scenarios yielded predictably higher lake levels (e.g., median levels of 2052.2 and 2053.1 m, respectively) (Figure 35a). Supplementation with 1,920 af/yr of Replenish Big Bear water markedly increased lake levels, *e.g.*, raising the minimum level for 5th-percentile scenario by up to 4.6 m and increasing median level from 2048.8 m for baseline to 2052.0 m (Figure 35b).

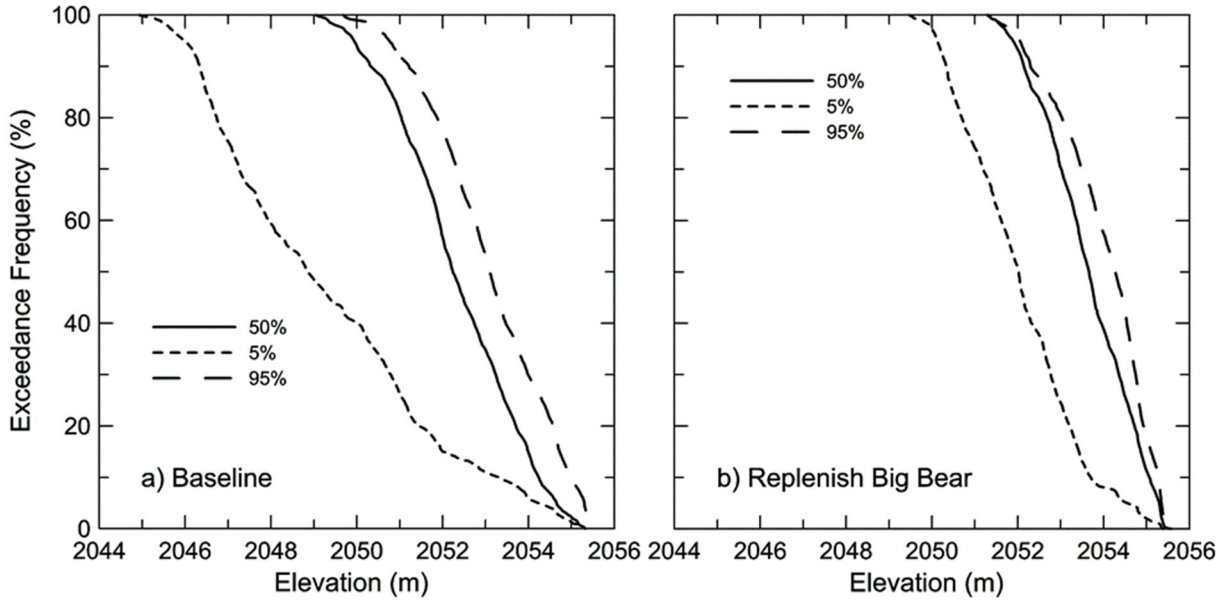


Figure 35. CDFs of predicted lake elevations at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

B. Lake Volume

Supplementation also substantially increased lake volumes, with volumes potentially as low as 6,000 af and a median volume of about 23,000 af for the 5th-percentile (drought) scenario (Figure 36). Supplementation with Replenish Big Bear water resulted in significant increases in lake volume for the other hydrologic scenarios as well (Figure 36).

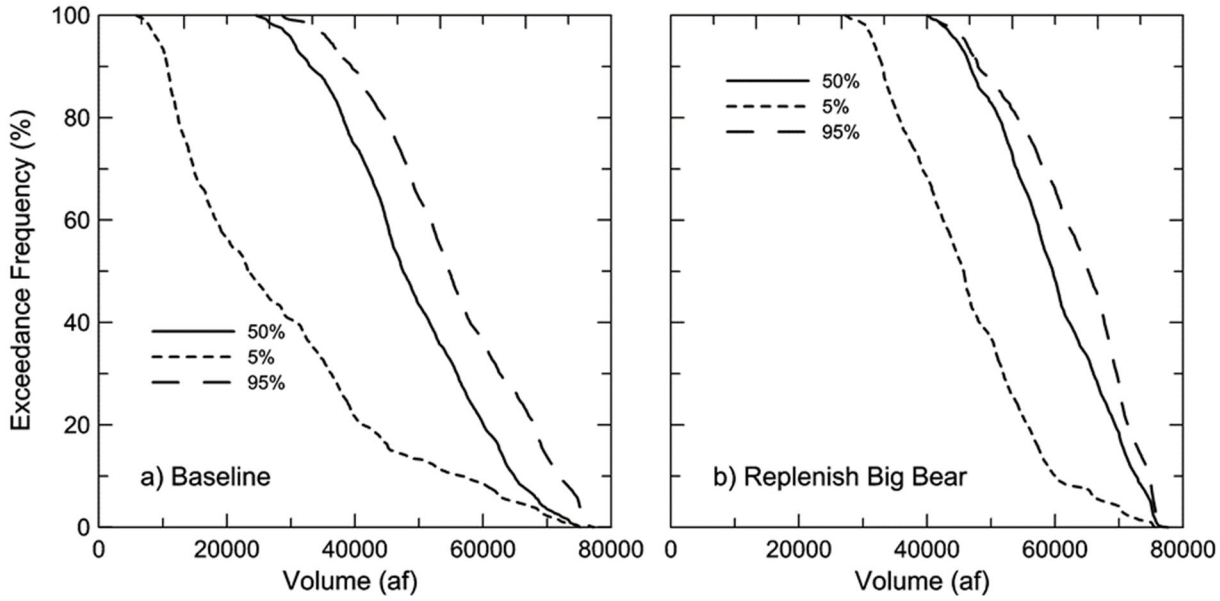


Figure 36. CDFs of predicted lake volumes at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

C. Lake Surface Area

The 5th-percentile hydrologic scenario also yielded very low lake surface areas, potentially <1000 acres and a median area of about 1700 acres (Figure 37a). The minimum predicted lake surface areas were about 2x larger and median surface areas were approximately 2300 and 2500 af for the 50th- and 95th-percentile hydrologic scenarios, respectively. Supplementation substantially increased lake area, shifting all CDFs to higher area values (Figure 37b). This can be seen more graphically in Figure 38, where the areas corresponding to the minimum and 75% exceedance frequencies (predicted to occur 25% of the time under the simulated protracted drought condition) are projected onto the natural lake boundary for the baseline and with project. At the minimum area, the lake divides into the impounded area behind the dam and a 2nd very shallow mid-basin, while the Project is able to maintain an extensive and contiguous lake area through the main body of the lake (Figure 38a). A considerable additional area is also maintained at the 75% exceedance frequency with supplementation (Figure 38b).

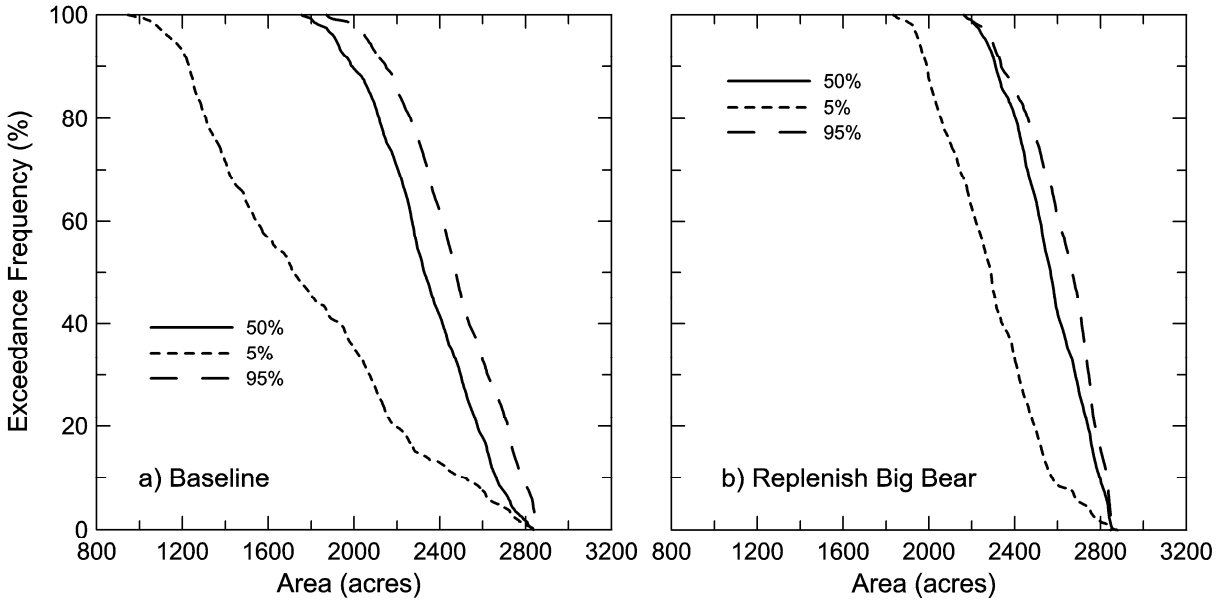


Figure 37. CDFs of predicted lake areas at 5th-,50th- and 95th-percentile hydrologic scenarios for a) baseline conditions and b) supplementation with Replenish Big Bear water.

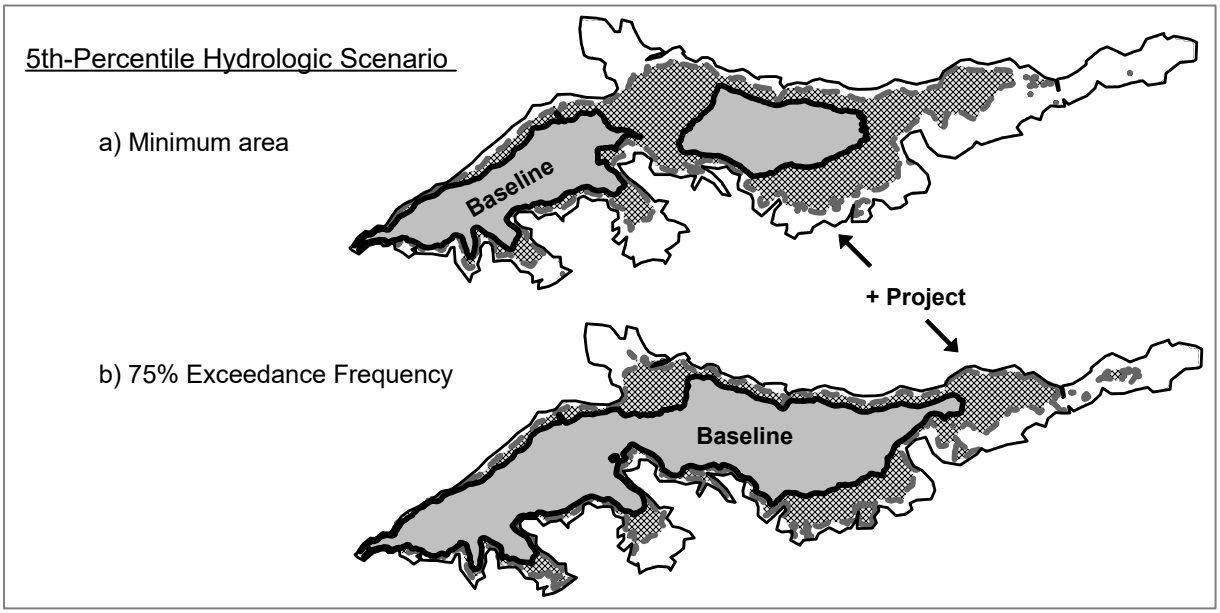


Figure 38. Lake surface under 5th-percentile flows (protracted drought) depicting areas under baseline conditions (solid gray) and with project (cross-hatched) at a) minimum area and b) 75% exceedance frequency (predicted to occur 25% of the time under the simulated protracted drought condition).

D. Total Dissolved Solids

The concentrations of TDS in Big Bear Lake vary naturally as a function of lake level as a result of runoff inputs and evapoconcentration. Thus, predicted TDS concentrations were greatest for the 5th-percentile hydrologic scenario (protracted drought) and lower for the 50th- and 95th-percentile hydrologic scenarios (Figure 39a). Unlike lake elevation, volume and area which are independent of the type of effluent treatment, predicted TDS concentrations in the lake are quite sensitive to it (Figure 39b-d).

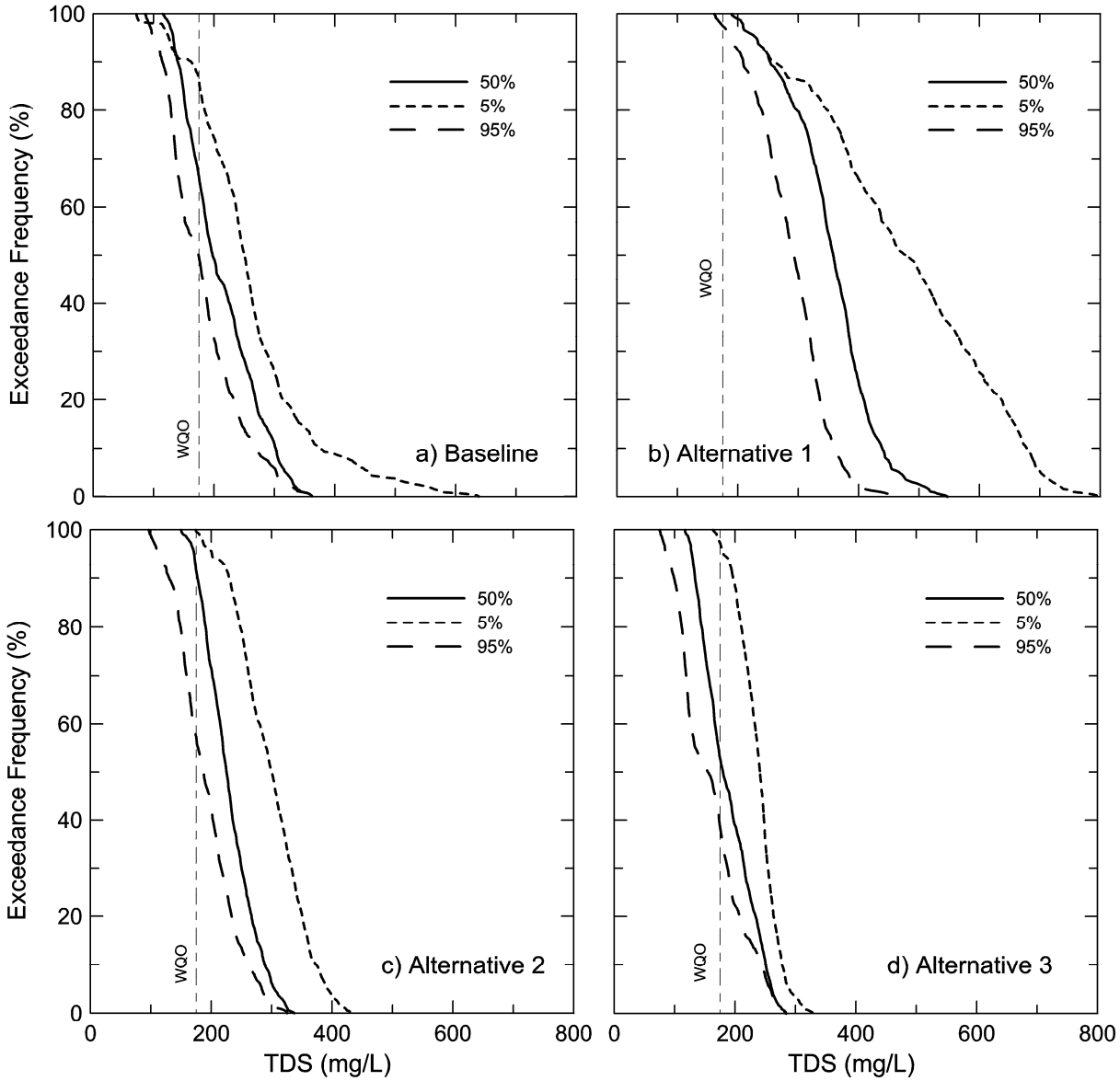


Figure 39. CDFs of predicted lake TDS at 5th-,50th- and 95th-percentile flows for a) baseline conditions, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

Alternative 1 treatment, involving only nutrient removal, yielded high concentrations of TDS that was predicted to exceed the water quality objective by wide margins (Figure 38b), while Alternative 2 shifted CDFs from baseline to slightly higher TDS levels, and the highest level of treatment (Alternative 3) yielded slightly lowered concentrations relative to Baseline scenario (Figure 39c,d).

E. Total P

Total P concentrations for the baseline condition were predicted to vary under the 3 hydrologic scenarios, exceeding 0.05 mg/L with some frequency under the drought scenario (Figure 40a).

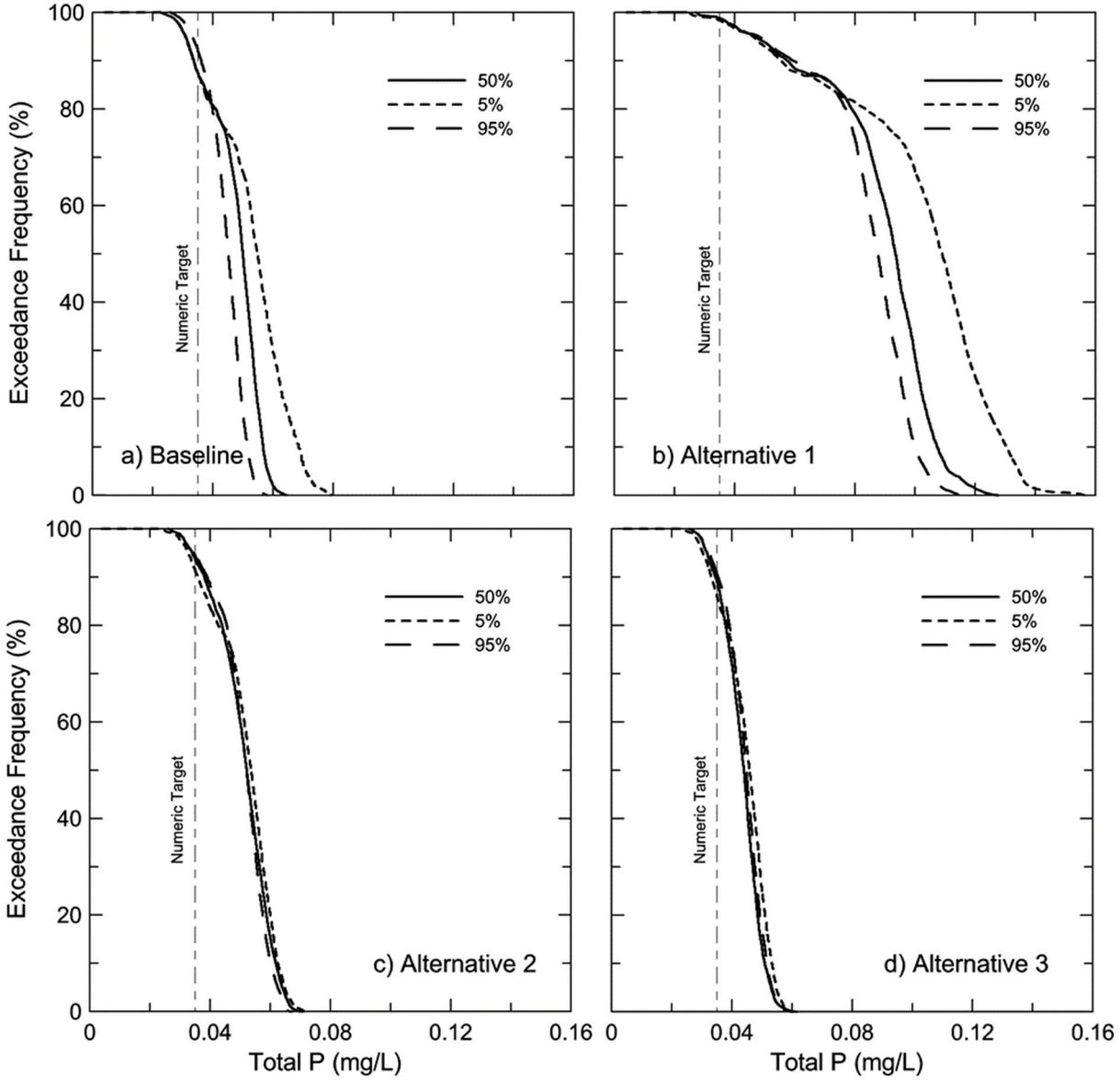


Figure 40. CDFs of predicted total P levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) Baseline, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

As noted in simulations for 2009-2019, supplementation with Replenish Big Bear effluent substantially degraded predicted water quality, and increased total P (Figure 40b), as well as total N (Figure 41b) and chlorophyll-a (Fig. 42b). Supplementation with higher quality Alternative 2 and 3 water reduced natural variability and provided comparable or lower levels (Figure 40c,d).

F. Total N

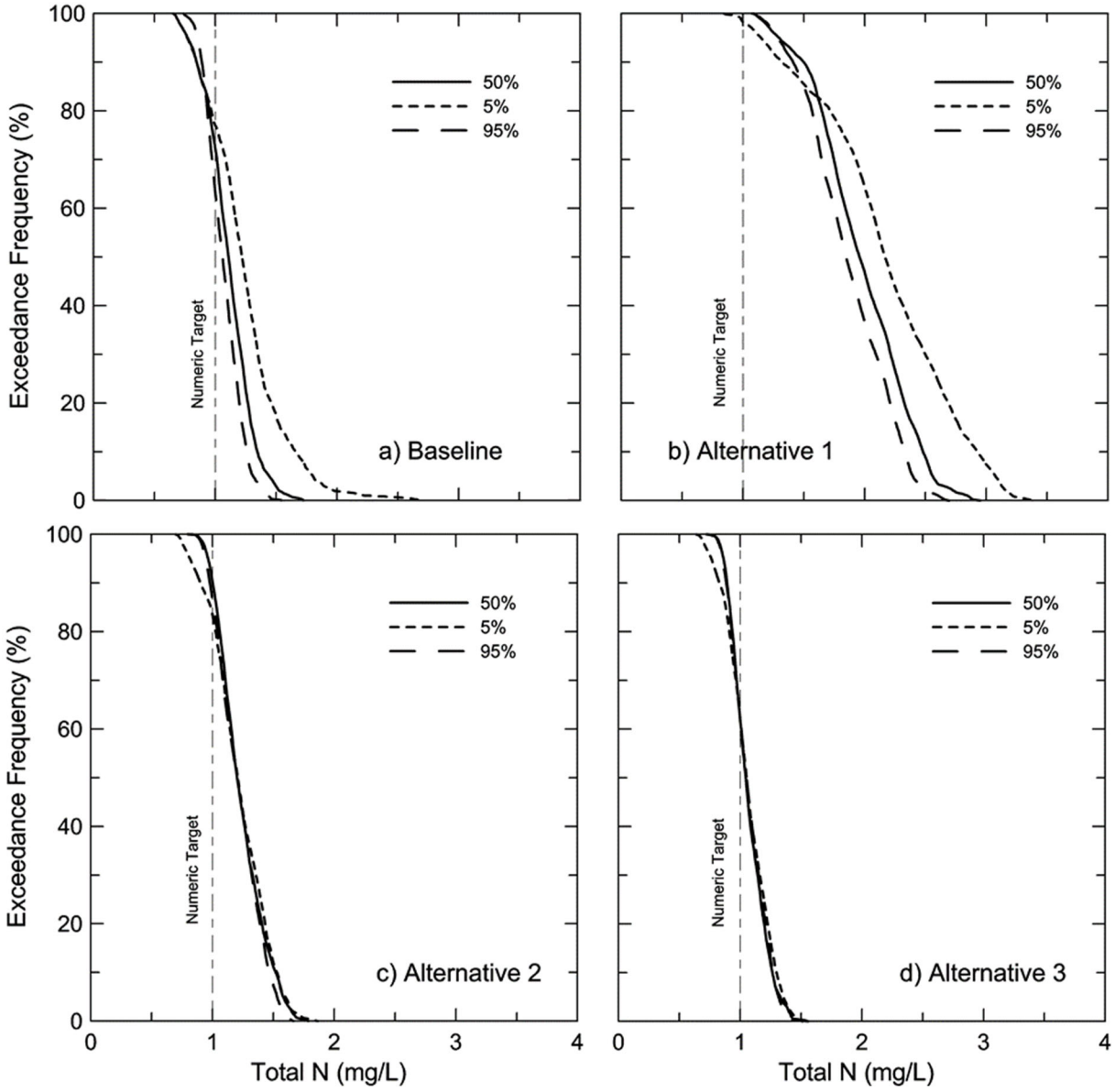


Figure 41. CDFs of predicted total N levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) baseline conditions, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

Predicted total N concentrations (Figure 41) followed the same trends as total P (Figure 40), with Alternative 1 significantly increasing concentrations, while Alternatives 2 and 3 reduced variability in baseline case due to stabilization of lake level with high quality water (Figure 41).

G. Chlorophyll-a

Chlorophyll-a concentrations followed similar trends as noted for total P and total N, with a >5x increase in median predicted concentrations with Alternative 1 compared with baseline, while Alternatives 2 and 3 yielded comparable or slightly higher predicted concentrations (Figure 42).

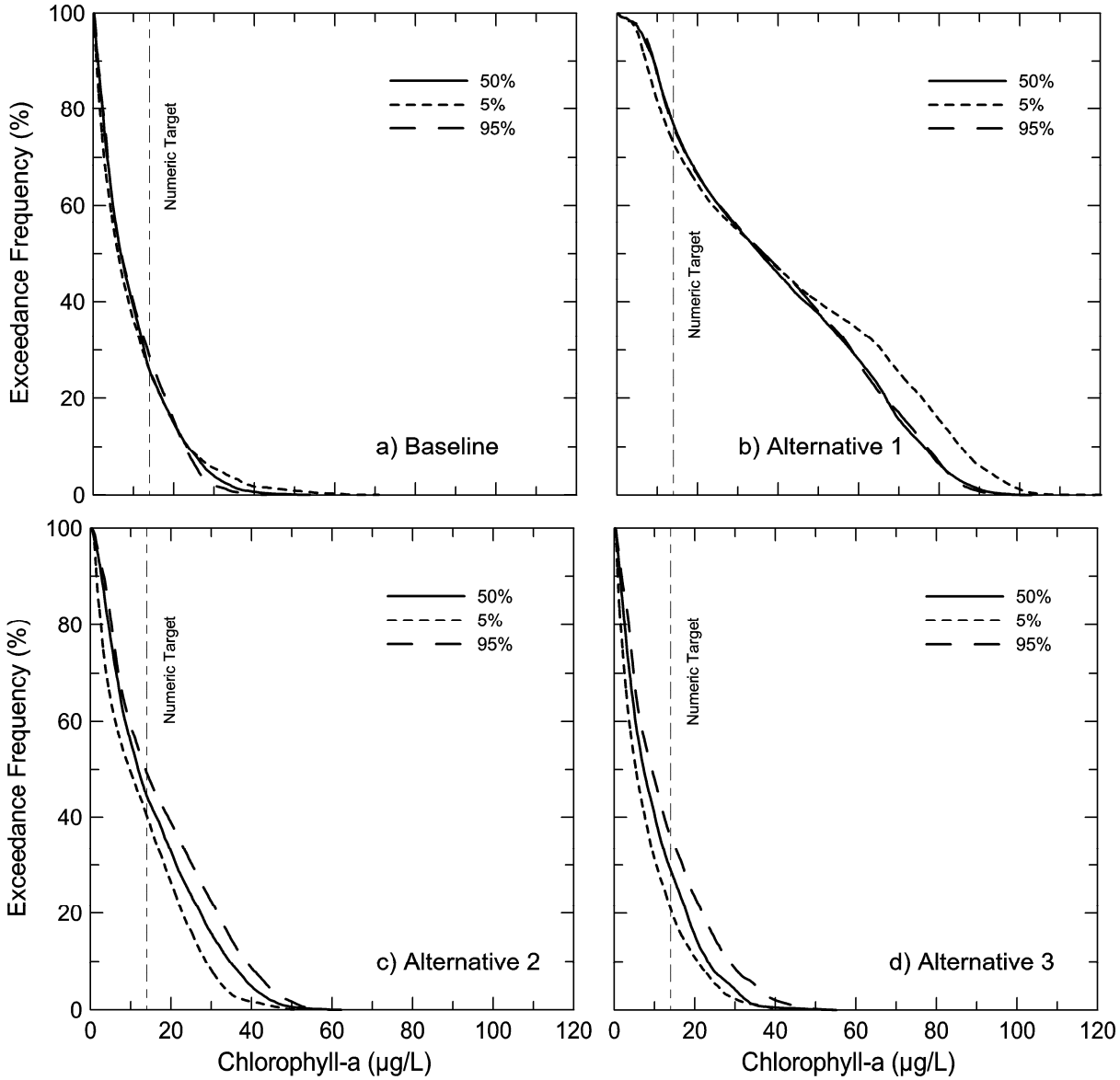


Figure 42. CDFs of predicted chlorophyll-a levels at 5th-, 50th- and 95th-percentile hydrologic scenarios for a) Baseline, and supplementation with b) Alternative 1, c) Alternative 2 and d) Alternative 3 water.

CDF Summary

CDFs convey a great deal of information, although it is often not easy to readily resolve differences across multiple graphs. Median lake dimensions for the 3 different hydrologic scenarios with and without supplementation with water from the Replenish Big Bear project from Figures 34-36 are summarized in Table 24.

Table 24. Influence of hydrologic scenarios and supplementation on median lake dimensions.

Parameter	Scenario	5th-Percentile	50th-Percentile	95th-Percentile
Elevation (m)	Baseline	2048.9	2052.2	2053.1
	+Project	2052.0 (+3.2)	2053.7 (+2.2)	2054.3 (+1.6)
Volume (af)	Baseline	23,404	47,536	54,724
	+Project	45,746 (+22,342)	59,664 (+12,128)	65,204 (+10,480)
Area (acres)	Baseline	1717	2328	2474
	+Project	2290 (+572)	2568 (+240)	2669 (+195)

Median concentrations of TDS, total N, total P and chlorophyll-a under the different hydrologic scenarios and levels of treatment are summarized in Table 25. As evident in the CDFs, the level of treatment of the supplemental water substantially affects the resulting water quality in the lake. Treated effluent with nutrient removal (Alternative 1), without additional treatment, offsets or other strategies, is predicted to have significant negative impacts to water quality in the lake, nearly doubling median concentrations of total P and total N, and increasing median chlorophyll-a concentrations by >5x relative to levels predicted for the natural (baseline) scenario (Table 25). Further advanced treatment of effluent (Alternatives 2 and 3), however, yielded predicted water quality broadly similar to or slightly better than the baseline case (Table 25).

Table 25. Influence of hydrologic scenarios and supplementation with alternative levels of treatment on predicted median concentrations of TDS, total N, total P and chlorophyll-a.

Parameter	Scenario	5th-Percentile	50th-Percentile	95th-Percentile
TDS (mg/L)	Baseline	250	198	175
	Alternative 1	478	358	293
	Alternative 2	300	225	187
	Alternative 3	241	180	155
Total P (mg/L)	Baseline	0.055	0.050	0.045
	Alternative 1	0.109	0.094	0.088
	Alternative 2	0.054	0.052	0.052
	Alternative 3	0.046	0.044	0.045
Total N (mg/L)	Baseline	1.22	1.11	1.06
	Alternative 1	2.17	1.96	1.85
	Alternative 2	1.21	1.20	1.20
	Alternative 3	1.05	1.05	1.05
Chlorophyll-a (µg/L)	Baseline	6.2	6.9	7.0
	Alternative 1	36.1	35.6	36.5
	Alternative 2	9.7	11.9	13.7
	Alternative 3	5.4	7.3	9.4

Summary

Simulations for 2009-2019 were extended to 2050 to evaluate possible long-term conditions in the lake under natural hydrologic variability with and without supplemental water from

Replenish Big Bear. Three hydrologic scenarios representing the 5th-, 50th- and 95th-percentile 30 year average annual flow records were used for predictions of future conditions in the lake. The 5th-percentile corresponded to an average inflow rate of 8,646 af/yr and represents extended drought, while the 50th-percentile (median) corresponded to intervals of both high runoff and drought comparable to 2009-2019 (average annual inflow of 10,595 af/yr), and the 95th-percentile represented a period of protracted above average rainfall and runoff (average annual inflow of 12,225 af/yr).

Supplementation with Replenish Big Bear was predicted to influence long-term (2009-2050) conditions in the lake which varied under the 3 hydrologic scenarios. Under the 50th-percentile hydrologic scenario, Replenish Big Bear was predicted to increase average lake level by 1.5 m, lake volume by nearly 13,000 af, and lake area by 260 acres relative to the predicted long-term baseline (no-project) condition. Water quality varied with level of effluent treatment, with Alternative 1 nearly doubling predicted long-term average concentrations of TDS, total P and total N and quadrupling average predicted chlorophyll-a levels. Long-term simulations indicate slight increases in average TDS, total P and total N and modest increase in chlorophyll-a for Alternative 2, and generally slight reductions or no significant change in concentrations with Alternative 3. Supplementation was predicted to have more substantial effects under the 5th-percentile hydrologic (drought) scenario, providing an average increase in lake level of 3.4 m, increase in volume of 16,104 af, and an additional average 638 surface acres (about 40% increase) relative to baseline. As with the 50th-percentile hydrologic scenario, supplementation with Alternative 1 effluent substantially degraded lake water quality, while further treatment as provided in Alternatives 2 and 3 yielded comparable or slightly improved water quality in the lake. Effects of Replenish Big Bear were more modest at the 95th-percentile runoff scenario, when supplementation is less important, owing to the lower overall contributions of water and TDS and nutrients relative to the watershed.

VI. ROUTING OF SUPPLEMENTAL WATER THROUGH STANFIELD MARSH

Simulations involved the delivery of Replenish Big Bear project water through Stanfield Marsh and into the main body of the lake. Wetlands are often very good at improving water quality by filtering and settling out of particulate matter, biological uptake of dissolved forms of nutrients, and under favorable conditions also denitrification and loss of NO_3-N to the atmosphere. Stanfield Marsh was predicted to be an effective sink for total P in supplemental water with Treatment Alternatives 1 and 2 but was a modest source of total P for Alternative 3 water (Figure 43, Table 26).

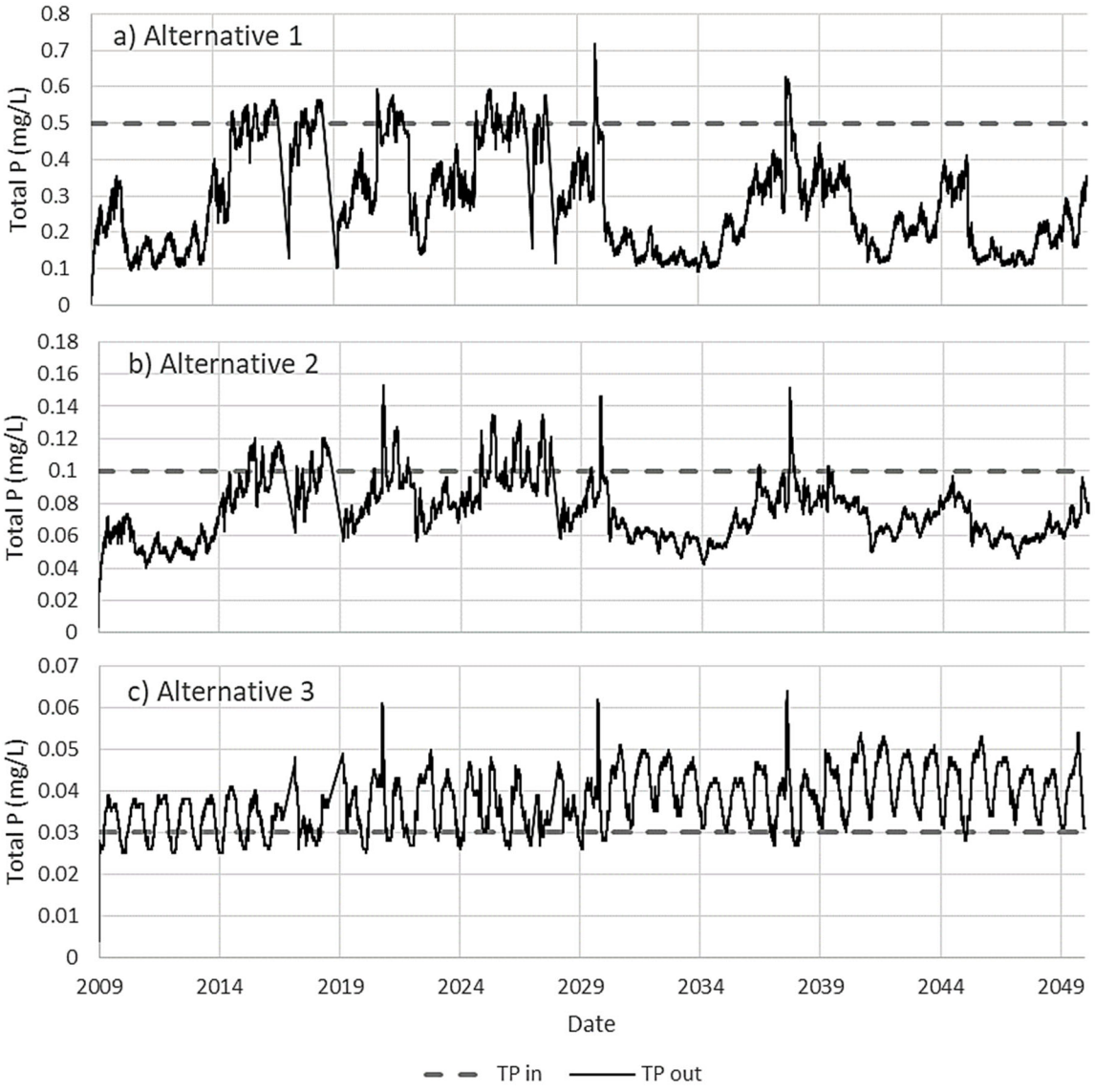


Figure 43. Total P concentrations into and out of Stanfield Marsh: a) Alternative 1, b) Alternative 2, and c) Alternative 3.

Interestingly, the marsh was predicted to be a net source of N for all 3 treatment scenarios; the basis for this is not entirely clear at this time, but sediment mineralization and potentially some N_2-fixation may be occurring during periods of intense primary production that could increase the total N concentration. Stabilization of the water level within the marsh through some hydraulic control would presumably increase nutrient retention and could promote denitrification, although additional work is needed to understand the dynamics within the Marsh, especially given natural variations in lake levels and intervals of wetting and desiccation.

Table 26. Predicted average total P and total N removal in Stanfield Marsh.

	Alternative 1		Alternative 2		Alternative 3	
	% Removal	kg/yr	% Removal	kg/yr	% Removal	kg/yr
Total P	14.8	175	8.4	20	-10.3	-7
Total N	-22.5	-1174	-17.0	-442	-19.0	-270

Summary

Simulations indicate net removal of total P from Alternative 1 and Alternative 2 effluents during flow through Stanfield Marsh, while the Marsh was predicted to be a modest source of total P to Alternative 3 water with very low influent concentrations. Interestingly, the Marsh was predicted to be a source of total N across all levels of treatment, due presumably to sediment decay, some N_2-fixation and subsequent decay in response high PO_4-P concentrations and high TN:TP ratios in the effluent. Further work is needed, however, to better understand the role of the Marsh as a net sink and/or source for nutrients.

VII. SUMMARY

Lake conditions and water quality in Big Bear Lake varied significantly over 2009-2019, with wide natural variations in lake level, volume and surface area, as well as concentrations of TDS, nutrients and chlorophyll-a. Statistical, machine learning and hypolimnetic mass balance analyses provided valuable new information about water quality in Big Bear Lake, while CE-QUAL-W2 was able to reproduce observed trends in lake conditions. Supplementation of natural runoff with Replenish Big Bear water significantly increased lake levels, volumes and surface areas, especially during periods of drought, with resulting recreational, aesthetic, community and related benefits. The level of treatment had dramatic effects on water quality, however. Nutrient removal (Alternative 1) was not sufficient to protect water quality in Big Bear Lake, although nutrient removal with further treatment (Alternatives 2 and 3) was predicted to yield water quality comparable to or slightly improved relative to baseline conditions.

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APPENDIX C: REPLENISH BIG BEAR: MODELING OF HIGHER FLOWS AND WITH ZERO TP LOAD

REPLENISH BIG BEAR: MODELING OF HIGHER FLOWS AND WITH ZERO TP LOAD

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Coeur d'Alene, ID

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Introduction

It was previously noted that water quality was predicted to vary markedly with the level of treatment of added Replenish Big Bear (RBB) recycled water, with Alternative 1 (TIN and TP removal) significantly degrading water quality in Big Bear Lake relative to predicted baseline conditions, while Alternative 2 (70% RO) modestly increased average predicted concentrations of TN, TP and chlorophyll-a, and Alternative 3 (100% RO) was predicted to slightly improve average water quality for the 2009-2019 period (Anderson, 2021, Table 22). Long-term simulations for different hydrologic scenarios yielded similar results, with 100% RO yielding predicted water quality typically comparable to baseline conditions. Notwithstanding, some subtle differences were observed between predicted median baseline concentrations and those for Alternative 3 which assumed steady annual flows of 1920 af/yr of 100% RO water (Anderson, 2021, Table 25).

Recent engineering work indicates that slightly higher inflows, up to 2210 af/yr, can be attained by the Replenish Big Bear project by employing additional brine minimization technology (Table 1). Note that a portion of the water produced by RBB may be discharged to Shay Pond and the earlier "Alternative 3" scenario had excluded those flows (up to 80 af/yr) from the analysis. However, to be conservative for permitting purposes, this analysis is based on discharging all of the recycled water produced to the Lake.

Table 1. Initial and recently updated Replenish Big Bear (RBB) flow projections.

Scenario	**Annual RBB Inflow (af)**	**Daily RBB Inflow (MGD)**
Baseline	0	0
Alternative 3 [(a)]	1920	1.71
High Flow (99% recovery) [(b)]	2210	1.57 – 2.18
Mid Flow (90% recovery) [(b)]	2009	1.42 – 1.98

Notes:

[(a)]Alternative 3 was assessed in the 2021 Lake Analysis and assumed that of the total Replenish Big Bear effluent contribution considered in the Lake Analysis (i.e., 2,000 AFY), 80 AFY would be delivered to Shay Pond. Therefore, only 1,920 AFY would be discharged to the Lake.

[(b)]The updated model analysis assumed that no discharge to Shay Pond would occur and all recycled water would be discharged to the Lake under two different total recovery rates scenarios.

Moreover, deliveries are expected to vary seasonally (Fig 1), thus varying from the earlier "Alternative 3" scenario that assumed uniform flows of 1.71 MGD throughout the year. Inflows to the WWTP are lower in the summer months due to reduced inflow.

Since the Replenish Big Bear project does not have a waste load allocation for total P (TP) in the current TMDL, it is proposing to offset the TP load in the project inflows delivered to Big Bear Lake. While RO is extremely effective at removing dissolved and particulate substances, there nonetheless is a small quantity of TP that is expected to evade treatment (the projected RO effluent concentration is 0.03 mg/L, principally as o-PO_4-P). Elimination of all TP through the treatment process is not practicable, so removal of an equivalent load of TP (up to 200 lbs/yr) from elsewhere in the lake or watershed will be necessary.

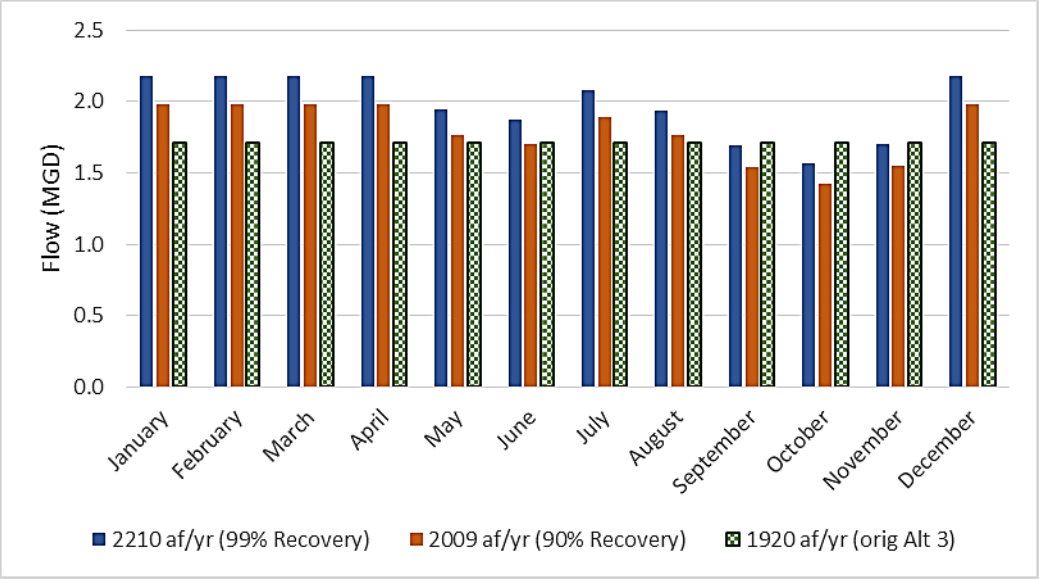

Fig. 1. Monthly flow rates (projected 2040) for Replenish Big Bear under three project inflow scenarios.

In light of these factors, further modeling was conducted to evaluate predicted water quality under these operational scenarios (increased and time-varying flows, with and without TP offset) for comparison with the previously predicted baseline condition and Alternative 3 scenario. Given the complexity of nutrient budgets of lakes, array of possible offset strategies, and equivalence of a given form of nutrient irrespective of its particular origin, TP offset will be modeled as equivalent to 0 influent concentration. This is an approximation that holds when considering whole-lake nutrient budget, but is nonetheless a simplification; depending upon details of offset, hydrodynamic considerations and other factors, some modest lateral gradients in water quality may result. The 50th percentile hydrologic scenario for 2009-2050 was used in this analysis, noting that it includes a wide array of runoff conditions, included extended drought and as well as periods of high runoff. All other hydrologic, meteorological, biological, chemical and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021).

Results

Long-term averaged predicted concentrations of TDS, TIN, total P, total N and chlorophyll-a were lower with addition of RBB water compared with predicted baseline conditions (no supplementation) (Table 2). For reference, TMDL target values are included in the table. Focusing on chlorophyll-a as the key response target, baseline conditions were predicted to yield growing-season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the TMDL target value of 14 µg/L, while Alternative 3 matched the target value, and larger inputs of RBB inflow that varied seasonally (Fig. 1) yielded values below baseline and TMDL target values (Table 2). Zeroing out the load of TP in RBB inflow yielded further reductions in chlorophyll-a; larger inflow volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 - 10.2 µg/L, significantly below predicted baseline and TMDL concentrations (Table 2).

Table 2. Long-term average predicted concentrations of total P, total N and chlorophyll-a in Big Bear Lake under different operational scenarios (total P and total N expressed as annual average concentrations; chlorophyll-a shown as growing season average concentrations).

Operational Scenario (all at 50th % hydrology)	**TDS (mg/L)**	**TIN (mg/L**	**Total P (µg/L)**	**Total N (mg/L)**	**Chlorophyll-a (µg/L)**
Baseline	**195**	**0.069**	**47.7**	**1.15**	**14.1**
Alternative 3 (1920 af)	182	0.052	43.3	1.07	14.0
2210 af (99% recovery)	**179**	**0.045**	**42.3**	**1.04**	**13.1**
2009 af (90% recovery)	**180**	**0.041**	**43.4**	**1.06**	**12.9**
2210 af + 0 total P	179	0.072	39.9	1.00	10.2
2009 af + 0 total P	180	0.040	40.9	1.00	9.5
TMDL target			***35.0***		***14.0***

Supplementation with RBB inflow also lowered concentrations of total P and total N relative to predicted baseline levels (Table 2). This is consistent with the reduced concentrations of total N and total P (and most dissolved forms of N and P) in RO water relative to watershed runoff concentrations (Anderson, 2021, Table 20), with concentrations projected to be only 40% - 80% of average watershed runoff concentrations (Anderson, 2021, Table 21). Interestingly, zeroing out the influent TP concentration not only lowered the predicted average total P concentration but also reduced the predicted total N concentrations, highlighting the complex biogeochemical coupling of these two key nutrients. While it is important to recognize the uncertainty in model predictions, it is nonetheless noteworthy that revised project flows, with varying seasonal flow and TP offset, yielded average chlorophyll-a concentrations significantly below baseline and TMDL values and also yielded long-term average TN concentrations approaching or reaching 1 mg/L, which is being considered by the Regional Water Board. Predicted long-term average TP concentrations remained above the TMDL target, but were nonetheless meaningfully lower than the predicted baseline level (Table 2). Average TDS and TIN concentrations were also lower than predicted baseline conditions (with exception of 2210 af + 0 TP, where a period of higher NO_3-N was predicted).

Inter-annual differences in water quality are nonetheless expected to persist. Cumulative distributions functions (CDFs) highlight the predicted wide range in annual and growing season average concentrations (Fig. 2). While addition of RBB inflow shifted CDFs to lower annual average total P and total N concentrations and growing season average chlorophyll-a concentrations, wide ranges in predicted concentrations remained in place (Fig. 2). Thus, the growing season average chlorophyll-a target of 14 µg/L was predicted to be exceeded about 53% of the time under baseline conditions, and exceeded about 41% and 31% of the time with RBB inflows of 2210 af/yr without and with TP offset, respectively (Fig. 2c; Table 3). Results for all scenarios are summarized in Table 3.

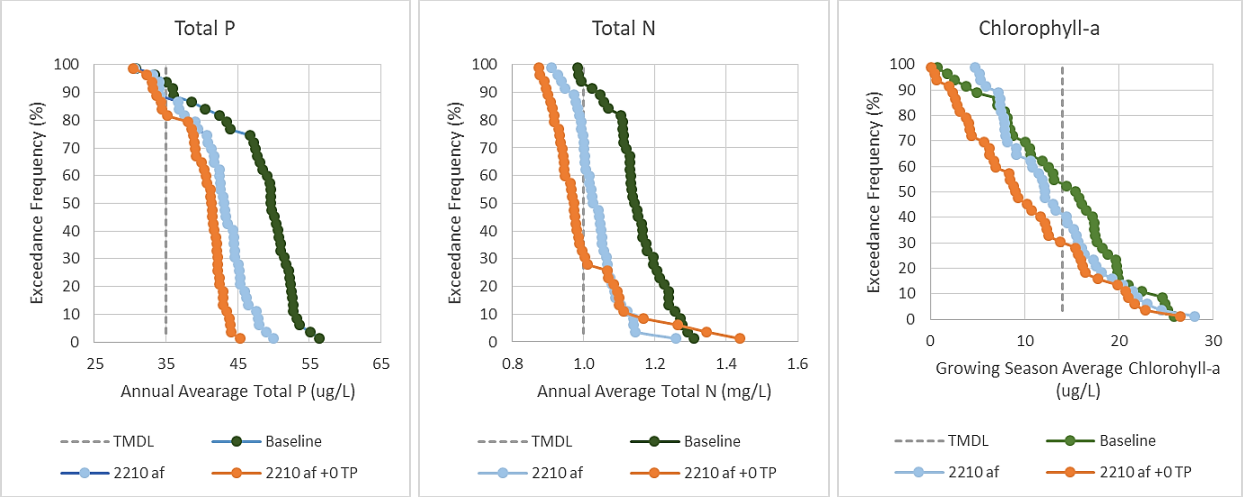

Fig. 2. Cumulative distribution functions for predicted annual total P and total N concentrations and growing season average chlorophyll-a concentrations for baseline condition and with 2210 af RBB inflow with and without TP offset.

Table 3. Predicted frequency of exceeding TMDL target under baseline conditions and different RBB inflow and TP offset scenarios (annual average or growing season average basis). Observed annual exceedance frequencies for 2009-19 period shown in parentheses under Baseline.

Variable	**Baseline**	**1920 af**	**2210 af**	**2210 af+0 TP**	**2009 af**	**2009 af+0 TP**
Total P	94 % (100%)	87 %	87 %	82 %	91 %	90 %
Total N[a]	91 % (na)	72 %	72 %	30 %	80 %	55 %
Chlorophyll-a	53 % (55%)	51 %	41 %	31 %	40 %	22 %

[a]*possible TMDL target*

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APPENDIX D: SECONDARY EFFLUENT, BIG BEAR LAKE, AND SHAY POND WATER QUALITY DATA FOR ANTIDEGRADATION ANALYSIS

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date	Excluded in Average Calculation?
Big Bear Lake		Total Nitrogen	J-Flag	0.87	mg/L			Calculated	12/2/2021	12/3/2021	No
Shay Pond		Total Nitrogen	=	1.2	mg/L			Calculated	11/17/2021	11/22/2021	No
Big Bear Lake		Total Kjeldahl Nitrogen	J-Flag	0.87	mg/L	1		EPA 351.2	12/2/2021	12/3/2021	No
Shay Pond		Total Kjeldahl Nitrogen	<	ND	mg/L	1		EPA 351.2	11/17/2021	11/22/2021	Yes
Big Bear Lake		Total Filterable Residue/TDS	=	320	mg/L	5		SM 2540C	12/2/2021	12/10/2021	No
Shay Pond		Total Filterable Residue/TDS	=	320	mg/L	5		SM 2540C	11/17/2021	11/29/2021	No
Secondary Effluent		TDS	=	451	mg/L				1/14/2021		No
Secondary Effluent		TDS	=	428	mg/L				2/3/2021		No
Secondary Effluent		TDS	=	398	mg/L				3/3/2021		No
Secondary Effluent		TDS	=	415	mg/L				4/14/2021		No
Secondary Effluent		TDS	=	438	mg/L				5/19/2021		No
Secondary Effluent		TDS	=	447	mg/L				6/16/2021		No
Secondary Effluent		TDS	=	460	mg/L				7/21/2021		No
Secondary Effluent		TDS	=	453	mg/L				8/11/2021		No
Secondary Effluent		TDS	=	475	mg/L				9/1/2021		No
Secondary Effluent		TDS	=	461	mg/L				10/6/2021		No
Secondary Effluent		TDS	=	450	mg/L				11/17/2021		No
Secondary Effluent		TDS	=	411	mg/L				12/8/2021		No
Secondary Effluent		Sulfate	=	35	mg/L	0.5	0.14	EPA 300.0	11/18/2021	11/18/2021	No
Big Bear Lake		Sulfate	=	18	mg/L	0.5		EPA 300.0	12/2/2021	12/2/2021	No
Shay Pond		Sulfate	=	23	mg/L	0.5		EPA 300.0	11/17/2021	11/18/2021	No
Secondary Effluent		Sulfate	=	41	mg/L				1/6/2021		No
Secondary Effluent		Sulfate	=	40	mg/L				1/20/2021		No
Secondary Effluent		Sulfate	=	41	mg/L				2/17/2021		No
Secondary Effluent		Sulfate	=	42	mg/L				2/24/2021		No
Secondary Effluent		Sulfate	=	42	mg/L				3/3/2021		No
Secondary Effluent		Sulfate	=	41	mg/L				3/10/2021		No
Secondary Effluent		Sulfate	=	41	mg/L				4/7/2021		No
Secondary Effluent		Sulfate	=	42	mg/L				4/14/2021		No
Secondary Effluent		Sulfate	=	41	mg/L				5/27/2021		No
Secondary Effluent		Sulfate	=	44	mg/L				6/9/2021		No
Secondary Effluent		Sulfate	=	43	mg/L				6/22/2021		No
Secondary Effluent		Sulfate	=	37	mg/L				7/21/2021		No
Secondary Effluent		Sulfate	=	38	mg/L				8/25/2021		No
Secondary Effluent		Sulfate	=	40	mg/L				9/8/2021		No
Secondary Effluent		Sulfate	=	42	mg/L				10/6/2021		No
Secondary Effluent		Sulfate	=	43	mg/L				10/20/2021		No
Secondary Effluent		Sulfate	=	40	mg/L				11/3/2021		No
Secondary Effluent		Sulfate	=	35	mg/L				11/17/2021		No
Secondary Effluent		Sulfate	=	43	mg/L				12/1/2021		No
Secondary Effluent		Specific Conductance (E.C.)	=	755	µmhos/cm			SM 2510B	11/18/2021		No
Big Bear Lake		Specific Conductance (E.C.)	=	470	µmhos/cm	2		SM 2510B	12/2/2021	12/3/2021	No
Shay Pond		Specific Conductance (E.C.)	=	450	µmhos/cm	2		SM 2510B	11/17/2021	11/18/2021	No
Big Bear Lake		Sodium	=	33	mg/L	1			12/2/2021		No
Secondary Effluent		Nitrite as N (NO2-N)	<	ND	mg/L	0.4	0.17	EPA 300.0	11/20/2019		Yes
Big Bear Lake		Nitrite as N (NO2-N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021	Yes
Shay Pond		Nitrite as N (NO2-N)	<	ND	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021	Yes

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date	Excluded in Average Calculation?
Secondary Effluent		Nitrate as N (NO3-N)	=	1.3	mg/L	0.4	0.12	EPA 300.0	11/20/2019		No
Big Bear Lake		Nitrate as N (NO3-N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021	Yes
Shay Pond		Nitrate as N (NO3-N)	=	1.2	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021	No
Big Bear Lake		Nitrate + Nitrite (as N)	<	ND	mg/L	0.4		EPA 300.0	12/2/2021	12/2/2021	Yes
Shay Pond		Nitrate + Nitrite (as N)	=	1.3	mg/L	0.4		EPA 300.0	11/17/2021	11/18/2021	No
Secondary Effluent		Methylmercury, Dissolved	=	0.13	ng/L	0.05		EPA 1630 filtrate	6/18/2020	6/25/2020	No
Secondary Effluent		Methylmercury	=	0.18	ng/L	0.05		EPA 1630	6/18/2020	6/25/2020	No
Secondary Effluent		Mercury, Dissolved	<	ND	µg/L	0.0005		EPA 1631E filtra	6/18/2020	6/24/2020	Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	12/1/2016		Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	11/29/2017		Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.05	EPA 245.1	12/5/2018		Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	11/20/2019		Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	12/18/2019		Yes
Secondary Effluent	8	Mercury	=	0.00076	µg/L	0.0005		EPA 1631E	6/18/2020	6/24/2020	No
Secondary Effluent	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	12/2/2020		Yes
Secondary Effluent	8	Mercury	<	ND	µg/L	1	0.15	EPA 245.1	11/18/2021	12/13/2021	Yes
Big Bear Lake	8	Mercury	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/8/2021	Yes
Big Bear Lake	8	Mercury	=	0.27	µg/L	0.2	0.15	EPA 245.1	12/2/2021	12/9/2021	No
Shay Pond	8	Mercury	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/30/2021	Yes
Shay Pond	8	Mercury	<	ND	µg/L	0.2	0.15	EPA 245.1	11/17/2021	11/30/2021	Yes
Secondary Effluent		MBAS (LAS Mole. Wt 340.0)	<	ND	mg/L	0.1	0.047	SM 5540C	11/20/2019		Yes
Secondary Effluent		MBAS (LAS Mole. Wt 340.0)	=	0.14	mg/L	0.1	0.047	SM 5540C	11/18/2021	11/18/2021	No
Big Bear Lake		MBAS (LAS Mole. Wt 340.0)	J-Flag	0.058	mg/L	0.1		SM 5540C	12/2/2021	12/2/2021	No
Shay Pond		MBAS (LAS Mole. Wt 340.0)	<	ND	mg/L	0.1		SM 5540C	11/17/2021	11/18/2021	Yes
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/1/2016		Yes
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	11/29/2017		Yes
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/5/2018		Yes
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/12/2018		Yes
Secondary Effluent	7	Lead	=	0.76	µg/L	5	0.51	EPA 200.8	11/20/2019		No
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/18/2019		Yes
Secondary Effluent	7	Lead	<	ND	µg/L	5	0.51	EPA 200.8	12/2/2020		Yes
Secondary Effluent	7	Lead	J-Flag	1.8	µg/L	5	0.51	EPA 200.8	11/18/2021	11/24/2021	No
Big Bear Lake	7	Lead	J-Flag	1.8	µg/L	5		EPA 200.8	12/2/2021	12/9/2021	No
Shay Pond	7	Lead	J-Flag	1.4	µg/L	5		EPA 200.8	11/17/2021	11/24/2021	No
Secondary Effluent		Hardness, Total (as CaCO3)	=	270	mg/L			Calculated	11/20/2019		No
Secondary Effluent		Hardness, Total (as CaCO3)	=	260	mg/L	6.6		Calculated	11/18/2021	11/24/2021	No
Big Bear Lake		Hardness, Total (as CaCO3)	=	180	mg/L	6.6		Calculated	12/2/2021	12/9/2021	No
Shay Pond		Hardness, Total (as CaCO3)	=	180	mg/L	6.6		Calculated	11/17/2021	12/1/2021	No
Secondary Effluent		Fluoride	=	0.3	mg/L	0.1	0.026	EPA 300.0	11/20/2019		No
Secondary Effluent		Fluoride	=	0.52	mg/L	0.1	0.026	EPA 300.0	11/18/2021	11/18/2021	No
Big Bear Lake		Fluoride	=	0.41	mg/L	0.1		EPA 300.0	12/2/2021	12/2/2021	No
Shay Pond		Fluoride	=	1.2	mg/L	0.1		EPA 300.0	11/17/2021	11/18/2021	No
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/1/2016		Yes
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	11/29/2017		Yes
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/5/2018		Yes
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/12/2018		Yes
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	11/20/2019		Yes

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date	Excluded in Average Calculation?
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/18/2019		Yes
Secondary Effluent	6	Copper	<	ND	µg/L	50	6.5	EPA 200.7	12/2/2020		Yes
Secondary Effluent	6	Copper	J-Flag	14	µg/L	50	6.5	EPA 200.7	11/18/2021	11/23/2021	No
Big Bear Lake	6	Copper	<	ND	µg/L	50		EPA 200.7	12/2/2021	12/10/2021	Yes
Shay Pond	6	Copper	J-Flag	31	µg/L	50		EPA 200.7	11/17/2021	11/23/2021	No
Secondary Effluent		Chloride	=	53	mg/L	1	0.075	EPA 300.0	11/18/2021	11/18/2021	No
Big Bear Lake		Chloride	=	26	mg/L	1		EPA 300.0	12/2/2021	12/2/2021	No
Shay Pond		Chloride	=	7.6	mg/L	1		EPA 300.0	11/17/2021	11/18/2021	No
Secondary Effluent		Chloride	=	62	mg/L				1/6/2021		No
Secondary Effluent		Chloride	=	58	mg/L				1/20/2021		No
Secondary Effluent		Chloride	=	60	mg/L				2/17/2021		No
Secondary Effluent		Chloride	=	60	mg/L				2/24/2021		No
Secondary Effluent		Chloride	=	59	mg/L				3/3/2021		No
Secondary Effluent		Chloride	=	59	mg/L				3/10/2021		No
Secondary Effluent		Chloride	=	58	mg/L				4/7/2021		No
Secondary Effluent		Chloride	=	60	mg/L				4/14/2021		No
Secondary Effluent		Chloride	=	63	mg/L				5/19/2021		No
Secondary Effluent		Chloride	=	59	mg/L				5/27/2021		No
Secondary Effluent		Chloride	=	60	mg/L				6/9/2021		No
Secondary Effluent		Chloride	=	60	mg/L				6/22/2021		No
Secondary Effluent		Chloride	=	55	mg/L				7/14/2021		No
Secondary Effluent		Chloride	=	55	mg/L				7/21/2021		No
Secondary Effluent		Chloride	=	58	mg/L				8/18/2021		No
Secondary Effluent		Chloride	=	58	mg/L				8/25/2021		No
Secondary Effluent		Chloride	=	58	mg/L				9/8/2021		No
Secondary Effluent		Chloride	=	57	mg/L				9/15/2021		No
Secondary Effluent		Chloride	=	56	mg/L				10/6/2021		No
Secondary Effluent		Chloride	=	62	mg/L				10/20/2021		No
Secondary Effluent		Chloride	=	59	mg/L				11/3/2021		No
Secondary Effluent		Chloride	=	53	mg/L				11/17/2021		No
Secondary Effluent		Chloride	=	59	mg/L				12/1/2021		No
Secondary Effluent		Chloride	=	57	mg/L				12/8/2021		No
Secondary Effluent	107	Chlordane	<	ND	µg/L	0.5	0.17	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	107	Chlordane	<	ND	µg/L	0.1	0.034	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	107	Chlordane	<	ND	µg/L	0.5	0.17	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/1/2016		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/29/2017		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/5/2018		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/12/2018		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/20/2019		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/18/2019		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	12/2/2020		Yes
Secondary Effluent	4	Cadmium	<	ND	µg/L	1	0.11	EPA 200.8	11/18/2021	11/24/2021	Yes
Big Bear Lake	4	Cadmium	<	ND	µg/L	1		EPA 200.8	12/2/2021	12/9/2021	Yes
Shay Pond	4	Cadmium	<	ND	µg/L	1		EPA 200.8	11/17/2021	11/24/2021	Yes
Secondary Effluent		Boron	=	270	µg/L	100	32	EPA 200.7	11/20/2019		No
Secondary Effluent		Boron	=	260	µg/L	100	32	EPA 200.7	11/18/2021	11/23/2021	No

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date	Excluded in Average Calculation?
Big Bear Lake		Boron	J-Flag	54	µg/L	100		EPA 200.7	12/2/2021	12/10/2021	No
Shay Pond		Boron	J-Flag	59	µg/L	100		EPA 200.7	11/17/2021	11/23/2021	No
Secondary Effluent	125	Aroclor 1260	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	125	Aroclor 1260	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	125	Aroclor 1260	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	124	Aroclor 1254	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	124	Aroclor 1254	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	124	Aroclor 1254	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	123	Aroclor 1248	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	123	Aroclor 1248	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	123	Aroclor 1248	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	122	Aroclor 1242	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	122	Aroclor 1242	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	122	Aroclor 1242	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	121	Aroclor 1232	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	121	Aroclor 1232	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	121	Aroclor 1232	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	120	Aroclor 1221	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	120	Aroclor 1221	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	120	Aroclor 1221	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent	119	Aroclor 1016	<	ND	µg/L	2.5	2.5	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	119	Aroclor 1016	<	ND	µg/L	0.5	0.5	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	119	Aroclor 1016	<	ND	µg/L	2.5	2.5	EPA 608M	11/17/2021	11/24/2021	Yes
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				11/28/2018		Yes
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				12/12/2018		Yes
Secondary Effluent		Ammonia as N (NH3-N)	=	22	mg/L				1/2/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	7.5	mg/L				1/16/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	0.45	mg/L				2/6/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	1.1	mg/L				2/13/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				3/6/2019		Yes
Secondary Effluent		Ammonia as N (NH3-N)	=	0.26	mg/L				3/20/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	0.27	mg/L				4/3/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				4/17/2019		Yes
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				5/1/2019		Yes
Secondary Effluent		Ammonia as N (NH3-N)	=	3.2	mg/L				5/15/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	0.39	mg/L				6/23/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	1.6	mg/L				7/17/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	3.1	mg/L				8/7/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	1.4	mg/L				8/21/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	6.6	mg/L				9/4/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				9/18/2019		Yes
Secondary Effluent		Ammonia as N (NH3-N)	=	2.3	mg/L				10/23/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	1.3	mg/L				11/6/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	0.55	mg/L				11/20/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	=	0.26	mg/L				12/4/2019		No
Secondary Effluent		Ammonia as N (NH3-N)	<	ND	mg/L				12/18/2019		Yes
Secondary Effluent		Ammonia as N (NH3-N)	=	1.2	mg/L				11/18/2021		No

Location	PTP	Analyte	Qualifier	Result	Units	RL	MDL	Analytical Method	Sample Date	Analysis Date	Excluded in Average Calculation?
Big Bear Lake		Ammonia as N (NH3-N)	J-Flag	0.29	mg/L	0.5		EPA 350.1	12/2/2021	12/16/2021	No
Shay Pond		Ammonia as N (NH3-N)	J-Flag	0.24	mg/L	0.5		EPA 350.1	11/17/2021	11/30/2021	No
Secondary Effluent		Aluminum	=	110	µg/L	50	14	EPA 200.7	11/20/2019		No
Secondary Effluent		Aluminum	=	250	µg/L	50	14	EPA 200.7	11/18/2021	11/23/2021	No
Big Bear Lake		Aluminum	=	58	µg/L	50		EPA 200.7	12/2/2021	12/10/2021	No
Shay Pond		Aluminum	=	120	µg/L	50		EPA 200.7	11/17/2021	11/23/2021	No
Secondary Effluent	108	4,4'-DDT	<	ND	µg/L	0.05	0.0052	EPA 608	11/18/2021	12/13/2021	Yes
Big Bear Lake	108	4,4'-DDT	<	ND	µg/L	0.01	0.001	EPA 608M	12/2/2021	12/10/2021	Yes
Shay Pond	108	4,4'-DDT	<	ND	µg/L	0.05	0.0052	EPA 608M	11/17/2021	11/24/2021	Yes

APPENDIX E: BIG BEAR LAKE AMMONIA AND HARDNESS CALCULATIONS

Constituent: Ammonia as N

Nutrient TMDL Data

For this analysis, the lake-wide annual average was estimated by averaging the four station annual averages consistent with the Nutrient TMDL approach, which consist of averaging the photic and bottom samples for each sampling date.

	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
Min	0.015	0.010	0.010	0.010	0.013
Max	0.306	0.230	0.245	0.135	0.167
Average	**0.087**	**0.072**	**0.056**	**0.035**	**0.063**
Median	0.069	0.063	0.044	0.028	0.051

MonthYear	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
5/1/2009	0.19	0.161	0.084	0.035	0.118
6/30/2009	0.176	0.111	0.078	0.055	0.105
7/31/2009	0.112	0.109	0.045	0.041	0.077
8/31/2009	0.074	0.102	0.048	0.013	0.059
9/30/2009	0.032	0.037	0.028	0.035	0.033
10/31/2009	0.046	0.044	0.054	0.037	0.045
11/30/2009	0.062	0.046	0.077	0.03	0.054
6/30/2010	0.259	0.156	0.152	0.06	0.157
7/31/2010	0.276	0.104	0.071	0.02	0.118
8/31/2010	0.306	0.138	0.078	0.03	0.138
9/30/2010	0.042	0.032	0.045	0.022	0.035
10/31/2010	0.055	0.048	0.046	0.027	0.044
11/30/2010	0.02	0.023	0.02	0.012	0.019
3/31/2011	0.018	0.034	0.014	0.026	0.023
4/30/2011	0.066	0.062	0.035	0.034	0.049
5/31/2011	0.09	0.066	0.046	0.043	0.061
6/30/2011	0.071	0.077	0.048	0.038	0.058
7/31/2011	0.202	0.125	0.097	0.09	0.128
8/31/2011	0.273	0.092	0.099	0.013	0.119
9/30/2011	0.022	0.034	0.025	0.016	0.024
3/31/2012	0.02	0.01	0.01	0.01	0.013
4/30/2012	0.045	0.028	0.035	0.01	0.029
5/31/2012	0.135	0.083	0.098	0.045	0.09
6/30/2012	0.04	0.045	0.038	0.033	0.039
7/31/2012	0.04	0.07	0.245	0.058	0.103
8/31/2012	0.113	0.113	0.103	0.065	0.098
9/30/2012	0.04	0.04	0.03	0.028	0.034
10/31/2012	0.035	0.01	0.023	0.018	0.021
3/31/2013	0.03	0.03	0.03	0.03	0.03
4/30/2013	0.075	0.14	0.09	0.03	0.084
5/31/2013	0.072	0.065	0.041	0.03	0.052

MonthYear	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
6/30/2013	0.062	0.062	0.044	0.022	0.047
7/31/2013	0.162	0.167	0.076	0.092	0.124
8/31/2013	0.108	0.116	0.119	0.083	0.106
9/30/2013	0.071	0.078	0.062	0.046	0.064
10/31/2013	0.041	0.05	0.019	0.02	0.033
11/30/2013	0.064	0.061	0.057	0.025	0.052
3/31/2014	0.093	0.04	0.03	0.015	0.044
4/30/2014	0.161	0.142	0.055	0.091	0.112
5/31/2014	0.058	0.068	0.043	0.027	0.049
6/30/2014	0.129	0.085	0.111	0.069	0.099
7/31/2014	0.204	0.214	0.122	0.128	0.167
8/31/2014	0.085	0.069	0.056	0.069	0.07
9/30/2014	0.029	0.015	0.015	0.015	0.019
10/31/2014	0.066	0.04	0.023	0.015	0.036
11/30/2014	0.125	0.135	0.12	0.015	0.099
3/31/2015	0.015	0.015	0.015	0.015	0.015
4/30/2015	0.063	0.015	0.015	0.015	0.027
5/31/2015	0.033	0.064	0.015	0.015	0.032
6/30/2015	0.115	0.101	0.054	0.026	0.074
7/31/2015	0.097	0.103	0.05	0.044	0.073
8/31/2015	0.015	0.024	0.015	0.015	0.017
9/30/2015	0.029	0.015	0.015	0.015	0.019
10/31/2015	0.019	0.021	0.025	0.015	0.02
11/30/2015	0.015	0.015	0.015	0.015	0.015
4/30/2016	0.028	0.015	0.015	0.015	0.018
5/31/2016	0.063	0.015	0.032	0.039	0.037
6/30/2016	0.09	0.08	0.075	0.034	0.07
7/31/2016	0.124	0.069	0.03	0.028	0.063
8/31/2016	0.041	0.049	0.026	0.015	0.033
9/30/2016	0.015	0.015	0.015	0.015	0.015
10/31/2016	0.148	0.1	0.073	0.021	0.085
11/30/2016	0.215	0.23	0.11	0.048	0.151
3/31/2017	0.027	0.015	0.015	0.015	0.018
4/30/2017	0.036	0.03	0.015	0.015	0.024
5/31/2017	0.128	0.146	0.141	0.037	0.113
6/30/2017	0.11	0.103	0.09	0.039	0.085
7/31/2017	0.191	0.1	0.036	0.031	0.089
8/31/2017	0.085	0.102	0.049	0.024	0.065
9/30/2017	0.038	0.039	0.024	0.015	0.029
10/31/2017	0.042	0.041	0.039	0.032	0.038
11/30/2017	0.015	0.015	0.038	0.037	0.026
4/30/2018	0.023	0.027	0.02	0.028	0.024
5/31/2018	0.073	0.075	0.044	0.025	0.054
6/30/2018	0.073	0.06	0.026	0.028	0.046
7/31/2018	0.111	0.136	0.038	0.03	0.079
8/31/2018	0.106	0.065	0.036	0.021	0.057

MonthYear	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
9/30/2018	0.036	0.015	0.024	0.015	0.022
10/31/2018	0.083	0.015	0.015	0.015	0.032
11/30/2018	0.015	0.015	0.015	0.015	0.015
3/20/2019	0.015	0.015	0.133	0.015	0.044
4/11/2019	0.102	0.118	0.1	0.135	0.114
5/15/2019	0.184	0.165	0.143	0.041	0.133
6/13/2019	0.217	0.214	0.149	0.052	0.158
7/11/2019	0.172	0.155	0.147	0.106	0.145
8/8/2019	0.075	0.091	0.052	0.059	0.069
9/5/2019	0.062	0.045	0.039	0.049	0.049
10/29/2019	0.044	0.042	0.04	0.041	0.042

Constituent: Hardness as CaCO3

Appendix E - Big Bear Lake Ammonia and Hardness Calculations

Nutrient TMDL Data

For this analysis, the lake-wide annual average was estimated by averaging the four station annual averages consistent with the Nutrient TMDL approach, which consist of averaging the photic and bottom samples for each sampling date.

	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
Min	124	126	127	131	128
Max	200	193	193	200	191
Average	161	161	164	164	163
Median	160	163	165	164	163

MonthYear	Station 1	Station 2	Station 6	Station 9	Lake Wide Annual Average
5/1/2009	160	164	164	163	163
6/30/2009	161	163	159	162	161
7/31/2009	164	164	167	164	165
8/31/2009	168	167	164	160	165
9/30/2009	167	168	167	164	166
10/31/2009	172	168	175	175	173
11/30/2009	170	170	171	172	170
6/30/2010	146	145	145	149	146
7/31/2010	151	153	162	159	156
8/31/2010	154	151	149	148	150
9/30/2010	150	152	149	150	150
10/31/2010	149	149	149	150	149
11/30/2010	149	149	149	150	149
3/31/2011	131	131	130	133	131
4/30/2011	124	127	130	133	129
5/31/2011	127	126	127	131	128
6/30/2011	129	131	132	132	131
7/31/2011	132	130	131	131	131
8/31/2011	135	134	134	135	134
9/30/2011	137	136	138	136	137
3/31/2012	145	147	147	147	147
4/30/2012	142	145	146	148	145
5/31/2012	146	145	145	147	146
6/30/2012	151	148	150	146	149
7/31/2012	158	156	155	152	155
8/31/2012	148	146	147	145	146
3/31/2013	143	140	150	155	147
4/30/2013	143	140	150	155	147
5/31/2013	150	160	158	150	154
6/30/2013	155	158	153	155	155

MonthYear	Station 1	Station 2	Station		Lake Wide Annual Average
7/31/2013	160	163	158	158	159
8/31/2013	153	155	165	155	157
9/30/2013	156	158	160	155	157
10/31/2013	153	153	155	153	153
11/30/2013	153	150	165	160	157
3/31/2014	180	175	170	175	175
4/30/2014	160	160	165	163	162
5/31/2014	160	163	160	165	162
6/30/2014	168	165	170	173	169
7/31/2014	165	165	165	163	164
8/31/2014	168	170	175	175	172
9/30/2014	175	175	185	175	178
10/31/2014	170	170	175	178	173
11/30/2014	170	170	175	175	173
3/31/2015	160	160	160	175	164
4/30/2015	175	175	180	180	178
5/31/2015	173	170	168	173	171
6/30/2015	185	185	190	180	185
7/31/2015	188	190	193	193	191
8/31/2015	173	178	183	178	178
9/30/2015	185	178	185	183	183
10/31/2015	185	185	188	190	187
11/30/2015	200	185	185	190	190
4/30/2016	170	173	180	180	176
5/31/2016	175	175	180	180	178
6/30/2016	190	193	188	180	188
7/31/2016	180	185	183	188	184
8/31/2016	178	188	188	183	184
9/30/2016	190	185	190	180	186
10/31/2016	175	178	173	178	176
11/30/2016	180	175	180	180	179
3/31/2017	150	150	160	165	156
4/30/2017	160	160	165	168	163
5/31/2017	150	158	163	165	159
6/30/2017	165	163	170	170	167
7/31/2017	160	160	163	160	161
8/31/2017	173	173	175	175	174
9/30/2017	180	178	170	178	176
10/31/2017	175	173	180	178	176
11/30/2017	175	175	180	175	176
4/30/2018	178	180	183	190	183
5/31/2018	183	185	188	183	184
6/30/2018	190	183	183	180	184
7/31/2018	190	188	185	185	187
8/31/2018	180	180	180	170	178
9/30/2018	175	180	178	180	178

MonthYear	Station 1	Station 2	Station		Lake Wide Annual Average
10/31/2018	190	180	180	185	184
11/30/2018	180	185	190	200	189
3/20/2019	130	130	130	140	133
4/11/2019	135	138	140	143	139
5/15/2019	135	140	140	148	141
6/13/2019	140	143	145	150	144
7/11/2019	140	143	155	155	148
8/8/2019	145	143	148	148	146
9/5/2019	150	153	150	158	153
10/29/2019	150	150	150	150	150

APPENDIX F: BORON MASS BALANCE ANALYSIS WITH LAKE DISCHARGE

Due to the limited amount of water quality data available, a simple spreadsheet model was completed to evaluate the contribution of the Lake discharge to boron concentrations in the Lake over time. See Section 5.3.2 of the Antidegradation Analysis for equations used.

Year	Lake Storage (AF)		Inflows (AF)		Outflows			Boron (mg/L)			Mass boron (pounds)				Lake at End		
Year	Watermaster	Adjusted Storage	Natural Inflows	BBARWA Discharge	Evaporation	Releases + Withdrawals + Leakage	Additional Releases	Lake	Inflow	Discharge	Lake	Inflow	Discharge	Releases	Mass	Volume (AF)	Concentration (mg/L)
1	36,009	36,009	7,112	2210	8,876	868	0	0.000	0.000	0.110	0	0	662	0	662	35,587	0.007
2	33,377	35,587	41,114	2210	12,112	999	0	0.000	0.000	0.110	0	0	662	0	662	65,800	0.004
3	61,380	65,800	25,447	2210	11,630	11,253	0	0.004	0.000	0.110	662	0	662	113	1,211	70,574	0.006
4	63,944	70,574	42,459	2210	11,883	31,045	0	0.006	0.000	0.110	1,212	0	662	533	1,341	72,315	0.007
5	63,475	72,315	6,568	2210	11,990	2,358	0	0.007	0.000	0.110	1,342	0	662	44	1,960	66,745	0.011
6	55,695	66,745	25,218	2210	11,125	2,951	6,777	0.011	0.000	0.110	1,962	0	662	256	2,368	73,320	0.012
7	66,837	73,320	35,142	2210	12,007	25,266	79	0.012	0.000	0.110	2,370	0	662	819	2,213	73,320	0.011
8	64,705	73,320	10,832	2210	11,710	2,524	0	0.011	0.000	0.110	2,215	0	662	76	2,801	72,128	0.014
9	61,303	72,128	9,396	2210	11,518	2,636	0	0.014	0.000	0.110	2,803	0	662	102	3,363	69,580	0.018
10	56,550	69,580	13,812	2210	11,515	1,488	0	0.018	0.000	0.110	3,366	0	662	72	3,956	72,599	0.020
11	57,359	72,599	8,005	2210	10,819	266	0	0.020	0.000	0.110	3,960	0	662	15	4,607	71,729	0.024
12	54,279	71,729	4,551	2210	11,161	355	0	0.024	0.000	0.110	4,612	0	662	23	5,251	66,974	0.029
13	47,314	66,974	4,967	2210	11,092	355	0	0.029	0.000	0.110	5,256	0	662	28	5,890	62,704	0.035
14	40,834	62,704	4,855	2210	9,542	457	0	0.035	0.000	0.110	5,896	0	662	43	6,515	59,770	0.040
15	35,690	59,770	11,658	2210	9,235	565	0	0.040	0.000	0.110	6,521	0	662	62	7,121	63,838	0.041
16	37,548	63,838	15,543	2210	10,714	489	0	0.041	0.000	0.110	7,129	0	662	55	7,736	70,388	0.040
17	41,887	70,388	48,613	2210	11,716	12,382	23,793	0.040	0.000	0.110	7,743	0	662	3,587	4,818	73,320	0.024
18	66,402	73,320	11,015	2210	11,784	2,903	0	0.024	0.000	0.110	4,823	0	662	191	5,293	71,858	0.027
19	62,730	71,858	33,340	2210	11,861	19,225	3,002	0.027	0.000	0.110	5,299	0	662	1,606	4,355	73,320	0.022
20	64,984	73,320	13,119	2210	12,262	4,228	0	0.022	0.000	0.110	4,359	0	662	251	4,769	72,159	0.024
21	61,613	72,159	8,757	2210	11,456	1,015	0	0.024	0.000	0.110	4,774	0	662	67	5,369	70,655	0.028
22	57,899	70,655	34,629	2210	11,464	12,790	9,920	0.028	0.000	0.110	5,374	0	662	1,614	4,422	73,320	0.022
23	68,274	73,320	3,774	2210	12,473	1,269	0	0.022	0.000	0.110	4,426	0	662	77	5,011	65,562	0.028
24	58,306	65,562	6,930	2210	11,829	1,106	0	0.028	0.000	0.110	5,016	0	662	85	5,594	61,767	0.033
25	52,301	61,767	6,915	2210	11,299	1,094	0	0.033	0.000	0.110	5,599	0	662	99	6,162	58,499	0.039
26	46,822	58,499	1,717	2210	10,375	1,040	0	0.039	0.000	0.110	6,168	0	662	110	6,720	51,011	0.048
27	37,109	51,011	8,295	2210	9,382	1,073	0	0.048	0.000	0.110	6,727	0	662	141	7,247	51,061	0.052
28	34,948	51,061	8,404	2210	9,025	1,154	0	0.052	0.000	0.110	7,254	0	662	164	7,752	51,496	0.055
29	33,173	51,496	39,600	2210	11,525	745	7,716	0.055	0.000	0.110	7,760	0	662	1,101	7,321	73,320	0.037
30	60,503	73,320	17,564	2210	12,421	1,371	5,982	0.037	0.000	0.110	7,328	0	662	645	7,345	73,320	0.037
31	64,274	73,320	2,841	2210	11,921	1,445	0	0.037	0.000	0.110	7,352	0	662	145	7,869	65,005	0.045
32	53,748	65,005	14,182	2210	11,460	865	0	0.045	0.000	0.110	7,877	0	662	105	8,434	69,072	0.045
33	55,605	69,072	9,212	2210	11,233	1,154	0	0.045	0.000	0.110	8,443	0	662	141	8,963	68,107	0.048
34	52,431	68,107	32,959	2210	11,374	3,269	15,313	0.048	0.000	0.110	8,972	0	662	2,146	7,488	73,320	0.038
35	70,746	73,320	16,908	2210	12,028	8,649	0	0.038	0.000	0.110	7,496	0	662	884	7,273	71,761	0.037
36	66,977	71,761	8,175	2210	12,503	1,871	0	0.037	0.000	0.110	7,281	0	662	190	7,753	67,772	0.042
37	60,778	67,772	3,129	2210	11,645	2,168	0	0.042	0.000	0.110	7,761	0	662	248	8,174	59,298	0.051
38	50,094	59,298	5,776	2210	10,942	1,386	0	0.051	0.000	0.110	8,182	0	662	191	8,653	54,956	0.058
39	43,543	54,956	3,677	2210	9,709	2,033	0	0.058	0.000	0.110	8,662	0	662	320	9,003	49,101	0.067
40	35,478	49,101	7,027	2210	9,309	1,349	0	0.067	0.000	0.110	9,012	0	662	248	9,426	47,680	0.073
41	31,847	47,680	13,213	2210	9,777	1,077	0	0.073	0.000	0.110	9,436	0	662	213	9,884	52,249	0.070
42	34,206	52,249	4,818	2210	9,391	1,391	0	0.070	0.000	0.110	9,894	0	662	263	10,293	48,495	0.078

Year	Lake Storage (AF)		Inflows (AF)		Outflows			Boron (mg/L)			Mass boron (pounds)				Lake at End		
Year	Watermaster	Adjusted Storage	Natural Inflows	BBARWA Discharge	Evaporation	Releases + Withdrawals + Leakage	Additional Releases	Lake	Inflow	Discharge	Lake	Inflow	Discharge	Releases	Mass	Volume (AF)	Concentration (mg/L)
43	28,242	48,495	25,391	2210	10,079	954	0	0.078	0.000	0.110	10,303	0	662	203	10,762	65,063	0.061
44	42,590	65,063	7,945	2210	10,608	1,264	0	0.061	0.000	0.110	10,773	0	662	209	11,225	63,346	0.065

Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location

December 22, 2017

Thomas Harder & Co.
Groundwater Consulting

WSC
Water Systems Consulting, Inc.

BBARWA
Big Bear Area Regional Wastewater Agency

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December 22, 2017

Prepared for

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A Regional Water Quality Control Board Investigative Order No. R7-2016-0026

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1 Introduction

This study assesses the groundwater quality beneath Big Bear Area Regional Wastewater Agency's (BBARWA's) Lucerne Valley Land Discharge Location (LVLDL) in Lucerne Valley in San Bernardino County, California (see Figure 1). The LVLDL consists of a 480-acre property of which 190 acres is used to grow various animal feed crops. Beginning in 1980, BBARWA has discharged all of their treated wastewater to the LVLDL, which is primarily used to irrigate the crops, although some of the water is periodically discharged to two unlined basins located on the southern end of the property (see Figure 2). This report has been prepared to assess changes in groundwater quality beneath the LVLDL area since BBARWA began collecting groundwater quality data in 1991.

1.1 Background

BBARWA has been discharging treated recycled water at the LVLDL since 1980. Treated water is conveyed via a pipeline from the BBARWA treatment plant near Big Bear City to the LVLDL located approximately 12 miles to the north (see Figure 1). The delivered water is discharged first to a lined balancing reservoir, located approximately 6,500 ft south of the LVLDL, and then distributed to irrigate crops. Crops grown on the LVLDL typically include alfalfa, fiber and seed crops. During periods of low crop water demand and/or high discharges, some of the water is discharged to two unlined basins on the south end of the property (see Figure 2).

Since 1991, recycled water discharges have been regulated under California Colorado River Regional Water Quality Control Board's (RWQCB's) Order No. 01-156. On June 30, 2016, the RWQCB adopted revised Waste Discharge Requirements (WDRs) for BBARWA in Order R7-2016-0026 (see Appendix A). As part of this new order, the RWQCB is requiring preparation of a study to assess the impacts that historical recycled water discharges have had on groundwater quality beneath the LVLDL (Order R7-2016-0026; Section E, No. 1).

The primary constituents of concern (COCs) of this study are total dissolved solids (TDS) and nitrate (as N). The maximum contaminant levels (MCLs) for TDS and nitrate (as N) are 500 and 10 milligrams per liter (mg/L), respectively. The RWQCB Basin Plan Objective for TDS and nitrate is to maintain the water quality to existing historical conditions where possible and to keep the chemical and physical groundwater quality close to or otherwise below the MCLs (RWQCB, 2006). Specific concentration limits for TDS and nitrate have not been established.

1.2 Site Description

The LVLDL (the Site) consists of approximately 480 acres of mostly cultivated land in Lucerne Valley in San Bernardino County, California (see Figures 1 and 2). The LVLDL is located

southeast of the intersection of Old Woman Springs Road and Camp Rock Road. Crops grown on the LVLDL typically include alfalfa, fiber and seed crops. During periods of low crop water demand and/or high discharges, some of the water conveyed to the LVLDL from BBARWA is discharged to two unlined basins on the south end of the property (see Figure 2).

There are three monitoring wells (MW-1, MW-2, and MW-3) located within the LVLDL. MW-1 is located on the south end of the property and MW-2 and MW-3 are located on the north end (see Figure 2). Groundwater levels and groundwater quality data have been collected from the monitoring wells on a semi-annual to annual basis since they were completed in 1991. Each monitoring well is constructed of 4-inch diameter polyvinyl chloride (PVC) casing to a depth of 250 feet below ground surface (ft bgs). The wells are each constructed with multiple perforation intervals between 135 ft bgs and 250 ft bgs (see Appendix B). The monitoring wells are completed 2.5 ft above ground surface with locking monument casing.

The land use surrounding the LVLDL is predominantly native, undisturbed vegetation with sporadic homes. There are approximately eleven homes in the vicinity of the site, four of which are upgradient of the site (see Figure 4). The homes in this area all discharge their wastewater via individual onsite septic tanks.

1.3 Purpose and Scope

The purpose of this report is to summarize an analysis of historical groundwater quality beneath the LVLDL in the context of historical BBARWA discharges and land use on and surrounding the site.

The report includes:

- An assessment, based on historical records, of ambient (pre-BBARWA discharges) groundwater nitrate and total dissolved solid (TDS) concentrations in the vicinity of the LVLDL;
- Documentation and analysis of historical nitrate and TDS concentrations in recycled water discharges;
- Documentation and analysis of historical trends in nitrate and TDS concentrations in groundwater collected from onsite monitoring wells;
- Analysis of historical groundwater level changes at the LVLDL;
- Analysis of groundwater flow direction and gradient in the vicinity of the LVLDL; and
- An analysis of potential sources of nitrate and TDS in groundwater other than BBARWA recycled water, including, but not limited to, onsite farming practices and potential up gradient sources.

2 Sources of Data

The evaluation of TDS and nitrate concentrations in groundwater beneath the LVLDL is based on existing data, reports, and maps. Since 1991, BBARWA has historically collected groundwater level and groundwater quality data from monitoring wells MW-1 through MW-3 on a semi-annual to annual basis. Groundwater quality constituents analyzed have typically included general minerals, such as TDS, nitrate, etc., and physical properties.

The following sources of data were utilized in the analysis:

- BBARWA
  - Historical monthly wastewater discharge volumes from the BBARWA treatment plant
  - Historical TDS and total inorganic nitrogen (TIN) concentrations in effluent from the BBARWA treatment plant
  - Nitrate and TDS concentrations in groundwater samples collected from MW-1, MW-2, and MW-3
  - Historical groundwater levels measured in MW-1, MW-2, and MW-3
  - Annual total discharges to the unlined ponds (basins) at the LVLDL
  - Annual total discharges to the fields at the LVLDL

- California Department of Water Resources (CDWR), 2016 California Statewide Groundwater Elevation Monitoring (CASGEM)
- Geoscience, 2005. Evaluation of Potential Ground Water Changes from Reductions in Discharge at the BBARWA Discharge Site in Lucerne Valley, California.
- Geoscience, 2006. Refined Estimates of Potential Ground Water Recharge from Crop Irrigation at the BBARWA Discharge Site in Lucerne Valley, California
- Law Environmental, 1992. Well Completion Report, Construction and Water Quality Analyses of Lucerne Valley Monitoring Wells.
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The period of record for this analysis is from 1991 through 2016.

3 Description of the Site

3.1 Geology

3.1.1 Regional Geologic Setting

The Lucerne Valley is located on the northern slope of the San Bernardino Mountains (CDWR, 2003; see Figure 1) within the northwestern portion of the Colorado River Basin. The basin formed during the uplift of the San Bernardino mountain range (USGS, 2000). The east-west trending valley is bounded by the Ord Mountains to the north, the Fry Mountains to the east, the San Bernardino Mountains on the south, and the Granite Mountains to the west (Pioneer Consultants, 1977). The most prominent geologic fault in the area is the Helendale Fault, a north-west trending, right lateral, strike-slip fault located southwest of the LVLDL (see Figure 1; Pioneer Consultants, 1977).

3.1.2 Geologic Units

The surrounding and underlying bedrock consists of pre-Tertiary igneous and metamorphic rock (Pioneer Consultants, 1977). Surficial sediments that make up the interior of the basin consist of Quaternary age alluvial fan, washes, and landslides (USGS, 2000). The alluvial fan deposits consist of unconsolidated to semi-consolidated sand, gravel and cobbles. The lowest elevation of the closed basin is the Lucerne Dry Lake, where sediments consist of lacustrine silt and clay deposits.

Borehole logs from the monitoring wells at the LVLDL state that the subsurface is primarily composed of sand and gravel with some minor interbedded silty and clayey sand to a depth of approximately 255 ft bgs (Law Environmental, Inc., 1992).

3.2 Hydrogeology

3.2.1 Regional Hydrogeology

The LVLDL is located within the Lucerne Valley Groundwater Basin (the Basin), as defined by CDWR's Bulletin 118 (CDWR, 2003). Topographically, the Basin is a closed hydrologic system such that all surface water flow terminates within the Basin at Lucerne Dry Lake (see Figure 1). Groundwater flow out of the basin is also assumed to be negligible (Pioneer Consultants, 1977).

The aquifer in the Basin is recharged from precipitation runoff and infiltration along the base of the San Bernardino Mountains and, to a lesser degree, along the Ord and Fry Mountains to the north (Pioneer Consultants, 1977; DWR, 1975). The primary source of groundwater discharge is through evapotranspiration at Lucerne Dry Lake. Previous reports have indicated that the aquifer in the vicinity of the LVLDL is unconfined (Blazevic, et al., 2005).

3.2.2 Local Groundwater Occurrence and Flow

Based on hydrographs from MW-1 through MW-3, groundwater elevations are generally between 2,845 and 2,885 ft above mean sea level (ft amsl; see Figure 3 and Table 1). This corresponds to a groundwater level depth of approximately 125 to 175 ft below ground surface (ft bgs). Groundwater elevations in MW-1 (the upgradient well) are generally 25 ft higher than those in MW-2 and MW-3. Since the onsite groundwater monitoring wells were first constructed in 1991, groundwater levels beneath the LVLDL have generally been rising (see Figure 3). Although there is year-to-year variation associated with precipitation trends, groundwater levels have risen approximately 10 ft beneath the Site between 1991 and 2016.

The groundwater flow direction beneath the LVLDL is generally to the northwest (see Figure 4). Although the groundwater elevations have changed over time as seen on Figure 3, the groundwater flow direction has been consistently towards the Lucerne Dry Lake.

3.2.3 Groundwater Quality

The native groundwater quality within the Lucerne Valley Groundwater Basin varies greatly with respect to location in the Basin. In the southern upgradient portion of the Basin, TDS concentrations in groundwater are generally below 500 mg/L. In the downgradient portion near Lucerne Dry Lake, natural TDS concentrations in groundwater increase significantly as a result of evaporative concentration. Time series plots of TDS concentration for the period between 1952 and 1980 for two wells immediately north of the Site (04N01E06H01S and 05N01E32R01S) show that TDS concentrations before 1980 (prior to BBARWA's discharge operation) were generally between 350 and 500 mg/L but periodically spiked above 500 mg/L (Schlumberger, 2007). The cause of the TDS spikes is unknown, but may be associated with localized pumping depressions that reverse the groundwater flow gradient, resulting in the capture of high TDS groundwater from beneath Lucerne Dry Lake, which is known to have TDS concentrations ranging from 2,000 to 3,000 mg/L (Schlumberger, 2007). The average TDS concentration in the Lucerne Valley Groundwater Basin is reported to be approximately 1,100 mg/L, although the average concentration in the southern portion of the Basin (south of Old Woman Springs Road and including the LVLDL) is likely closer to 500 mg/L.

Data regarding nitrate concentrations in groundwater in the vicinity of the LVLDL was not available for the period prior to 1980 when the facility began operation. The earliest available data, from 1991 through 1998, show nitrate concentrations in groundwater in the Lucerne Valley to be less than 2 mg/L (SWRCB, 2017).

3.3 BBARWA Operations

Treated wastewater from BBARWA's treatment plant near Big Bear City is conveyed to the LVLDL via a pipeline (see Figure 1). The pipeline follows State Highway 18 until Camp Rock

Road, at which time it trends due north to the Site. Between 2000 and 2016, the average monthly discharge to the site was 70 million gallons per month. The average annual flow to the Site for the same time period is approximately 2,580 acre-ft/yr.

Treated water delivered to the LVLDL is either conveyed to an irrigation system for application on crops or discharged to two unlined basins located on the south end of the property. On an annual basis, the volume of water used for irrigating crops is typically approximately two thirds of the water discharged to the basins (see Figure 5). On a monthly basis, the percentage of delivered water discharged to crops is highest during the growing season (March through October) while the opposite is true between November and February (see Figure 6).

4 Analysis of Groundwater Quality Changes at the Lucerne Valley Land Discharge Location

4.1 BBARWA Water Quality

The quality of the water delivered to the LVLDL is addressed herein as it relates to TDS and Nitrate concentrations. The TDS concentration of the water delivered to the LVLDL, based on monthly averages measured at the BBARWA treatment plant, ranges from 318 mg/L to 519 mg/L (see Figure 7). The TDS concentration in the treated water has remained below 500 mg/L except for two months in 2014. Except for periodic outliers, the TDS concentration in the delivered water is typically between 400 and 500 mg/L.

Nitrate (as N) concentrations in the water delivered to the LVLDL from BBARWA have changed over time as a result of nitrate treatment at the BBARWA plant. Between 1990 and 1997, nitrate concentrations in the delivered water were highly variable and ranged from none detected to greater than 20 mg/L (see Figure 8). As the MCL for nitrate is 10 mg/L, BBARWA implemented a nitrate treatment process, which became operational in 1997. Since 1997, nitrate concentrations in the water delivered to the LVLDL have ranged from none detected to 13 mg/L but are typically below the MCL of 10 mg/L (see Figure 8).

4.2 Groundwater Quality

4.2.1 TDS Concentrations in Groundwater

The lowest TDS concentrations detected in groundwater samples collected from the three monitoring wells in the LVLDL area have been from the upgradient well (MW-1). Prior to 2010, the TDS concentration in MW-1 was relatively stable at approximately 300 mg/L (see Figure 7). As this concentration is from the upgradient well, it is likely indicative of the native TDS concentration of the aquifer beneath the Site prior to discharges at the LVLDL. Since 2010, the TDS concentration in samples from MW-1 has steadily increased and has periodically spiked as high as 720 mg/L (see Table 2). The reason for this increase is unknown but, given the well's location on the upgradient portion of the Site, it is likely associated with an upgradient TDS source.

TDS concentrations in samples from the two downgradient monitoring wells at the LVLDL (MW-2 and MW-3) show relatively stable trends between 2000 and 2010 and decreasing trends since 2010. Since 2000, TDS concentrations in these wells have ranged from approximately 500 mg/L to 900 mg/L and more recently the concentrations have been between 500 mg/L and 700 mg/L. It is noted that the TDS concentration detected in MW-2 rose sharply between construction of the well in 1991 and 1998. Concentrations rose as high as 1,200 mg/L before declining again and eventually becoming stable between approximately 700 and 800 mg/L after 2001 (see Figure 7). The reason for this spike in concentration is not clear, as

samples collected and analyzed from the nearby downgradient monitoring well (MW-3) did not show the same TDS concentration or trend. As MW-2 is directly downgradient of an irrigated field, the concentrations may be associated with the leaching of accumulated salts into the groundwater beneath the agricultural fields. This could have occurred during the period of high precipitation preceding 1998 or as a result of irrigation practices.

Prior to the start of BBARWA's discharges to the LVLDL in 1980, TDS concentrations in groundwater to the north and downgradient of the site were known to be relatively high. Time series plots of TDS concentration for the period from 1952 to 1980 for two wells approximately three miles northwest of the Site (04N01E06H01S and 05N01E32R01S; see Figure 2) show that TDS concentrations before 1980 were generally between 350 and 500 mg/L but periodically spiked as high as 1,500 mg/L (Schlumberger, 2007). TDS concentrations further north in the vicinity of Lucerne Dry Lake have been higher, at concentrations greater than 4,000 mg/L. The average TDS concentration in the Lucerne Valley Groundwater Basin is 1,099 mg/L (Schlumberger, 2007). Potential sources of high TDS groundwater northwest and downgradient of the LVLDL may include historical farming operations and evaporative concentration of salts beneath the dry lake. As the downgradient TDS concentrations are equal to or above the TDS concentrations of water delivered to the LVLDL from BBARWA, the current discharges are not predicted to degrade existing groundwater quality or limit existing beneficial uses.

4.2.2 Nitrate Concentrations in Groundwater

Nitrate concentration changes in groundwater samples collected from the upgradient monitoring well MW-1 between 1991 and 2016 are likely associated with historical discharges at the LVLDL basins or an upgradient source(s). The nitrate concentration in the sample collected in 1991 was 4.8 mg/L (see Figure 8). Concentrations in samples from this well rose to 10.5 mg/L (just over the MCL of 10 mg/L) between 1991 and 2000, decreased to between 7 and 8 mg/L between 2004 and 2010, and then started increasing again to as high as 15.7 mg/L in 2015. The initial rise in concentrations between 1991 and 2000 was likely associated with the higher concentration of nitrate in the delivered water that was discharged to the unlined basins between 1991 and 1997. With the delivery of treated water with lower nitrate concentrations in 1997, the nitrate concentration in MW-1 dropped between 2000 and 2010. Since 2010, nitrate concentrations in samples from MW-1 have been increasing, despite the fact that nitrate concentrations in the delivered water remain, for the most part, lower than the concentrations in MW-1. This trend is similar to that observed for TDS and suggests that there is an upgradient source of the nitrate and TDS that is contributing to the concentrations observed in this well.

Nitrate concentration changes in groundwater samples collected from the downgradient monitoring wells MW-2 and MW-3 between 1991 and 2016 are likely associated with irrigation practices and agricultural land use at the LVLDL. Nitrate concentrations between 2000 and 2016 generally range from 14 to 20 mg/L and show a decreasing concentration trend over time

(see Figure 8; Table 2). The decreasing concentrations may be a result of lower concentrations in the delivered BBARWA water, increased irrigation efficiency, or both. The nitrate spike observed in the samples from MW-2 collected between 1997 and 2000 correlate with a similar spike in TDS concentrations observed in the samples from this well during the same time. Nitrate concentrations were detected as high as 70 mg/L during this time. As MW-2 is directly downgradient of an irrigated field, the concentrations may be associated with differential fertilization and/or overirrigation of the crops directly upgradient of this well during this time, cross-contamination during sampling, or some other source. It is noted that WSC (2016) conducted a study of the nitrate demand and historical fertilization practices for the crops grown at the LVLDL and found that there was no evidence of over-fertilization of the fields.

4.2.3 Analysis of Changes in Groundwater Quality at the LVLDL

The TDS and nitrate concentrations in groundwater directly beneath the LVLDL between 1991 and 2016 appear to be associated with a combination of native groundwater quality, delivered BBARWA water quality, agricultural land use, and upgradient sources. Data from the upgradient well MW-1 suggests that the native TDS beneath the Site was approximately 300 mg/L. The TDS of treated water delivered to the Site from BBARWA has ranged from 400 to 500 mg/L. Although the BBARWA delivered water could account for somewhat higher TDS concentrations in groundwater beneath the site (between 300 and 500 mg/L), even higher concentrations detected in the downgradient monitoring wells (MW-2 and MW-3), which range from 500 to 900 mg/L, appear to be associated with a source other than BBARWA treated water delivered to the site. The same correlation is also true of nitrate for the time period between approximately 2000 and 2016.

The most likely source of the elevated TDS and nitrate concentrations in the groundwater at the downgradient wells is historical return flow from irrigation and fertilization in excess of plant demands. Based on interviews of the farmers of the crops on the LVLDL, as reported in BBARWA's Draft Irrigation Management Plan for the Lucerne Valley Facility (WSC, 2016), the rate of fertilizer application does not exceed the crop demand. As such, it is possible that irrigation practices, such as periodic overwatering, could have leached the nitrogen below the root zones of the plants and into the groundwater before the plants were able to absorb the fertilizer.

Since 2010, increases in TDS and nitrate concentrations in the upgradient monitoring well (MW-1) are likely associated with an upgradient source. There are multiple homes in the vicinity of the LVLDL (see Figure 4). Homes in this area discharge their wastewater through individual onsite septic systems. There are three homes upgradient of the LVLDL and one home is located approximately 1,400 feet upgradient from MW-1. Given that the TDS and nitrate concentrations detected in samples from MW-1 since 2010 generally exceed concentrations in

the delivered water from BBARWA and, in some cases, the concentrations in the downgradient monitoring wells, an upgradient source is likely and discharges via individual septic systems are a plausible source.

Changes in groundwater quality over time from 1991, 1998 and 2001 in wells MW-1 through MW-3 are shown on Figure 9 in the form of a trilinear or piper diagram. A piper diagram presents selected major constituents, including calcium, magnesium, sodium, potassium, bicarbonate, chloride and sulfate and graphically illustrates the results of the water quality analysis. As shown, the general water chemical signature of samples collected from the upgradient well is distinct from the water chemical signature of the samples from the downgradient wells. As the most recent samples were collected in 2001, this likely illustrates the difference between the native water quality and the water quality changes associated with agricultural land use. Changes in the upgradient MW-1 water quality between 1991 and 2001 may be associated with influence from the infiltration of delivered BBARWA water in the unlined basins and/or upgradient sources.

5 Conclusions and Recommendations

Based on the findings of this study, TH&Co has developed the following conclusions:

- Groundwater levels in monitoring wells at the Site have risen steadily since the wells were constructed in 1991 (see Figure 3) and indicate that natural recharge to the aquifer beneath the Site is being supplemented from a combination of irrigation return flow and discharge to the unlined basins.
- With the exception of periodic spikes, TDS and nitrate concentrations in the water delivered to the LVLDL are generally below the secondary MCL for TDS (500 mg/L) and primary MCL for nitrate (10 mg/L). The average TDS concentration in the BBARWA water is 427 mg/L from 1991 to 2015 and the average nitrate concentration from 2002 to 2017 is 2.4 mg/L.
- As the TDS and nitrate concentrations in the delivered water from BBARWA are lower than the TDS and nitrate concentrations detected in samples from the downgradient monitoring wells at the Site (MW-2 and MW-3), it is concluded that the delivered water from BBARWA is not the source of the high TDS and nitrate concentrations in these two wells.
- A possible source of high TDS and nitrate concentrations in groundwater from MW-2 and MW-3 is the leaching of salts and fertilizer in return flow from the agricultural operation.
- Historical TDS concentrations in groundwater downgradient of the LVLDL have been equal to or higher than the TDS concentrations in BBARWA's water delivered to the LVLDL. The downgradient high TDS concentrations were measured prior to BBARWA's discharge at the site and may be related to other farming operations in the area and, to a lesser degree, capture of high TDS groundwater resulting from evaporative concentration of salts beneath Lucerne Dry Lake.
- Recent increases in TDS and nitrate concentrations in the upgradient monitoring well at the Site (MW-1) indicate that an upgradient source is contributing to the elevated TDS and nitrate concentrations in the groundwater beneath the Site. A potential offsite source of the high TDS and high nitrate may be discharges from one or more individual septic systems at homes located upgradient of the Site.

The RWQCB does not currently have a Basin Plan Objective for TDS in groundwater in the Lucerne Valley Groundwater Basin. The secondary MCL for TDS in groundwater is 500 mg/L. Prior to BBARWA's discharges to the LVLDL in 1980, TDS concentrations in wells downgradient of the Site generally ranged from approximately 350 to 500 mg/L but periodically spiked as high as 1,500 mg/L. In the furthest downgradient portion of the Basin beneath Lucerne Dry Lake, the TDS concentrations in groundwater are significantly higher. The average TDS concentration in the Basin as a whole is approximately 1,100 mg/L (Schlumberger, 2007).

As the downgradient TDS concentrations in groundwater are equal to or above the TDS concentrations of water delivered to the LVLDL from BBARWA and the basinwide average TDS concentration is above that of the delivered water, the delivered water is not predicted to degrade the existing groundwater quality or limit existing downgradient beneficial uses. The previous BBARWA effluent limit for TDS is 400 mg/L over the TDS of the domestic source water. Based on the findings of this groundwater quality evaluation, there is no need to change BBARWA's discharge TDS limit from the existing criteria.

6 References

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Tables

Groundwater Elevations in Lucerne Valley Monitoring Wells

Well Name	Date	Reference Point Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
MW-1	7-Oct-91	3,050.72	186.6	2,864.12
MW-1	16-Nov-93	3,050.72	184.2	2,866.52
MW-1	20-Nov-95	3,050.72	175.5	2,875.22
MW-1	16-Apr-96	3,050.72	175.3	2,875.42
MW-1	27-Nov-96	3,050.72	174.9	2,875.82
MW-1	15-May-97	3,050.72	174.5	2,876.22
MW-1	18-Nov-97	3,050.72	175.6	2,875.12
MW-1	19-May-98	3,050.72	174.4	2,876.32
MW-1	19-Nov-98	3,050.72	171.8	2,878.92
MW-1	23-Nov-99	3,050.72	171.5	2,879.22
MW-1	8-Aug-00	3,050.72	171.5	2,879.22
MW-1	14-Nov-00	3,050.72	172.0	2,878.72
MW-1	24-Apr-01	3,050.72	172.3	2,878.42
MW-1	19-Nov-01	3,050.72	173.0	2,877.72
MW-1	16-Apr-02	3,050.72	173.9	2,876.82
MW-1	26-Nov-02	3,050.72	174.8	2,875.92
MW-1	1-May-03	3,050.72	174.9	2,875.82
MW-1	18-Nov-03	3,050.72	175.3	2,875.42
MW-1	1-Apr-04	3,050.72	175.4	2,875.32
MW-1	4-Nov-04	3,050.72	175.6	2,875.12
MW-1	5-May-05	3,050.72	173.0	2,877.68
MW-1	3-Nov-05	3,050.72	171.5	2,879.22
MW-1	27-Apr-06	3,050.72	171.6	2,879.12
MW-1	16-Nov-06	3,050.72	171.4	2,879.32
MW-1	27-Apr-07	3,050.72	170.4	2,880.32
MW-1	7-Nov-07	3,050.72	170.4	2,880.32
MW-1	19-Feb-08	3,050.72	172.0	2,878.72
MW-1	15-Apr-08	3,050.72	171.4	2,879.32
MW-1	29-Jul-08	3,050.72	171.2	2,879.52
MW-1	18-Nov-08	3,050.72	171.5	2,879.22
MW-1	13-Apr-09	3,050.72	172.0	2,878.72
MW-1	10-Aug-09	3,050.72	172.5	2,878.22
MW-1	9-Nov-09	3,050.72	172.8	2,877.92
MW-1	18-Feb-10	3,050.72	172.9	2,877.82
MW-1	20-Apr-10	3,050.72	171.7	2,879.02
MW-1	3-Aug-10	3,050.72	170.4	2,880.32
MW-1	1-Nov-10	3,050.72	170.6	2,880.12

Groundwater Elevations in Lucerne Valley Monitoring Wells

Well Name	Date	Reference Point Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
MW-1	7-Feb-11	3,050.72	170.4	2,880.32
MW-1	26-Apr-11	3,050.72	168.9	2,881.82
MW-1	2-Aug-11	3,050.72	168.0	2,882.72
MW-1	1-Nov-11	3,050.72	168.1	2,882.62
MW-1	9-Mar-12	3,050.72	167.5	2,883.22
MW-1	17-Apr-12	3,050.72	167.0	2,883.72
MW-1	9-Aug-12	3,050.72	167.2	2,883.52
MW-1	15-Nov-12	3,050.72	167.9	2,882.82
MW-1	24-Jan-13	3,050.72	167.8	2,882.92
MW-1	23-Apr-13	3,050.72	167.2	2,883.52
MW-1	5-Aug-13	3,050.72	167.7	2,883.02
MW-1	18-Nov-13	3,050.72	168.5	2,882.22
MW-1	18-Feb-14	3,050.72	168.0	2,882.72
MW-1	21-Apr-14	3,050.72	167.9	2,882.82
MW-1	11-Aug-14	3,050.72	168.8	2,881.92
MW-1	20-Nov-14	3,050.72	167.0	2,883.72
MW-1	27-Apr-15	3,050.72	170.4	2,880.32
MW-1	10-Aug-15	3,050.72	171.0	2,879.72
MW-1	17-Nov-15	3,050.72	171.9	2,878.82
MW-1	22-Feb-16	3,050.72	172.3	2,878.42
MW-1	4-Apr-16	3,050.72	172.0	2,878.72
MW-1	26-Jul-16	3,050.72	171.8	2,878.92
MW-1	16-Aug-16	3,050.72	172.0	2,878.72
MW-2	7-Oct-91	2,980.14	-	2,839.14
MW-2	16-Nov-93	2,980.14	137.9	2,842.24
MW-2	20-Nov-95	2,980.14	131.5	2,848.64
MW-2	16-Apr-96	2,980.14	131.1	2,849.04
MW-2	27-Nov-96	2,980.14	129.9	2,850.24
MW-2	15-May-97	2,980.14	130.0	2,850.14
MW-2	18-Nov-97	2,980.14	133.0	2,847.14
MW-2	19-May-98	2,980.14	135.0	2,845.14
MW-2	19-Nov-98	2,980.14	132.6	2,847.54
MW-2	23-Nov-99	2,980.14	130.4	2,849.74
MW-2	8-Aug-00	2,980.14	129.2	2,850.94
MW-2	14-Nov-00	2,980.14	129.6	2,850.54
MW-2	24-Apr-01	2,980.14	127.9	2,852.24
MW-2	19-Nov-01	2,980.14	129.4	2,850.74

Groundwater Elevations in Lucerne Valley Monitoring Wells

Well Name	Date	Reference Point Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
MW-2	16-Apr-02	2,980.14	130.3	2,849.84
MW-2	26-Nov-02	2,980.14	131.0	2,849.14
MW-2	1-May-03	2,980.14	131.0	2,849.14
MW-2	18-Nov-03	2,980.14	131.1	2,849.04
MW-2	1-Apr-04	2,980.14	130.3	2,849.84
MW-2	4-Nov-04	2,980.14	130.2	2,849.94
MW-2	5-May-05	2,980.14	131.6	2,848.54
MW-2	3-Nov-05	2,980.14	131.0	2,849.14
MW-2	27-Apr-06	2,980.14	130.3	2,849.84
MW-2	16-Nov-06	2,980.14	128.7	2,851.44
MW-2	27-Apr-07	2,980.14	128.7	2,851.44
MW-2	7-Nov-07	2,980.14	129.8	2,850.34
MW-2	15-Apr-08	2,980.14	128.9	2,851.24
MW-2	18-Nov-08	2,980.14	129.8	2,850.34
MW-2	13-Apr-09	2,980.14	130.0	2,850.14
MW-2	9-Nov-09	2,980.14	130.6	2,849.54
MW-2	20-Apr-10	2,980.14	131.4	2,848.74
MW-2	1-Nov-10	2,980.14	130.7	2,849.44
MW-2	26-Apr-11	2,980.14	130.4	2,849.74
MW-2	1-Nov-11	2,980.14	128.1	2,852.04
MW-2	17-Apr-12	2,980.14	127.6	2,852.54
MW-2	15-Nov-12	2,980.14	128.0	2,852.14
MW-2	23-Apr-13	2,980.14	127.4	2,852.74
MW-2	18-Nov-13	2,980.14	127.2	2,852.94
MW-2	21-Apr-14	2,980.14	126.3	2,853.84
MW-2	12-May-14	2,980.14	126.4	2,853.74
MW-2	20-Nov-14	2,980.14	126.8	2,853.34
MW-2	27-Apr-15	2,980.14	127.2	2,852.94
MW-2	17-Nov-15	2,980.14	127.3	2,852.84
MW-2	4-Apr-16	2,980.14	127.8	2,852.34
MW-2	26-Jul-16	2,980.14	128.0	2,852.14
MW-2	16-Aug-16	2,980.14	128.0	2,852.14
MW-3	7-Oct-91	2,988.42	-	2,835.82
MW-3	16-Nov-93	2,988.42	148.8	2,839.62
MW-3	20-Nov-95	2,988.42	140.5	2,847.92
MW-3	16-Apr-96	2,988.42	140.8	2,847.62
MW-3	27-Nov-96	2,988.42	141.2	2,847.22

Groundwater Elevations in Lucerne Valley Monitoring Wells

Well Name	Date	Reference Point Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
MW-3	15-May-97	2,988.42	142.8	2,845.62
MW-3	18-Nov-97	2,988.42	143.1	2,845.32
MW-3	19-May-98	2,988.42	144.5	2,843.92
MW-3	19-Nov-98	2,988.42	143.5	2,844.92
MW-3	23-Nov-99	2,988.42	139.8	2,848.62
MW-3	8-Aug-00	2,988.42	140.2	2,848.22
MW-3	14-Nov-00	2,988.42	140.4	2,848.02
MW-3	24-Apr-01	2,988.42	136.6	2,851.82
MW-3	19-Nov-01	2,988.42	138.4	2,850.02
MW-3	16-Apr-02	2,988.42	141.0	2,847.42
MW-3	26-Nov-02	2,988.42	142.4	2,846.02
MW-3	1-May-03	2,988.42	142.3	2,846.12
MW-3	18-Nov-03	2,988.42	141.4	2,847.02
MW-3	1-Apr-04	2,988.42	141.6	2,846.82
MW-3	4-Nov-04	2,988.42	141.4	2,847.02
MW-3	5-May-05	2,988.42	143.3	2,845.12
MW-3	3-Nov-05	2,988.42	142.5	2,845.92
MW-3	27-Apr-06	2,988.42	142.0	2,846.42
MW-3	16-Nov-06	2,988.42	139.5	2,848.92
MW-3	27-Apr-07	2,988.42	140.1	2,848.32
MW-3	7-Nov-07	2,988.42	140.9	2,847.52
MW-3	15-Apr-08	2,988.42	141.8	2,846.62
MW-3	18-Nov-08	2,988.42	142.0	2,846.42
MW-3	13-Apr-09	2,988.42	140.7	2,847.72
MW-3	9-Nov-09	2,988.42	141.6	2,846.82
MW-3	20-Apr-10	2,988.42	143.0	2,845.42
MW-3	1-Nov-10	2,988.42	142.4	2,846.02
MW-3	26-Apr-11	2,988.42	140.7	2,847.72
MW-3	1-Nov-11	2,988.42	140.4	2,848.02
MW-3	17-Apr-12	2,988.42	139.6	2,848.82
MW-3	15-Nov-12	2,988.42	139.8	2,848.62
MW-3	23-Apr-13	2,988.42	139.9	2,848.52
MW-3	18-Nov-13	2,988.42	140.6	2,847.82
MW-3	21-Apr-14	2,988.42	141.0	2,847.42
MW-3	12-May-14	2,988.42	141.2	2,847.22
MW-3	20-Nov-14	2,988.42	142.0	2,846.42
MW-3	27-Apr-15	2,988.42	142.4	2,846.02

Groundwater Elevations in Lucerne Valley Monitoring Wells

Well Name	Date	Reference Point Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
MW-3	17-Nov-15	2,988.42	141.5	2,846.92
MW-3	4-Apr-16	2,988.42	141.7	2,846.72
MW-3	26-Jul-16	2,988.42	140.9	2,847.52
MW-3	16-Aug-16	2,988.42	140.8	2,847.62

TDS and Nitrate Results in Lucerne Valley Land Discharge Location Monitoring Wells

Well	Date Sampled	TDS (mg/L)	Nitrate as N (mg/L)
MW-1	31-Oct-91	560	4.8
MW-1	27-May-97	310	7.6
MW-1	18-Nov-97	298	8.4
MW-1	19-Nov-98	285	9.8
MW-1	23-Nov-99	296	10.4
MW-1	8-Aug-00	N/A	10.5
MW-1	14-Nov-00	292	10.1
MW-1	24-Apr-01	N/A	10.0
MW-1	19-Nov-01	320	8.8
MW-1	16-Apr-02	318	9.1
MW-1	26-Nov-02	324	8.5
MW-1	1-May-03	278	8.1
MW-1	18-Nov-03	316	8.1
MW-1	1-Apr-04	286	8.0
MW-1	4-Nov-04	322	8.1
MW-1	4-May-05	310	7.7
MW-1	3-Nov-05	320	9.4
MW-1	27-Apr-06	N/A	7.7
MW-1	16-Nov-06	N/A	7.8
MW-1	27-Apr-07	N/A	7.1
MW-1	7-Nov-07	N/A	7.7
MW-1	19-Feb-08	N/A	7.3
MW-1	15-Apr-08	309	7.3
MW-1	29-Jul-08	N/A	N/A
MW-1	18-Nov-08	409	7.5
MW-1	13-Apr-09	348	7.6
MW-1	10-Aug-09	N/A	N/A
MW-1	9-Nov-09	354	8.5
MW-1	18-Feb-10	N/A	N/A
MW-1	20-Apr-10	314	7.4
MW-1	3-Aug-10	N/A	N/A
MW-1	1-Nov-10	N/A	10.0
MW-1	7-Feb-11	N/A	N/A
MW-1	26-Apr-11	N/A	9.7
MW-1	2-Aug-11	N/A	N/A
MW-1	1-Nov-11	425	8.9
MW-1	9-Mar-12	N/A	N/A

TDS and Nitrate Results in Lucerne Valley Land Discharge Location Monitoring Wells

Well	Date Sampled	TDS (mg/L)	Nitrate as N (mg/L)
MW-1	17-Apr-12	370	8.7
MW-1	9-Aug-12	N/A	N/A
MW-1	15-Nov-12	424	9.6
MW-1	24-Jan-13	N/A	N/A
MW-1	23-Apr-13	N/A	9.2
MW-1	5-Aug-13	N/A	N/A
MW-1	18-Nov-13	483	9.9
MW-1	18-Feb-14	N/A	N/A
MW-1	21-Apr-14	454	9.0
MW-1	11-Aug-14	N/A	N/A
MW-1	20-Nov-14	720	12.6
MW-1	27-Apr-15	504	10.3
MW-1	10-Aug-15	N/A	N/A
MW-1	17-Nov-15	674	15.7
MW-1	22-Feb-16	N/A	N/A
MW-1	4-Apr-16	415	7.9
MW-1	26-Jul-16	N/A	N/A
MW-1	16-Aug-16	473	10.0
MW-2	31-Oct-91	460	8.6
MW-2	18-Nov-97	1140	66.6
MW-2	19-May-98	N/A	61.8
MW-2	19-Nov-98	1220	69.5
MW-2	24-May-99	N/A	39.1
MW-2	08-Jun-99	876	30
MW-2	23-Nov-99	957	38
MW-2	08-Aug-00	N/A	28.4
MW-2	14-Nov-00	740	17.9
MW-2	24-Apr-01	N/A	24
MW-2	19-Nov-01	730	23
MW-2	16-Apr-02	716	18.9
MW-2	26-Nov-02	746	17.6
MW-2	01-May-03	660	17
MW-2	18-Nov-03	661	16.7
MW-2	01-Apr-04	688	16.3
MW-2	04-Nov-04	699	15.9
MW-2	04-May-05	697	15.2
MW-2	3-Nov-05	740	18.0

TDS and Nitrate Results in Lucerne Valley Land Discharge Location Monitoring Wells

Well	Date Sampled	TDS (mg/L)	Nitrate as N (mg/L)
MW-2	27-Apr-06	N/A	16.2
MW-2	16-Nov-06	N/A	17.0
MW-2	27-Apr-07	N/A	14.7
MW-2	7-Nov-07	N/A	15.0
MW-2	15-Apr-08	742	14.8
MW-2	18-Nov-08	786	14.4
MW-2	13-Apr-09	761	14.1
MW-2	9-Nov-09	737	15.1
MW-2	20-Apr-10	729	13.8
MW-2	1-Nov-10	N/A	17
MW-2	26-Apr-11	N/A	17
MW-2	1-Nov-11	780	15.4
MW-2	17-Apr-12	726	15.7
MW-2	15-Nov-12	713	15.4
MW-2	23-Apr-13	N/A	15.8
MW-2	18-Nov-13	719	17.0
MW-2	21-Apr-14	691	15.7
MW-2	12-May-14	N/A	N/A
MW-2	20-Nov-14	689	15.7
MW-2	27-Apr-15	688	15.3
MW-2	17-Nov-15	702	16.5
MW-2	4-Apr-16	615	16
MW-2	26-Jul-16	N/A	N/A
MW-2	16-Aug-16	688	16.1
MW-3	31-Oct-91	440	4
MW-3	01-Nov-91	N/A	0.9
MW-3	15-May-97	650	14
MW-3	18-Nov-97	544	12.6
MW-3	19-May-98	N/A	13.7
MW-3	19-Nov-98	620	13.8
MW-3	23-Nov-99	672	18.2
MW-3	08-Aug-00	N/A	20.6
MW-3	14-Nov-00	700	16.3
MW-3	24-Apr-01	N/A	24

TDS and Nitrate Results in Lucerne Valley Land Discharge Location Monitoring Wells

Well	Date Sampled	TDS (mg/L)	Nitrate as N (mg/L)
MW-3	19-Nov-01	860	28
MW-3	16-Apr-02	776	23.1
MW-3	26-Nov-02	829	22.4
MW-3	01-May-03	798	21.7
MW-3	18-Nov-03	776	21.9
MW-3	01-Apr-04	782	21.6
MW-3	04-Nov-04	709	21.6
MW-3	04-May-05	705	21.2
MW-3	3-Nov-05	790	19.0
MW-3	27-Apr-06	N/A	20.5
MW-3	16-Nov-06	N/A	21.0
MW-3	27-Apr-07	N/A	19.3
MW-3	7-Nov-07	N/A	20.1
MW-3	15-Apr-08	687	20.6
MW-3	18-Nov-08	701	20.0
MW-3	13-Apr-09	696	19.6
MW-3	9-Nov-09	686	20.1
MW-3	20-Apr-10	747	18.2
MW-3	1-Nov-10	665	20
MW-3	26-Apr-11	N/A	19
MW-3	1-Nov-11	665	17.5
MW-3	17-Apr-12	660	16.7
MW-3	15-Nov-12	577	16.4
MW-3	23-Apr-13	N/A	16.1
MW-3	18-Nov-13	577	17.0
MW-3	21-Apr-14	568	15.7
MW-3	12-May-14	N/A	N/A
MW-3	20-Nov-14	608	15.6
MW-3	27-Apr-15	602	15.0
MW-3	17-Nov-15	573	16.5
MW-3	4-Apr-16	494	15.4
MW-3	26-Jul-16	N/A	N/A
MW-3	16-Aug-16	573	15.2

Notes:

N/A = Not Available

Data from Big Bear Area Regional Wastewater Agency.

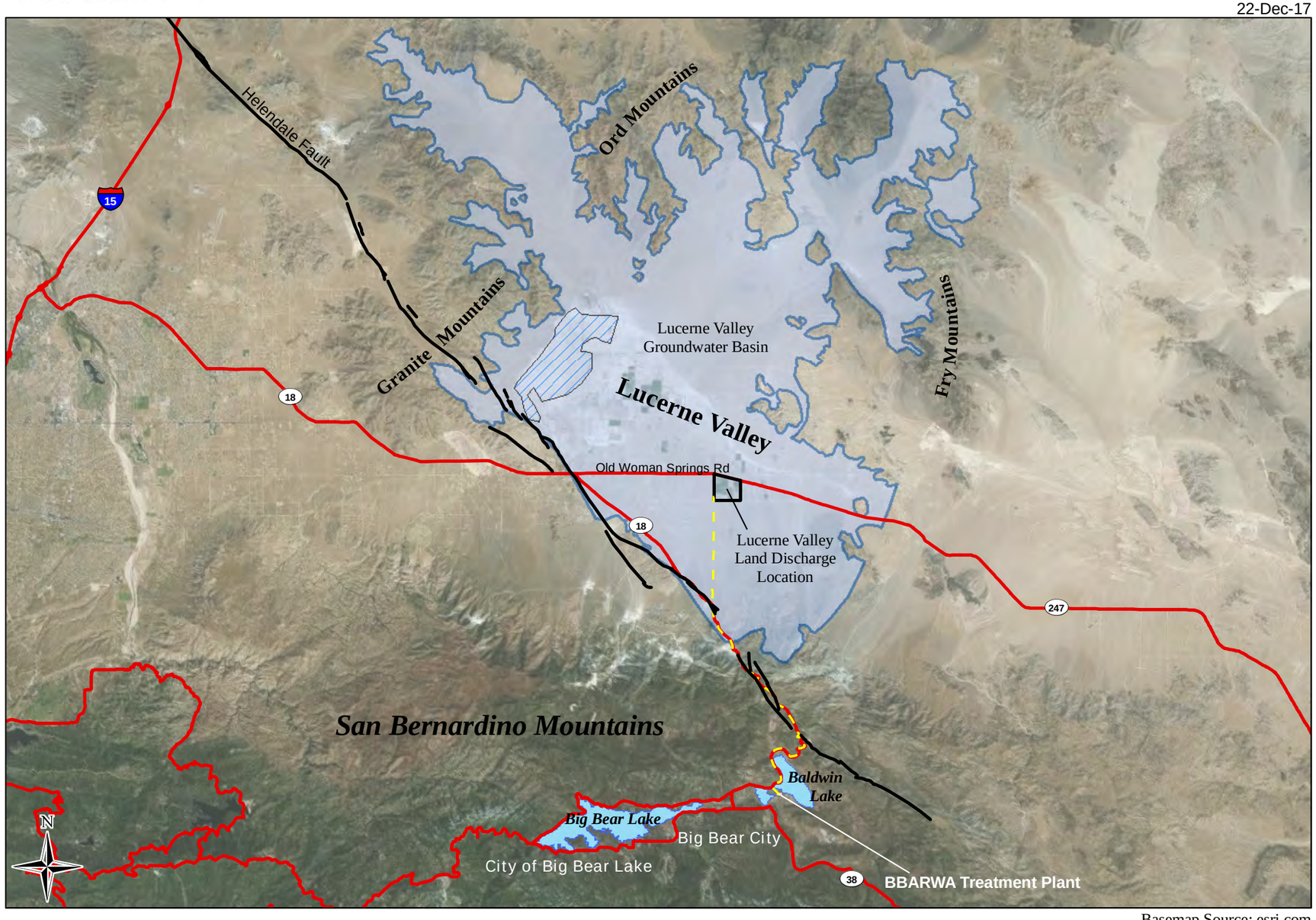
Figures

WSC
Water Systems Consulting, Inc.

BBARWA
BIG BEAR AREA REGIONAL WASTEWATER AGENCY

Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location

22-Dec-17



0 2.5 5 10 Miles

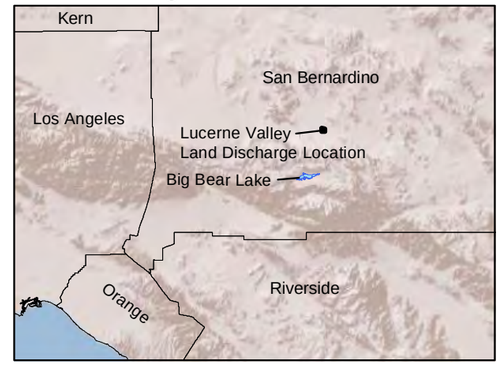
NAD 83 UTM Zone 11

Basemap Source: esri.com

Map Features

- Lucerne Valley Groundwater Basin
- Lucerne Valley Land Discharge Location
- Lake
- Lucerne Dry Lake
- Helendale fault
- Discharge Pipeline
- Highway

Regional Location



Thomas Harder & Co.
Groundwater Consulting

Regional Location

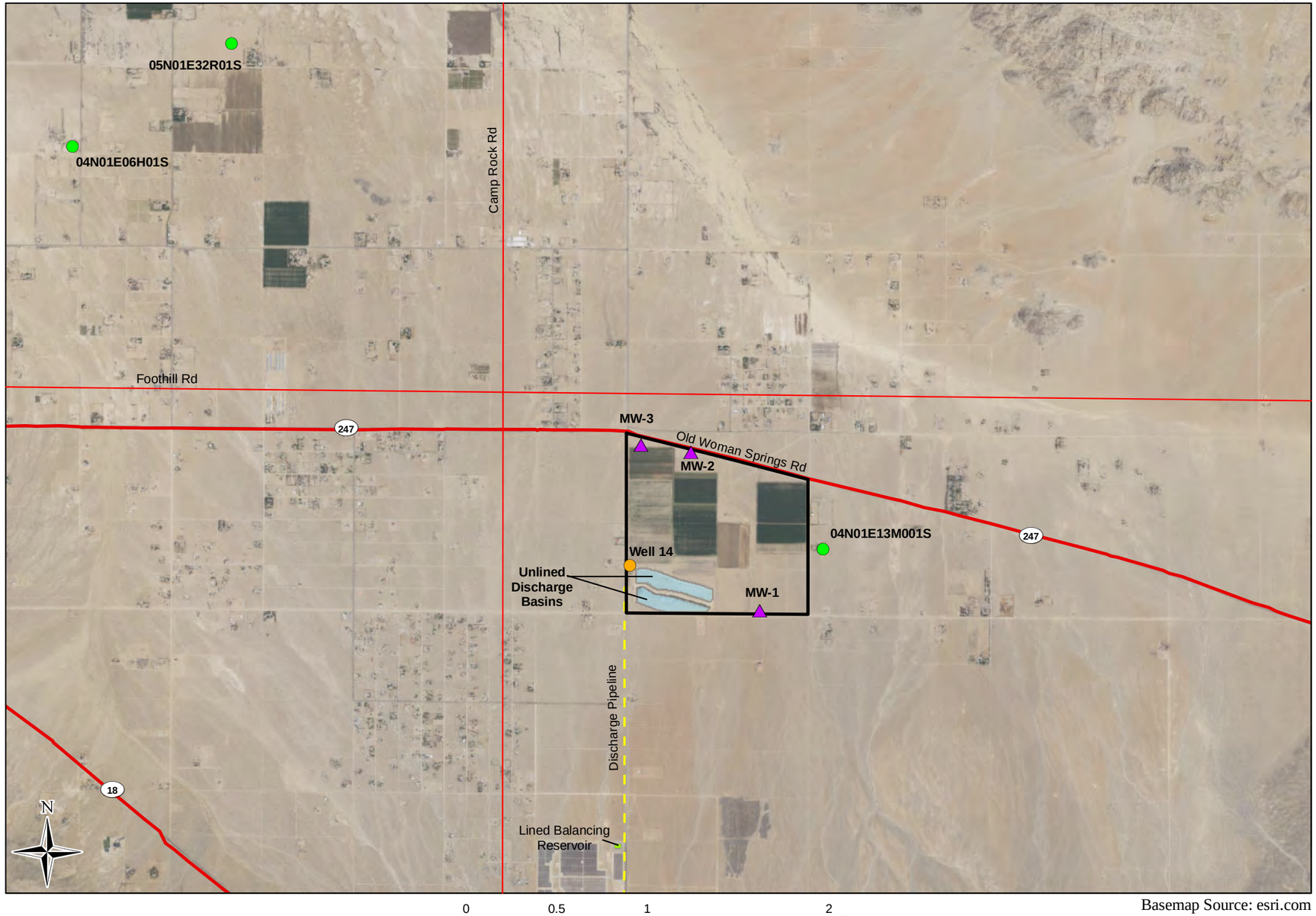
Figure 1

WSC
WATER SYSTEMS CONSULTING, INC.

BBARWA
BIG BEAR AREA REGIONAL WASTEWATER AGENCY

Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location

22-Dec-17



Basemap Source: esri.com

NAD 83 UTM Zone 11

Map Features

- BBARWA Monitoring Well
- Other Well
- Well 14
- Discharge Pipeline
- Freeway
- BBARWA Property Boundary
- Balancing Reservoir
- Unlined Discharge Basin

Thomas Harder & Co.
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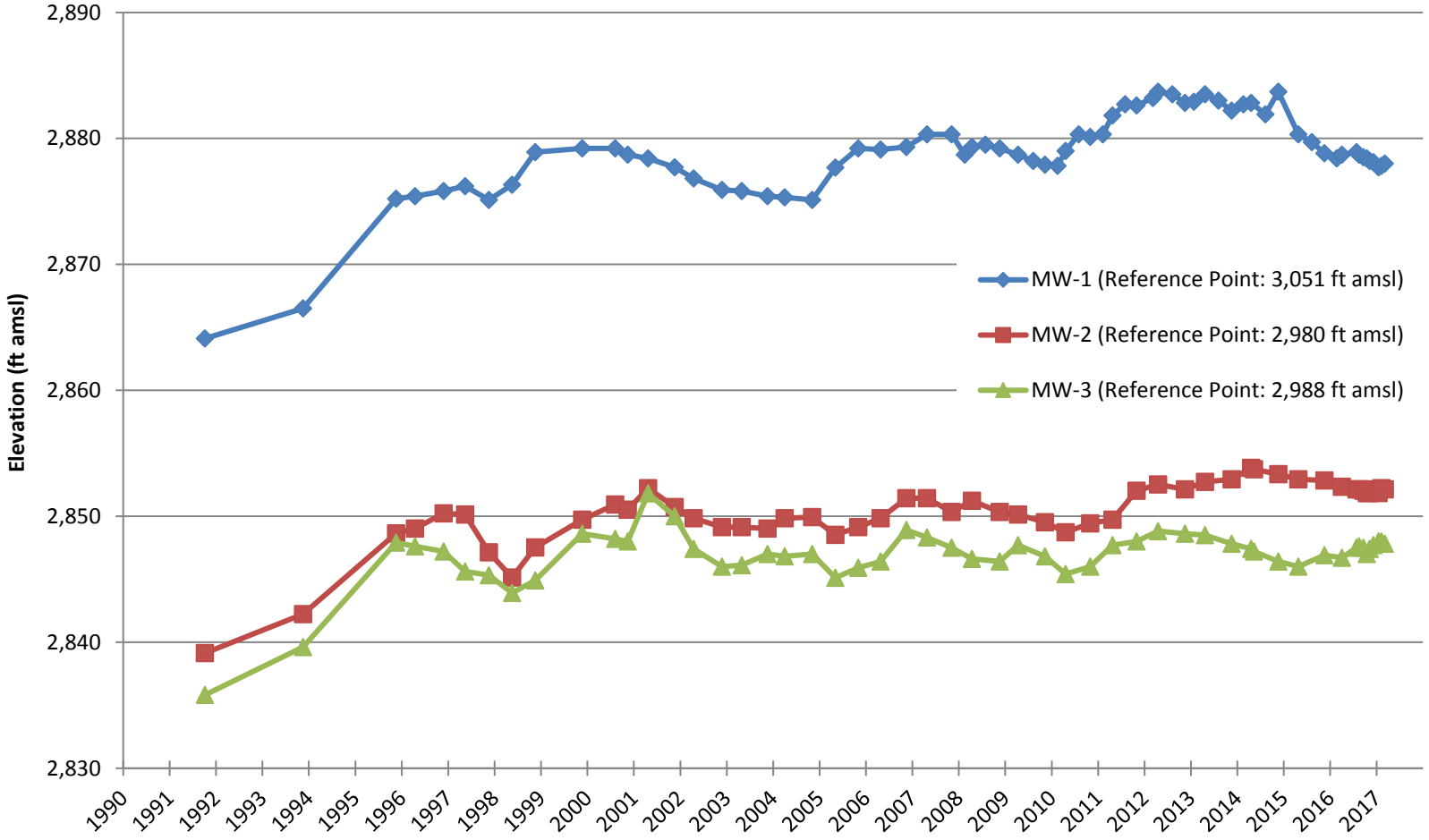
Lucerne Valley Land Discharge Location

Figure 2

Figure 3

Lucerne Valley Groundwater Elevation



Note: ft amsl = feet above mean sea level

Thomas Harder & Co.
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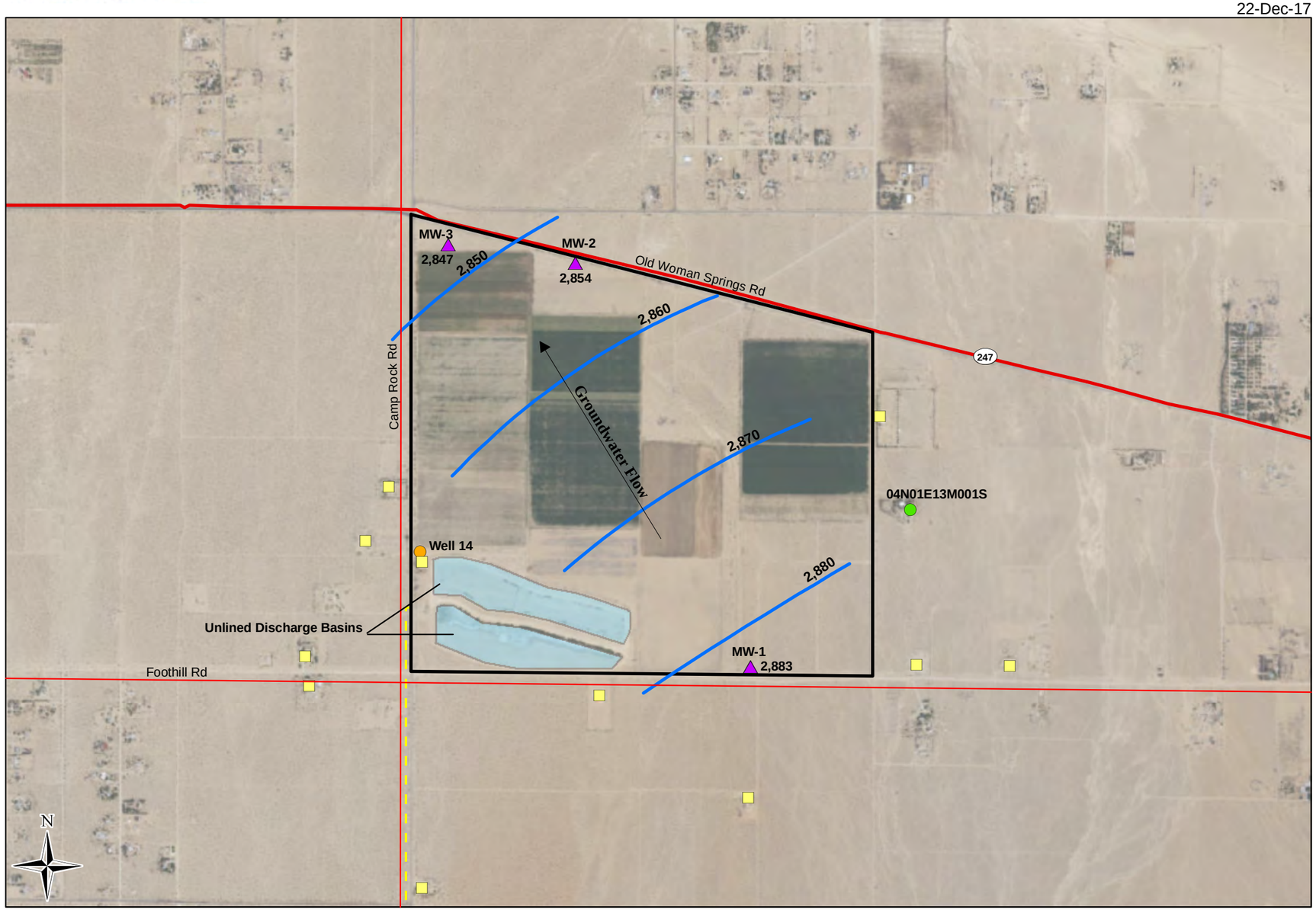
22-Dec-17

WSC
WATER SYSTEMS CONSULTING, INC.

BBARWA
BIG BEAR AREA REGIONAL WASTEWATER AGENCY

Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location

22-Dec-17



Basemap Source: esri.com

NAD 83 UTM Zone 11

Map Features

- 2,860 Groundwater Elevation Contour (ft amsl)
- BBARWA Monitoring Well
- Other Well
- House
- Discharge Pipeline
- Highway
- Lucerne Valley Land Discharge Location
- Unlined Discharge Basin

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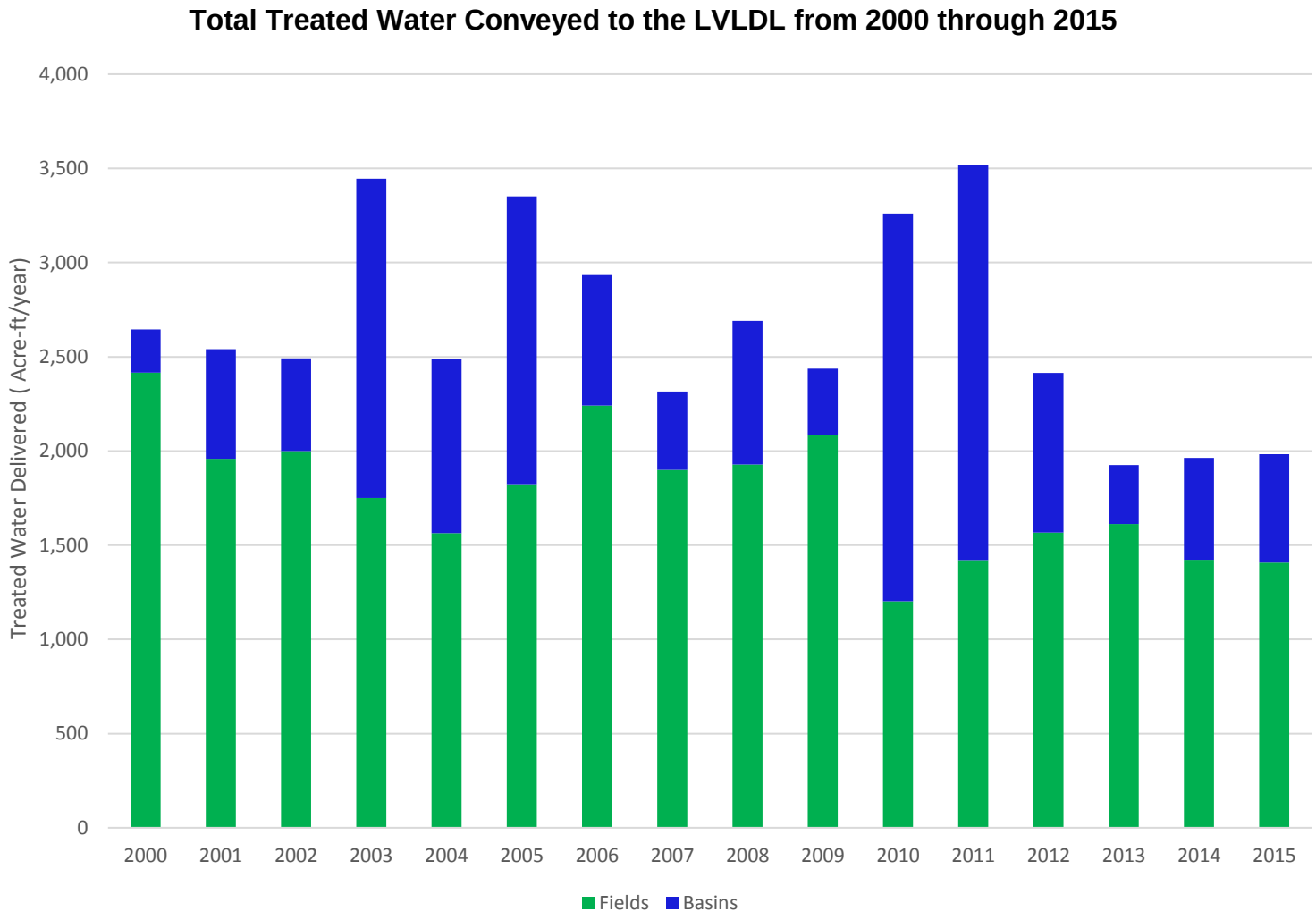
Groundwater Consulting

Groundwater Level Contours April 2014

Figure 4

Water Systems Consulting, Inc. /
Big Bear Area Regional Wastewater Agency
Groundwater Quality Evaluation in the Lucerne Valley Land Discharge Location

Figure 5



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22-Dec-17

Figure 6

Average Monthly Treated Water Conveyed to Basins and Fields from 2005 through 2015

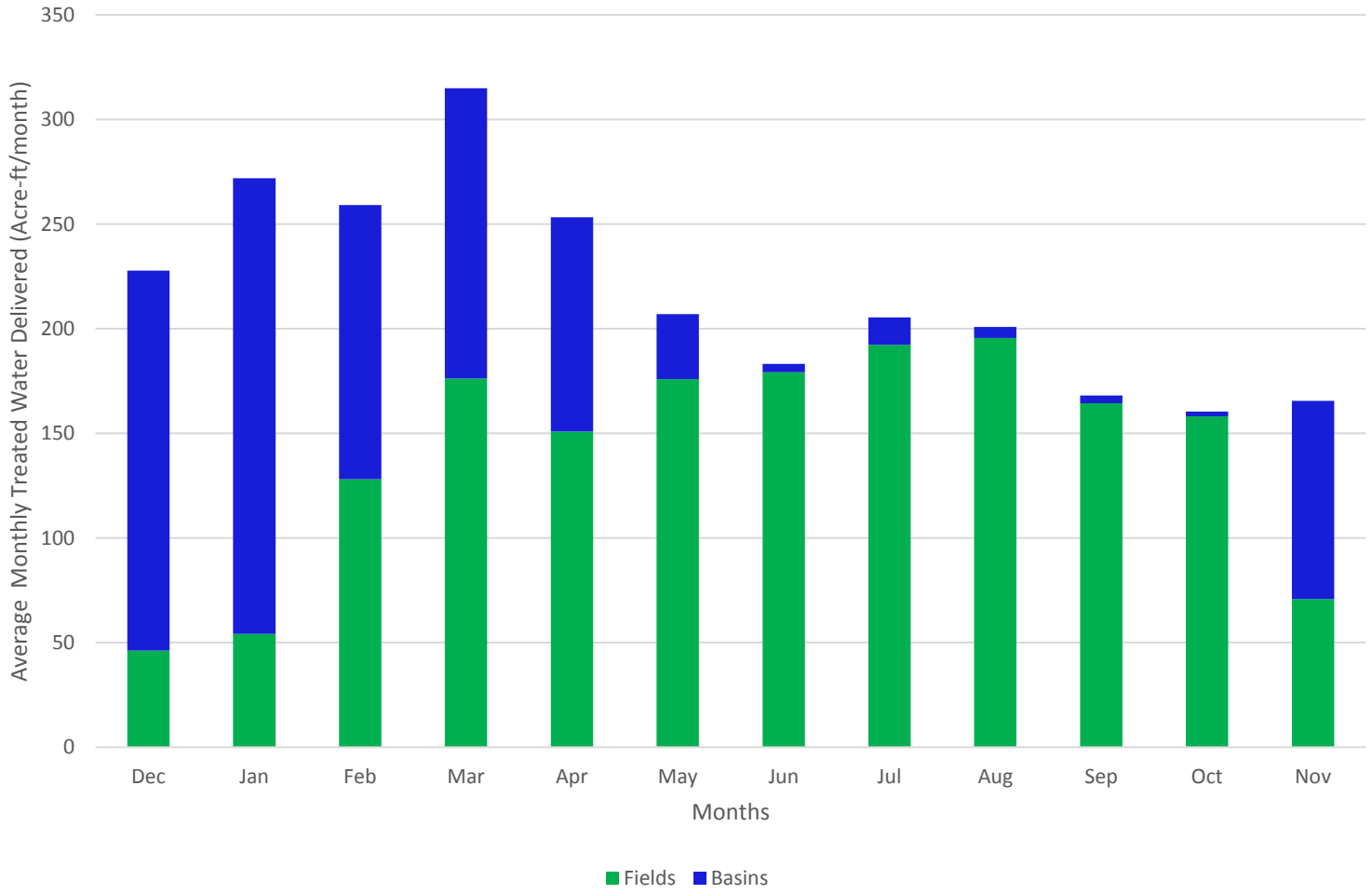
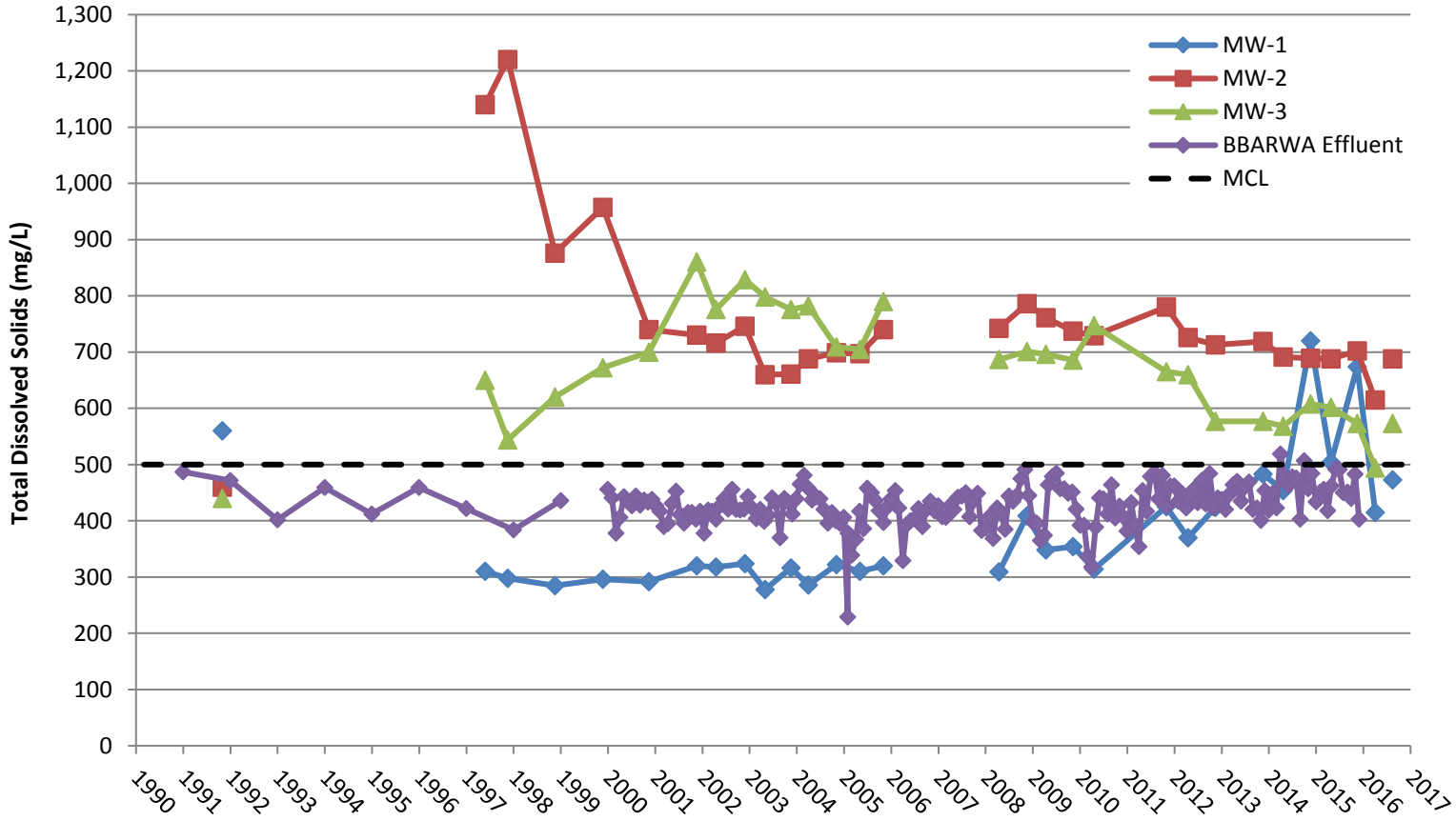


Figure 7

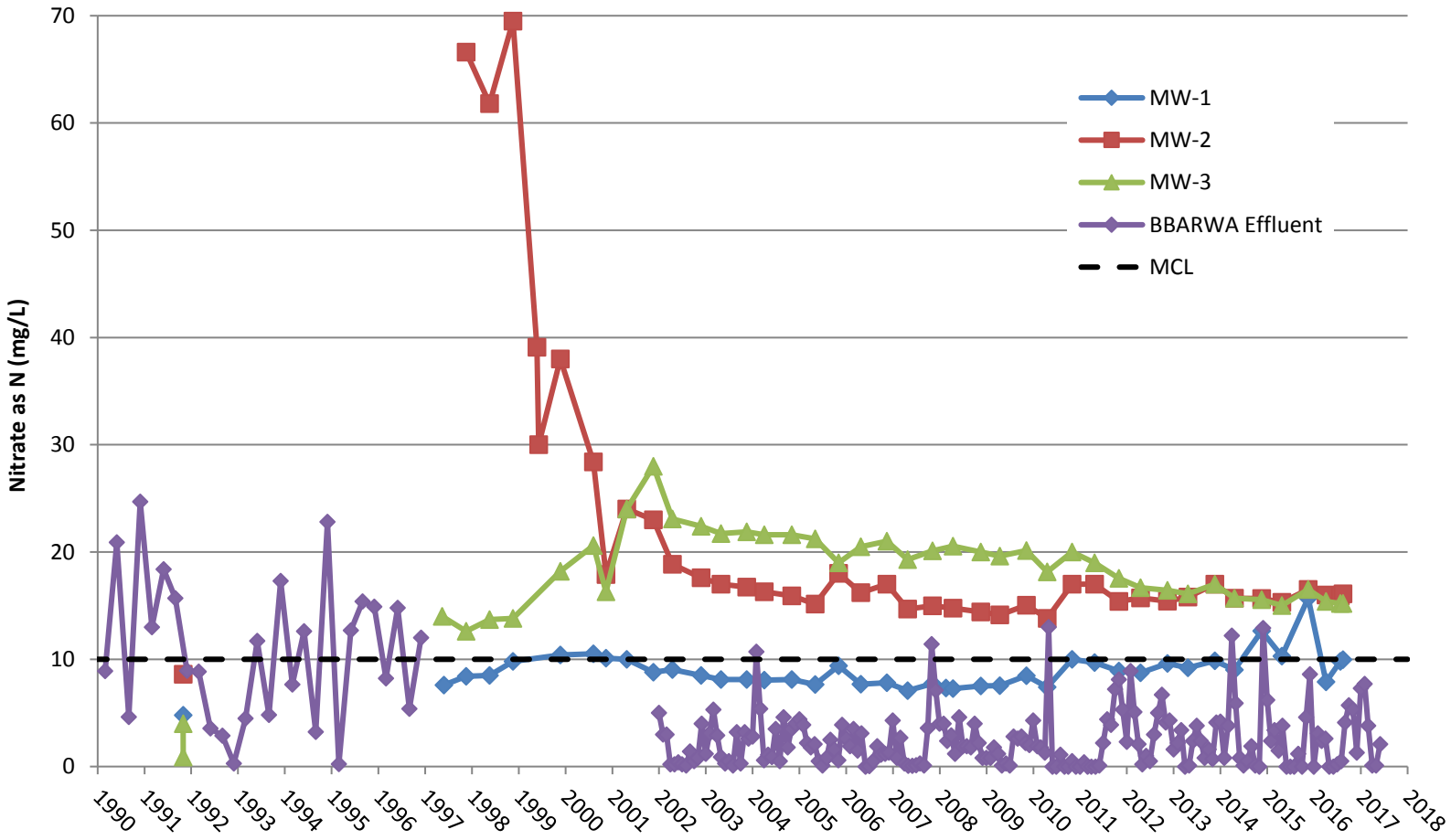
Total Dissolved Solids Concentrations
Lucerne Valley Monitoring Wells



Note: mg/L = milligrams per liter

Figure 8

Nitrate (as N) Concentrations
Lucerne Valley Monitoring Wells



Note: mg/L = milligrams per liter

Thomas Harder & Co.
Groundwater Consulting

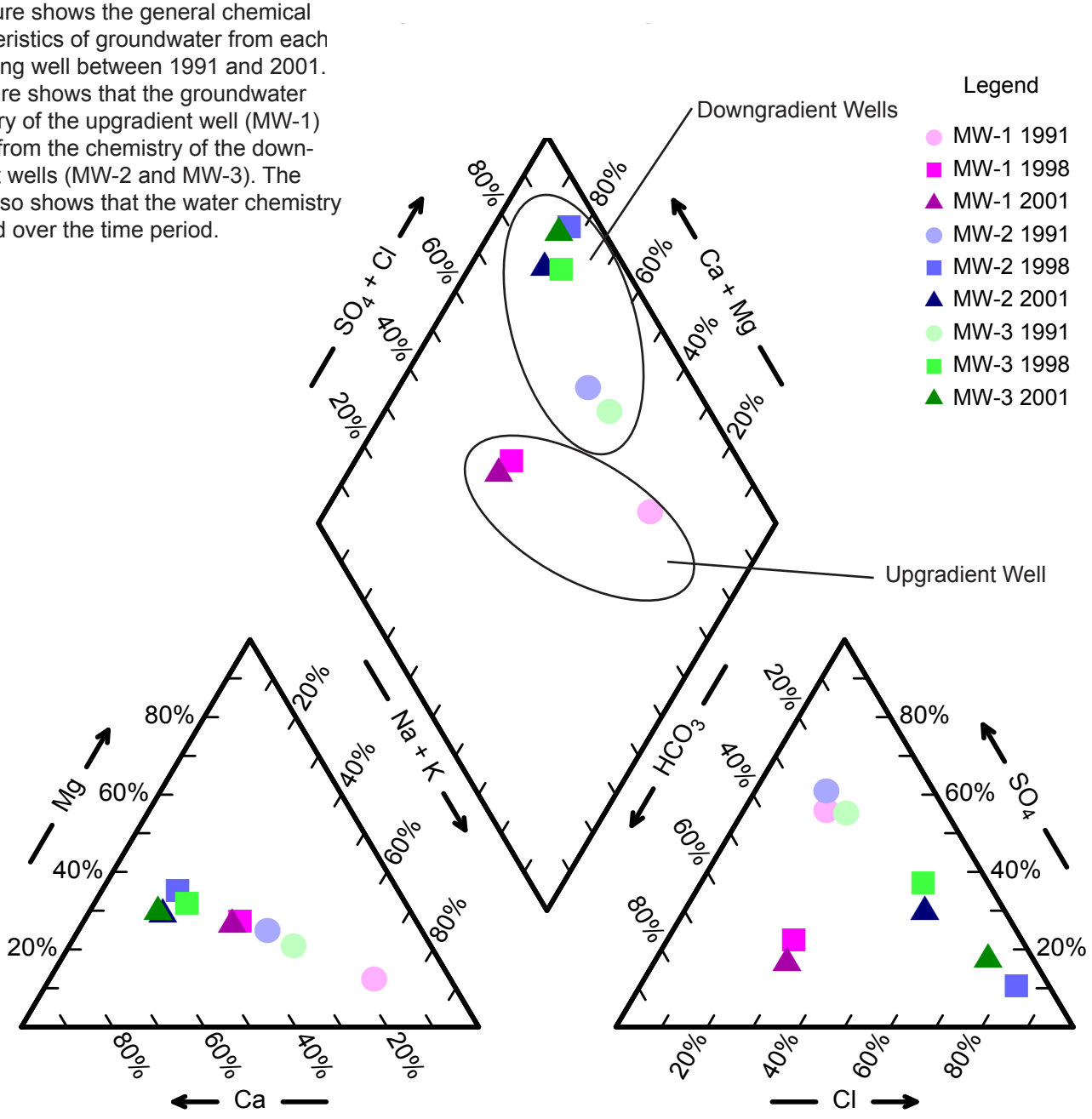
22-Dec-17

Water Systems Consulting, Inc./
Big Bear Area Regional Water Agency
Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location

Figure 9

Monitoring Wells Piper Diagram

This figure shows the general chemical characteristics of groundwater from each monitoring well between 1991 and 2001. The figure shows that the groundwater chemistry of the upgradient well (MW-1) distinct from the chemistry of the down-gradient wells (MW-2 and MW-3). The figure also shows that the water chemistry changed over the time period.



Appendix A

RWQCB's Investigative Order No. R7 to 2016 to 0026

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

BOARD ORDER R7-2016-0026

WASTE DISCHARGE REQUIREMENTS
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

The California Regional Water Quality Control Board, Colorado River Basin Region (Colorado River Basin Water Board) finds that:

1. Big Bear Area Regional Wastewater Agency (BBARWA or Discharger), P. O. Box 517, Big Bear City, California 92314, owns 480 acres in the Lucerne Valley, of which 340 acres are irrigated with recycled water from the Discharger's Wastewater Treatment Plant (WWTP). There are an additional 140 acres available for irrigation, also in the Lucerne Valley. BBARWA's WWTP provides sewerage service to the City of Big Bear Lake, Big Bear City Community Services District, and County Service Area 53-B. The WWTP is located at 122 Palomino Drive, Big Bear City, California 92314, and has a design treatment capacity of 4.89 million gallons-per-day (MGD) and a hydraulic capacity of 9.2 MGD.

2. The WWTP is located outside the boundary of the Colorado River Basin Water Board and is regulated by the California Regional Water Quality Control Board, Santa Ana Region (Santa Ana Water Board) under Waste Discharge Requirements (WDRs) Order R8-2005-0044.

3. The WWTP consists of: preliminary treatment, secondary treatment, and sludge drying and treatment. Secondary treated wastewater from the WWTP is disposed through three possible discharge points that are designated in Board Order R8-2005-0044 as Point 001, Point 002 and Point 003. The discharges from the WWTP at Points 002 and 003 are regulated by the Santa Ana Water Board. Most of the treated wastewater is discharged through Discharge Point 001 into the Lucerne Valley to irrigate fodder, fiber, and seed crops.

4. This Board Order regulates the discharge from the WWTP at Point 001. Infrastructure associated with this discharge includes a concrete-lined reservoir and two overflow ponds that are used to dispose of treated recycled wastewater by percolation and evaporation in the Lucerne Valley (Lucerne Valley Facility) located on Assessor's Parcel Number (APN) 0449-082-040000.

5. The Lucerne Valley Facility has been subject to WDRs adopted in Colorado River Basin Water Board Order 01-156 adopted November 14, 2001.

6. The WDRs are being updated to comply with current laws and regulations as set forth in the California Water Code (CWC) and the California Code of Regulations (CCR) and to incorporate any changes in ownership or operation undertaken by the Discharger.

7. The Lucerne Valley Facility is assigned California Integrated Water Quality System (CIWQS) number CW- CW-208930; Waste Discharger Identification (WDID) number 7A360100011, and GeoTracker Global ID number WDR100027897.

Wastewater Treatment and Discharge

8. The Lucerne Valley Facility is located on 480 acres owned by BBARWA and located near the intersection of State Hwy 247 (Old Woman Springs Road) and Camp Rock Road in the Lucerne Valley of San Bernardino County in Section 14, Township 4 North, Range 1 East, San Bernardino Base & Meridian, as shown in Attachment A, Vicinity Map, incorporated herein, and made part of this Board Order by reference.

9. Wastewater that is discharged at the Lucerne Valley Facility goes through preliminary and secondary treatment at the WWTP before it is sent via gravity to the concrete reservoir at the Lucerne Valley Facility. The WWTP components that are used for treatment are described below:

   a. Preliminary Treatment. Untreated wastewater flows to the preliminary treatment system, which consists of bar screens, aerated grit chamber with grit washer, and a flow bypass channel. This treatment stage removes screenings, rag material and grit.

   b. Secondary Treatment. Effluent flows by gravity from the preliminary treatment system to three parallel oxidation ditches for secondary (biological) treatment and timed processes for nutrient (nitrogen) removal. The number of ditches in operation depends on the seasonal fluctuations of the influent flow. The effluent from the oxidation ditches flows into a system of three secondary clarifiers for removal of floatable and settleable solids/materials. The secondary treated effluent flows to two cement-lined balancing chambers and then flows to equalization storage ponds at the WWTP until pumped for offsite irrigation disposal. A process flow diagram of the WWTP is shown on Attachment B, incorporated herein, and made part of this Board Order by reference.

   c. Offsite Irrigation/Disposal. Undisinfected secondary treated wastewater is pumped from the WWTP's main pump building (5.2 MGD) or auxiliary pump building (9.2 MGD) approximately 16.5 miles to an offsite 2.26-million gallon concrete-lined reservoir (undisinfected secondary recycled water reservoir). This reservoir is located one mile south of the irrigation site. Wastewater from the reservoir flows by gravity through an outfall line connected to the irrigation system. In the event of an overflow at the concrete-lined reservoir, the wastewater flows by gravity to earthen overflow ponds located adjacent to the irrigation site.

10. Approximately 2.01 MGD of undisinfected secondary recycled water (as defined in Title 22 California Code of Regulations Section 60301.900) is discharged to the Lucerne Valley Facility for irrigation of fodder and fiber crops. Undisinfected secondary wastewater has been approved by the California Department of Public Health (DPH) [now State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW)] for irrigation use at this site. Approximately 340 acres are being irrigated at the Lucerne Valley Facility, with an additional 140 acres available for irrigation at the site. The effluent discharge limit of 4.8 MGD in this Board Order is based on the capacity of the irrigated crops to take up nitrogen. The Lucerne Valley Facility site layout is shown in Attachment C, incorporated herein, and made part of this Board Order by reference.

11. The SWRCB's Division of Drinking Water has established statewide reclamation criteria in Title 22 CCR Section 60301 et seq. for the use of recycled water and has developed guidelines for specific uses. Title 22 CCR Section 60304(d)(4) allows the use of undisinfected secondary recycled water for the surface irrigation of fodder and fiber crops and pasture for animals not producing milk for human consumption. BBARWA's Title 22

Engineering Report was initially approved on November 3, 1980, by the California DHS, (now DDW). The Title 22 report was last updated November 4, 1998, to allow for the use of tertiary treated wastewater in the Big Bear Area.

12. The grazing of sheep on the irrigation site has been allowed under certain conditions, as outlined in a letter from Colorado River Basin Water Board staff dated November 15, 1994, and under the conditions shown in Discharge Specification D.22 of this Order.

13. No sewage sludge is discharged at the recycled water reuse site.

14. BBARWA's Self-Monitoring Reports (SMRs) from April 2011 through March 2016 characterize the WWTP effluent as follows:

Constituent	Units	Average	Maximum	Minimum
Flow	MGD	2.01	4.18	1.42
20° C BOD_5[1]	mg/L[2]	6	17	2
TSS[3]	mg/L	13	48	5
pH	s.u.[4]	7.8	8.0	7.4
TDS[5]	mg/L	450	519	354
Nitrate as N	mg/L	3.5	21.6	0.1
Total Nitrogen	mg/L	6.9	28	1.9
Chloride	mg/L	52	61	34
Sulfate	mg/L	40	48	26
Fluoride	mg/L	0.37	0.54	0.24
Boron	mg/L	0.18	0.25	<0.1

Hydrogeologic Conditions at the Lucerne Valley Facility

15. BBARWA installed one groundwater monitoring well in 1979 and three more groundwater monitoring wells in 1991 (MW-1, MW-2 and MW-3). Monitoring well MW-3 replaced the 1979 monitoring well, which was never monitored because the groundwater level is below the bottom of the well. Previous monitoring did not require depth to groundwater monitoring; however, the Discharger's reports indicate that MW-1 is the upgradient well. This Board Order will require depth to groundwater monitoring in order to establish the groundwater gradient.

[1] 5-day biochemical oxygen demand at 20 degrees Celsius.
[2] milligrams per Liter
[3] Total Suspended Solids
[4] Standard pH units
[5] Total Dissolved Solids

16. An irrigation well (14M1) was installed immediately northwest of the overflow ponds in 1986. The distance from well 14M1 to the nearest overflow pond is 180 feet.

17. BBARWA has reported that the depth to groundwater at the Lucerne Valley Facility is a minimum 150 feet below ground surface.

18. Groundwater monitoring data collected from monitoring wells MW-1, MW-2 and MW-3 during the period from 2009 to the present show the following average characteristics:

Constituent	Units	MW-1	MW-2	MW-3
Depth to Groundwater[6]	ft	176	130	141
TDS	mg/L	464	718	619
Total Nitrogen	mg/L	10.6	16.2	17.6
Nitrate as Nitrogen	mg/L	9.4	15.6	17.2
Sulfate	mg/L	63.3	203	173
Chloride	mg/L	106	122	135
Fluoride	mg/L	0.25	0.14	0.25
Boron	mg/L	<0.01	<0.01	<0.01
VOCs – MTBE	ug/L	9.0	ND	ND
VOCs – Methylene Chloride	ug/L	ND	1.4	1.1
VOCs – Bromomethane	ug/L	ND	ND	1.3

19. An analysis of groundwater monitoring data in monitoring wells MW1, MW2 and MW3 from 2000 to the present indicates that concentrations for nitrate, sulfate and chloride are decreasing in the downgradient wells (MW2 and MW3) and increasing in the upgradient well (MW1). This Board Order will require that the Discharger submit a technical report providing an analysis of the water quality impacts by nitrogen and TDS to groundwater resulting from the discharge and to report annual trend monitoring of the data collected in the groundwater monitoring network. The monitoring frequency for total nitrogen and nitrate in the groundwater monitoring wells will be increased from annually to monthly for 12 months and quarterly thereafter to establish groundwater gradient and flow direction. In addition, this Board Order will require annual reporting of nitrogen application of fertilizers and in farming practices and provide a nitrogen and water use balance for the recycled water used on-site.

20. Annual precipitation in the Lucerne Valley region averages about 5.5 inches. Annual evapotranspiration rate is approximately 68 inches.

21. The project lies beyond the toe of a large alluvial fan emanating from the mouth of Cushenbury Canyon in the eastern portion of Lucerne Valley.

[6] Measurement made in 2004.

22. There are several domestic wells in the vicinity of the on-site evaporation/percolation ponds.

23. Water supply to the Big Bear area communities is from numerous groundwater production wells located in Big Bear Valley. TDS in the water supply averages about 280 mg/L based on data reported in the BBARWA's SMRs from 2008 through 2015.

24. Regional groundwater flow in the irrigation and disposal area is generally to the northwest.

25. BBARWA conducted a geotechnical study referenced as *Geotechnical Study, Irrigation Site, Lucerne Valley Area, San Bernardino County, California for Big Bear Area Regional Wastewater Agency, July 29, 1977,* as an initial investigation of the site for use for irrigation. The report shows that the site is underlain by soils consisting of fine to coarse, clean to silty sands containing various amounts of grave from 5 to 24 feet below ground surface. Beneath this, to a depth of 60 to 100 feet below ground surface, the soil consists of fine to medium silty sands containing varying amounts of gravel, and is locally cemented with calcium carbonate accumulated during deposition of the sediments. Bedrock underlies the older alluvium at a depth of 400 to 600 feet.

Basin Plan, Beneficial Uses, and Regulatory Considerations

26. The Water Quality Control Plan for the Colorado River Basin Region of California (Basin Plan), which was adopted on November 17, 1993, and amended on November 13, 2012, designates the beneficial uses of ground and surface waters in this Region, and contains implementation programs and policies to achieve water quality objectives, including narrative objectives for ground water quality, in Chapter 3, section IV, Ground Water Objectives.

27. The discharge is within the Lucerne Hydrologic Unit. The beneficial uses of groundwater in the Lucerne Hydrologic Unit include:

    a. Municipal supply (MUN),

    b. Industrial supply (IND), and

    c. Agricultural supply (AGR).

28. These WDRs implement numeric and narrative water quality objectives for ground and surface waters established by the Basin Plan. The numeric objectives for groundwater designated for municipal and domestic supply are the maximum contaminant levels (MCLs) specified in sections 64431, 64444, and 64678 of Title 22 of the California Code of Regulations (CCR), and the bacteriological limits specified in section 64426.1 of Title 22, CCR.

29. It is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. This order promotes that policy by requiring discharges to meet maximum contaminant levels designed to protect human health and ensure that water is safe for domestic use.

30. Section 13267 of the CWC authorizes the Colorado River Basin Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (MRP) establishes monitoring and reporting requirements to implement federal and state

requirements.

31. This Order establishes WDRs pursuant to Division 7, Chapter 4, Article 4, of the CWC for discharges that are not subject to regulation under Clean Water Act (CWA) section 402 (33 U.S.C. section 1342).

32. Pursuant to CWC section 13263(g), the discharge of waste is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

33. The discharge authorized by this Board Order, and treatment and storage facilities associated with discharges of treated municipal wastewater, except for discharges of residual sludge and solid waste, are exempt from the requirements of the Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste, as set forth in Title 27, CCR, Division 2, Subdivision 1. This exemption is based on section 20090(a) of Title 27, which states in relevant part that discharges of domestic sewage or treated effluent are exempt provided that such discharges are regulated by WDRs, or for which WDRs have been waived, and which are consistent with applicable water quality objectives, and treatment or storage facilities.

Groundwater Degradation

34. State Water Board Resolution 68-16, "Policy with Respect to Maintaining High Quality Waters of the State"(Resolution 68-16) states:

    "Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies."

    Resolution 68-16 further states:

    "Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control [BPTC] of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

35. Some degradation of groundwater from the discharge to the evaporation/percolation ponds is consistent with Resolution 68-16, provided that the degradation:

    a. Is confined to a reasonable area;

    b. Is minimized by means of full implementation, regular maintenance, and optimal operation of BPTC measures;

    c. Is limited to waste constituents typically encountered in domestic wastewater; and

    d. Does not result in the loss of any beneficial use as prescribed in the applicable basin plan, or violation of any water quality objective.

36. The discharge of wastewater as permitted by Order R7-2016-0026 and Order R8-2005-

0044 reflects BPTC. The controls assure the discharge does not create a condition of pollution or nuisance, and that water quality will be maintained, which is consistent with the anti-degradation provisions of Resolution No. 68-16. The Discharger incorporates:

a. A WWTP that provides treatment to secondary standards and nitrification/denitrification processes;

b. An operation and maintenance manual;

c. Staffing to assure proper operation and maintenance;

d. A network of groundwater monitoring wells at the recycle site;

e. A requirement for an Irrigation Management Plan; and

f. A standby emergency power generator of sufficient size to operate the treatment plant and ancillary equipment during periods of loss of commercial power.

Accordingly, the discharge as authorized is consistent with the anti-degradation provisions of Resolution 68-16 and the applicable water quality objectives.

Constituents of Concern

37. Constituents in domestic wastewater effluent that present the greatest risk to groundwater quality are nitrogen, coliforms (pathogen-indicator organisms), and TDS. Recycled water used for irrigation at the Lucerne Valley Facility is treated to secondary standards and has undergone substantial removal of soluble organic matter, solids, and nitrogen treatment.

38. Title 22, CCR, section 64431, Maximum Contaminant Level (MCL) for Nitrate plus Nitrite as Nitrogen is 10 mg/L. To account for the fate of transport for the various components of Total Nitrogen, as a conservative value it is assumed that all nitrogen present converts to nitrate/nitrite. BBARWA's SMRs report an average of 6.9 mg/L for Total Nitrogen between April 2011 and March 2015. Prior to the operation of nitrification/denitrification processes at the WWTP, groundwater analyses at the irrigation and disposal site demonstrated degradation by nitrates. This Board Order will require the Discharger to provide a technical report in the form of a study that analyses the impacts to groundwater by the discharge and an evaluation of water quality trends. In addition, this Board Order will implement a monthly average effluent limitation of 10 mg/L for total nitrogen as a means to mitigate groundwater degradation.

39. While secondary treatment reduces fecal coliform densities by 90 to 99%, the remaining organisms in effluent are still 10^5 to 10^6 MPN/100 ml (United States Environmental Protection Agency, Design Manual, Municipal Wastewater Disinfection; October 1986). Given the depth to groundwater, it is not likely that pathogen-indicator bacteria will reach groundwater at densities exceeding those prescribed in Title 22, CCR.

40. The typical incremental addition of dissolved salts from domestic water usage is 150 to 380 mg/L. Domestic water supply to the Big Bear area communities showed an average concentration of about 280 mg/L during the period of 2011 to 2016. From April 2011 to March 2016 treated wastewater discharged had an average TDS concentration of approximately 450 mg/L. Thus, the average TDS increase over the domestic water supply in the discharge during the same time period was about 170 mg/L. Treated wastewater discharged by the WWTP has a TDS limit of a maximum of 400 mg/L above the domestic source water as regulated by Board Order 01-156. This Board Order will

require the Discharger to provide a technical report in the form of a study that analyzes the impacts to groundwater by the discharge and an evaluation of water quality trends. The results of the study will be used to establish an appropriate effluent limitation for TDS.

CEQA and Public Participation

41. In accordance with section 15301, Chapter 3, Title 14, CCR, the issuance of these WDRs, which govern the operation of an existing facility involving negligible or no expansion of use beyond that previously existing, is exempt from the provisions of the California Environmental Quality Act (CEQA, Pub. Resources Code, section 21000 et seq.).

42. The Colorado River Basin Water Board has notified the Discharger and all known interested agencies and persons of its intent to draft WDRs for this discharge, and has provided them with an opportunity for a public meeting and an opportunity to submit comments.

43. The Colorado River Basin Water Board, in a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, that Board Order 01-156 is rescinded upon the effective date of this Order, except for enforcement purposes, and, in order to meet the provisions contained in Division 7 of the California Water Code, and regulations adopted thereunder, the Discharger shall comply with the following:

A. Effluent Limitations

1. Effluent discharged into the overflow evaporation/percolation ponds for disposal shall not exceed the following effluent limits:

Constituent	Units	30-Day Arithmetic Mean	7-Day Arithmetic Mean	Daily Maximum
20° C BOD_5	mg/L	30	45	-----
Total Suspended Solids	mg/L	30	45	-----
Chloride	mg/L	60	-----	80
Sulfate	mg/L	60	-----	80
Boron	mg/L	-----	-----	0.75
Total Nitrogen	mg/L	10	-----	-----

2. The 30-day average daily dry weather discharge for irrigation shall not exceed 4.8 MGD.

3. Effluent discharge for irrigation shall not have a pH below 6.0 or above 9.0.

B. Groundwater Limitations

1. Discharge at the Lucerne Valley Facility shall not cause groundwater to:

   a. Contain constituents in excess of California MCLs, as set forth in the California Code

of Regulations, Title 22, section 64426.1 for bacteriological constituents; section 64431 for inorganic chemicals; section 64444 for organic chemicals; and section 64678 for determination of exceedances of lead and copper action levels.

b. Contain taste or odor-producing substances in concentrations that adversely affect beneficial uses as a result of human activity.

C. Discharge Prohibitions

1. Discharge of waste classified as "hazardous", as defined in Title 23, CCR, section 2521(a), or "designated", as defined in California Water Code section 13173, is prohibited.

2. Discharge of treated wastewater at a location other than the designated disposal areas or as recycled water used for irrigation at approved use areas, is prohibited.

3. The discharge of recycled water to any drainage courses or surface waters is prohibited.

4. Discharge of waste to land not owned or authorized for such use by the Discharger is prohibited.

5. Surfacing or ponding of wastewater outside of the designated disposal locations is prohibited.

6. Bypass, overflow, discharge, or spill of untreated or partially treated waste is prohibited.

7. Application recycled water and fertilizers containing nitrogen at a rate greater than the agronomic uptake rate of the crops grown is prohibited.

D. Discharge Specifications

1. The discharge shall not cause pollution or nuisance as defined in sections 13050(l) and 13050(m) of Division 7 of the California Water Code, respectively.

2. A minimum depth of freeboard of two (2) feet shall be maintained at all times in the overflow earthen basins and concrete-lined reservoir.

3. The overflow ponds shall be managed to prevent breeding of mosquitoes. In particular:
    a. An erosion control program should assure that small coves and irregularities are not created around the perimeter of the water surface.
    b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.
    c. Dead algae, vegetation, and debris shall not accumulate on the water

4. All storage and disposal areas shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

5. The overflow ponds shall have sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, ancillary inflow, and infiltration during the non-irrigation season. Design seasonal precipitation shall be based on total

annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.

6. Public contact with non-disinfected wastewater shall be precluded through such means as fences, signs, and other acceptable alternatives. The non-disinfected wastewater is not approved for off-site distribution. Conspicuous signs shall be posted in a prominent location in each area where non-disinfected wastewater is stored on-site. Each sign or label with "Non-disinfected wastewater - No body contact or drinking" wording shall be displayed as well as the international warning symbol.

7. Objectionable odors originating at the Lucerne Valley Facility shall not be perceivable beyond the limits of the wastewater treatment and disposal area.

8. The overflow ponds and concrete-lined reservoir shall be maintained so they will be kept in aerobic conditions.

9. The dissolved oxygen content in the upper zone (one foot) of the concrete reservoir and overflow ponds shall not be less than 1.0 mg/L.

10. There shall be no surface flow of wastewater away from the designated disposal areas.

11. On-site wastes, including windblown spray from recycled water application, shall be strictly confined to the lands specifically designated for the disposal operation, and on-site irrigation practices shall be managed so there is no runoff of effluent from irrigated areas.

12. No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

13. No spray irrigation of any recycled water shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground or schoolyard.

14. Except as allowed under Section 7604 of Title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

15. Undisinfected secondary recycled water, as defined in Title 22, Section 60301.900 is limited only for irrigation in the following applications:

    a. Orchards where the recycled water does not come into contact with the edible portion of the crop,

    b. Vineyards where the recycled water does not come into contact with the edible portion of the crop,

    c. Non-food bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

    d. Fodder and fiber crops and pasture for animal not producing milk for human consumption,

e. Seed crops not eaten by humans,

f. Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans, and

g. Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

16. No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with edible portions of food crops eaten raw by humans.

17. The storage, delivery, or use of recycled water shall not individually or collectively, directly or indirectly, result in pollution, or adversely affect water quality, as defined in the CWC.

18. The delivery or use of recycled water shall be in conformance with the reclamation criteria contained in Title 22, or amendments thereto, for the irrigation of food crops, irrigation of fodder, fiber, and seed crops, landscape irrigation, supply of recreational impoundments and ground water recharge.

19. Prior to delivering recycled water to any new user, BBARWA shall submit to the Colorado River Basin Water Board a report discussing any new distribution system being constructed by the Discharger to provide service to the new user.

20. Recycled water shall not be delivered to any new user who has not first received a discharge permit from the Colorado River Basin Water Board and approval from the SWRCB's Division of Drinking Water.

21. Treated or untreated sludge or similar solid waste materials shall be disposed at locations approved by the Colorado River Basin Water Board's Executive Officer.

22. Grazing of sheep on the irrigation site is allowed only under the following conditions, unless otherwise approved by the Colorado River Basin Water Board 's Executive Officer:

    a. Grazing will only be conducted in October or November after the last cutting of hay has been baled;

    b. Grazing animals will not be allowed into a portion of the site until 10 days after it was last irrigated;

    c. Temporary fences will be erected to contain the grazing animals in an area of 40 acres or less;

    d. Only ewes that are about to lamb or ewes with newly born will be grazed;

    e. No animals will be sold for slaughter within 90 days after grazing.

    f. No milk produced by sheep that have grazed at the irrigation site shall be used for human consumption.

E. Special Provisions

1. Within **three months** of the adoption of this Board Order, the Discharger shall submit a technical report that is a work plan, for approval by the Colorado River Basin Water

Board's Executive Officer, to conduct a study of the groundwater in the vicinity of the recycled water irrigation use site. The objective of the study shall be to address the impacts that the discharges to unlined ponds and the irrigation area have on areal groundwater quality. The Discharger shall submit the final technical report containing the results of the study within **18 months** of the adoption of this Board Order and shall propose recommendations to mitigate the effects of nitrogen loading to groundwater and propose an appropriate effluent limit for TDS.

2. Within six months of the adoption of this Board Order, the Discharger shall prepare and submit an Irrigation Management Plan that includes a water balance and nutrient balance to assure that recycled water is applied at appropriate rates. The Irrigation Management Plan shall be submitted for approval by the Colorado River Basin Water Board's Executive Officer.

3. Within **nine months** of the adoption of this Order, the Discharger shall submit to the Colorado River Basin Water Board office a technical report that includes a copy of the Maintenance and Operations Manual for the Lucerne Valley Facility.

F. Standard Provisions

1. The Discharger shall comply with all of the conditions of this Board Order. Noncompliance is a violation of the Porter-Cologne Water Quality Control Act (CWC, section 13000 et seq.), and is grounds for enforcement action.

2. The Discharger shall comply with Monitoring and Reporting Program R7-2016-0026 and future revisions thereto as specified by the Colorado River Basin Water Board's Executive Officer.

3. The Discharger shall comply with the Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under Monitoring and Reporting Program (MRP) R7-2016-0026, and future revisions thereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and pdf monitoring reports to the State Water Resources Control Board GeoTracker https://geotracker.waterboards.ca.gov/ database. Documents that are normally mailed by the Discharger, such as regulatory documents, narrative technical monitoring program reports, and such reports submissions, materials, data, and correspondence, to the Colorado River Basin Water Board shall also be uploaded into GeoTracker in the appropriate Microsoft software application, such as word, excel, or an Adobe Portable Document Format (PDF) file. Large documents are to be split into manageable file sizes appropriately labelled and uploaded into GeoTracker.

4. All technical reports required in conjunction with this Order are required pursuant to Section 13267 of the CWC, and shall include a statement by the Discharger, or an authorized representative of the Discharger, certifying under penalty of perjury under the laws of the State of California, that the report is true, complete, and accurate.

5. In accordance with California Business and Professions Code Sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of California registered professionals (i.e., civil engineer, engineering geologist, geologist, etc.) competent and proficient in the fields pertinent to the required activities. All technical reports specified herein that contain work plans, that describe the conduct of investigations and studies, or that contain technical conclusions and

recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately qualified professionals, even if not explicitly stated. Each technical report submitted by the Discharger shall contain a statement of qualifications of the responsible licensed professionals as well as the professional's signature and/or stamp of the seal. Additionally, to the extent that preparation of a required technical report involves field activities, field activities shall be conducted under the direct supervision of one or more of these professionals.

6. The Discharger shall not cause degradation of any water supply in accordance with State Water Board Resolution 68-16.

7. Standby power generating facilities shall be available to operate the plant during a commercial power failure.

8. Adequate measures shall be taken to assure that flood or surface drainage waters do not erode or otherwise render portions of the discharge facilities inoperable.

9. The use of recycled water at the Lucerne Valley Facility shall be supervised by persons possessing certification of appropriate grade pursuant to section 3680, Chapter 26, Division 3, Title 23 of the California Code of Regulations.

10. The Discharger shall at all times properly operate and maintain all systems and components of collection, treatment and control, installed or used by the Discharger to achieve compliance with this Board Order. Proper operation and maintenance includes effective performance, adequate process controls, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities/systems when necessary to achieve compliance with this Board Order. All systems in service or reserved shall be inspected and maintained on a regular basis. Records of inspections and maintenance shall be retained, and made available to the Colorado River Basin Water Board's Executive Officer on request.

11. The Discharger shall ensure that all site-operating personnel are familiar with the content of this Board Order, and shall maintain a copy of this Board Order at the site.

12. The Discharger shall allow the Colorado River Basin Water Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter the premises regulated by this Board Order, or the place where records are kept under the conditions of this Board Order;

    b. Have access to and copy, at reasonable times, records kept under the conditions of this Board Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Board Order; and

    d. Sample or monitor at reasonable times, for the purpose of assuring compliance with this Board Order or as otherwise authorized by the California Water Code, any substances or parameters at this location.

13. Ponds shall be managed to prevent breeding of mosquitoes. In particular,

    a. An erosion control program should assure that small coves and irregularities are not

created around the perimeter of the water surface.

b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.

c. Dead algae, vegetation, and debris shall not accumulate on the water surface.

14. Disposal of oil and grease, biosolids, screenings, and other solids collected from liquid wastes shall be pursuant to Title 27, and the review and approval of the Colorado River Basin Water Board Executive Officer.

15. Any proposed change in use or disposal of biosolids requires the approval of the Colorado River Basin Water Board Executive Officer, and U.S. Environmental Protection Agency Regional Administrator, who must be notified at least 90 days in advance of the change.

16. Sludge use and disposal shall comply with Federal and State laws and regulations, including permitting requirements, and technical standards in 40 CFR Part 503. If the State and Colorado River Basin Water Boards are delegated the authority to implement 40 CFR Part 503 regulations, this Order may be revised to incorporate appropriate time schedules and technical standards. The Discharger shall comply with the standards and time schedules in 40 CFR part 503, whether or not part of this Order.

17. The Discharger shall provide a plan as to the method, treatment, handling and disposal of sludge that is consistent with all State and Federal laws and regulations and obtain prior written approval from the Colorado River Basin Water Board specifying location and method of disposal, before disposing of treated or untreated sludge, or similar solid waste.

18. The Discharger shall maintain a permanent log of all solids hauled away from the treatment facility for use/disposal elsewhere and shall provide a summary of the volume, type (screenings, grit, raw sludge, digested sludge), use (agricultural, composting, etc.), and the destination in accordance with the MRP of this Board Order. Sludge that is stockpiled at the treatment facility shall be sampled and analyzed for those constituents listed in the sludge monitoring section of the MRP of this Board Order and as required by Title 40, Code of Federal Regulations, Part 503. The results of the analyses shall be submitted to the Colorado River Basin Water Board as part of the MRP.

19. The Discharger shall provide a report to the Colorado River Basin Water Board when it determines that the plant's average dry-weather flow rate for any month exceeds 80 percent of the design capacity. The report should indicate what steps, if any, the Discharger intends to take to provide for the expected wastewater treatment capacity necessary when the plant reaches design capacity.

20. Prior to implementing a modification that results in a material change in the quality or quantity of wastewater treated or discharged, or a material change in the location of discharge, the Discharger shall report all pertinent information in writing to the Colorado River Basin Water Board, and obtain revised requirements.

21. Prior to a change in ownership or management of the Lucerne Valley Facility, the Discharger shall transmit a copy of this Board Order to the succeeding owner/operator, and forward a copy of the transmittal letter to the Colorado River Basin Water Board.

22. The Discharger shall provide adequate notice to the Colorado River Basin Water Board

Executive Officer of the following:

a. Any substantial change in the volume or character of pollutants introduced into any treatment facility described in the Findings of this Board Order, by an existing or new source; and

b. Any planned physical alteration or addition to the facilities described in this Board Order, or change planned in the Discharger's sludge use or disposal practice, where such alterations, additions, or changes may justify the application of Board Order conditions that are different from or absent in the existing Board Order, including notification of additional disposal sites not reported during the Board Order application process, or not reported pursuant to an approved land application plan.

23. The Discharger shall report orally, any noncompliance that may endanger human health or the environment. The noncompliance shall be reported immediately to the Colorado River Basin Water Board's Executive Officer at (760) 346-7491, and the California Office of Emergency Services at (800) 852-7550 as soon as:

    a. The Discharger has knowledge of the discharge,

    b. Notification is possible, and

    c. Notification will not substantially impede cleanup or other emergency measures.

    During non-business hours, the Discharger shall leave a message on the Colorado River Basin Water Board's office voice recorder at the above listed number. Incident information shall be provided orally as soon as possible and within 24 hours from the time the Discharger becomes aware of the incident. A written report shall also be provided within five (5) business days of the time the Discharger becomes aware of the incident. The written report shall contain a description of the noncompliance and its cause, the period of noncompliance, the anticipated time to achieve full compliance, and the steps taken or planned, to reduce, eliminate, and prevent recurrence of the noncompliance. The Discharger shall report all intentional or unintentional spills in excess of one thousand (1,000) gallons occurring within the Colorado River Basin Water Board's jurisdiction, including the Lucerne Valley Facility or disposal line, in accordance with the above time limits.

24. The Discharger shall report all instances of noncompliance. Reports of noncompliance shall be submitted with the Discharger's next scheduled SMRs or earlier if requested by the Colorado River Basin Water Board's Executive Officer, or if required by an applicable standard for sludge use and disposal.

25. By-pass (i.e., the intentional diversion of waste streams from any portion of the treatment facilities, except diversions designed to meet variable effluent limits) is prohibited. The Colorado River Basin Water Board may take enforcement action against the Discharger for by-pass unless:

    a. By-pass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to be inoperable, or substantial and permanent loss of natural resources reasonably expected to occur in the absence of a by-pass. Severe property damage does not mean economic loss caused by delays in production; and

    There were no feasible alternatives to by-pass, such as the use of auxiliary treatment

facilities or retention of untreated waste. This condition is not satisfied if adequate back-up equipment was not installed to prevent by-pass occurring during equipment downtime, or preventive maintenance.

b. By-pass is:

   i. Required for essential maintenance to assure efficient operation; and

   ii. Neither effluent nor receiving water limitations are exceeded; and

   iii. The Discharger notifies the Colorado River Basin Water Board ten (10) days in advance.

26. In the event of an unanticipated by-pass, the Discharger shall immediately report the incident to the Colorado River Basin Water Board. During non-business hours, the Discharger shall leave a message on the Colorado River Basin Water Board office voice recorder. A written report shall be provided within five business days the Discharger is aware of the incident. The written report shall include a description of the by-pass, any noncompliance, the cause, period of noncompliance, anticipated time to achieve full compliance, and steps taken or planned, to reduce, eliminate, and prevent recurrence of the noncompliance.

27. Federal regulations for storm water discharges require specific categories of facilities which discharge storm water associated with industrial activity (storm water) to obtain National Pollutant Discharge Elimination System (NPDES) permits and to implement Best Conventional Pollutant Technology (BCT) and Best Available Technology Economically Achievable (BAT) to reduce or eliminate industrial storm water pollution.

28. All storm water discharges from this facility must comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies, regarding discharges of storm water to storm water drain systems or other courses under their jurisdiction.

29. Storm water discharges from the facility shall not cause or threaten to cause pollution or contamination.

30. Storm water discharges from the facility shall not contain hazardous substances equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.

31. The Discharger is the responsible party for the waste discharge requirements and the monitoring and reporting program for the facility. The Discharger shall comply with all conditions of these waste discharge requirements. Violations may result in enforcement actions, including Colorado River Basin Water Board Orders or court orders, requiring corrective action or imposing civil monetary liability, or in modification or revocation of these waste discharge requirements by the Colorado River Basin Water Board.

32. This Board Order does not authorize violation of any federal, state, or local laws or regulations.

33. This Board Order does not convey property rights of any sort, or exclusive privileges, nor does it authorize injury to private property or invasion of personal rights, or infringement of federal, state, or local laws or regulations.

34. This Board Order may be modified, rescinded, or reissued, for cause. The filing of a

request by the Discharger for a Board Order modification, rescission or reissuance, or notification of planned changes or anticipated noncompliance, does not stay any Board Order condition. Causes for modification include a change in land application plans, or sludge use or disposal practices, and adoption of new regulations by the State or Colorado River Basin Water Board (including revisions to the Basin Plan), or Federal government.

I, Jose L. Angel, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on June 30, 2016.

Jose L. Angel

JOSE L. ANGEL P.E.
Executive Officer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

MONITORING AND REPORTING PROGRAM R7-2016-0026
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

Location of Discharge:
Section 14, T4N, R1E, SBB&M

A. Monitoring

1. This Monitoring and Reporting Program (MRP) describes requirements for monitoring a wastewater system and groundwater quality (when needed). This MRP is issued pursuant to California Water Code (CWC) section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer.

2. Water Code section 13267 states, in part:

   "In conducting an investigation specified in subdivision (a), the Colorado River Basin Water Board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the Colorado River Basin Water Board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the Colorado River Basin Water Board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

3. Water Code section 13268 states, in part:

   "(a) (1) Any person failing or refusing to furnish technical or monitoring program reports as required by subdivision (b) of section 13267, or failing or refusing to furnish a statement of compliance as required by subdivision (b) of section 13399.2, or falsifying any information provided therein, is guilty of a misdemeanor, and may be liable civilly in accordance with subdivision (b). (b) (1) Civil liability may be administratively imposed by a Colorado River Basin Water Board in accordance with Article 2.5 (commencing with section 13323) of Chapter 5 for a violation of subdivision (a) in an amount which shall not exceed one thousand dollars ($1,000) for each day in which the violation occurs."

4. BBARWA owns and operates the wastewater system that is subject to Board Order R7-2016-0026. The reports are necessary to ensure that the Discharger complies with the Order. Pursuant to Water Code section 13267, the Discharger shall implement the MRP and shall submit the monitoring reports described herein.

5. All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded

on the sample chain of custody form. If composite samples are collected, the basis for sampling (time or flow weighted) shall be approved by Colorado River Basin Water Board staff.

6. Field test instruments (such as those used to test pH, dissolved oxygen, and electrical conductivity) may be used provided that:
   a. The user is trained in proper use and maintenance of the instruments;
   b. The instruments are field calibrated prior to monitoring events at the frequency recommended by the manufacturer;
   c. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
   d. Field calibration reports are submitted as described in the "Reporting" section of this MRP.

7. The collection, preservation and holding times of all samples shall be in accordance with U. S. Environmental Protection Agency (USEPA) approved procedures. Unless otherwise approved by the Colorado River Basin Water Board's Executive Officer, all analyses shall be conducted by a laboratory certified by the State Water Resources Control Board, Division of Drinking Water. All analyses shall be conducted in accordance with the latest edition of the "Guidelines Establishing Test Procedures for Analysis of Pollutants" (40 CFR Part 136), promulgated by the USEPA.

8. All monitoring instruments and devices used by the Discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy. In the event that continuous monitoring equipment is out of service for period greater than 24-hours, the Discharger shall obtain representative grab samples each day the equipment is out of service. The Discharger shall correct the cause(s) of failure of the continuous monitoring equipment as soon as practicable. The Discharger shall report the period(s) during which the equipment was out of service and if the problem has not been corrected, shall identify the steps which the Discharger is taking or proposes to take to bring the equipment back into service and the schedule for these actions.

9. The Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Board Order, and records of all data used to complete the application for this Board Order, for a period of at least five (5) years from the date of the sample, measurement, report or application. This period may be extended by request of the Colorado River Basin Water Board's Executive Officer at any time. Records of monitoring information shall include:
   a. The date, exact place, and time of sampling or measurement(s);
   b. The individual(s) who performed the sampling or measurement(s);
   c. The date(s) analyses were performed;
   d. The individual(s) who performed the analyses;
   e. The analytical techniques or method used; and
   f. The results of such analyses.

10. Samples shall be collected at the location specified in the WDRs. If no location is

specified, sampling shall be conducted at the most representative sampling point available.

11. Given the monitoring frequency prescribed by MRP R7-2016-0026, if only one sample is available for a given reporting period, compliance with monthly average, or weekly average Discharge Specifications, will be determined from that sample.

12. If the facility is not in operation, or there is no discharge during a required reporting period, the Discharger shall forward a letter to the Colorado River Basin Water Board indicating that there has been no activity during the required reporting period.

Effluent Monitoring

13. Representative samples of the undisinfected secondary recycled water shall be taken at the WWTP. The samples shall be analyzed for the following constituents:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Irrigation Flow	MGD	Flow Meter Reading	Daily	Monthly
20°C BOD_5	mg/L	24 Hr. Composite	2x/Month	Monthly
Total Suspended Solids	mg/L	24 Hr. Composite	2x/Month	Monthly
pH	s.u. [1]	Grab	Daily	Monthly
Dissolved Oxygen[2]	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids	mg/L	24 Hr. Composite	Monthly	Monthly
Sulfate (SO_4)	mg/L	24 Hr. Composite	Monthly	Monthly
Chloride	mg/L	24 Hr. Composite	2x/Month	Monthly
Fluoride (F)	mg/L	24 Hr. Composite	Monthly	Monthly
Nitrate (NO_3-N) as N	mg/L	24 Hr. Composite	Monthly	Monthly
Total Nitrogen	mg/L	24 Hr. Composite	Monthly	Monthly
VOCs[3]	µg/L[4]	24 Hr. Composite	Annually	Annually

Overflow Pond Monitoring

14. During months when the overflow evaporation/percolation ponds are not used, the Discharger shall report that there has been no activity. During months when the overflow evaporation percolation ponds are in use, the ponds shall be monitored according to the following schedule:

[1] standard pH units
[2] Dissolved Oxygen shall be monitored at the upper one foot layer of the storage or percolation ponds.
[3] Analysis of Volatile Organic Compounds is to be accomplished using the USEPA test methods 601, 602 or 624
[4] micrograms per liter

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Flow Quantity	MGD	Flow Measurement	Daily	Monthly
Dissolved Oxygen	mg/L	Grab	Twice Monthly	Monthly
pH	s.u.	Grab	Twice Monthly	Monthly
Total Dissolved Solids	mg/L	Grab	Twice Monthly	Monthly
Freeboard	ft	Measurement	Twice Monthly	Monthly

Groundwater Monitoring

15. The groundwater monitoring wells shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring[5] Frequency	Reporting Frequency
Depth to Groundwater	ft (msl)[6]	Measurement	Monthly	Monthly
Groundwater Gradient[7]	NA	Direction	Monthly	Monthly
Total Nitrogen	mg/L	Grab	Monthly	Monthly
Nitrate as N	mg/L	Grab	Monthly	Monthly
Chloride	mg/L	Grab	Monthly	Monthly
Fluoride	mg/L	Grab	Monthly	Monthly
Sulfate	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids	mg/L	Grab	Monthly	Monthly
Boron	mg/L	Grab	Monthly	Monthly
VOCs	μg/L	Grab	Annually	Annually

Domestic Water Supply Monitoring

16. The domestic water supply shall be a flow weighted composite sample monitored at the water supply production wells in Big Bear Valley and include notations of which wells are non-operating for a reporting period and in accordance to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Total Dissolved Solids	mg/L	Grab	Annually	Annually

[5] Groundwater monitoring shall be performed monthly for the first 12 months and quarterly thereafter.
[6] Above mean sea level.
[7] Groundwater flow direction.

B. Reporting

1. The Discharger shall inspect and document any operation/maintenance problems by inspecting each unit process. Operation and Maintenance reports shall be submitted to the Colorado River Basin Water Board Office annually, containing documentation showing the calibration of flow meters and equipment as performed in a timely manner, modifications and updates to the Operation and Maintenance Manual, and modifications and updates to the Agency's waste water ordinance or rules and regulations.

2. The Discharger shall annually report a trend monitoring analysis for total nitrogen and nitrates in the groundwater in the vicinity of the recycled water use site. The analysis shall be reported with the Discharger's annual Self-Monitoring Report (SMR).

3. The Discharger shall provide an annual nitrogen balance for the recycled water use site which includes nitrogen loading by application of recycled water and the use of fertilizers for farming. Nitrogen balance shall consider nitrogen uptake by crops grown and provide documentation of crop-specific nitrogen uptake rates. The analysis shall be reported with the Discharger's annual SMR.

4. The Discharger shall provide an operator certification status update including number of staff and grade certification annually.

5. SMRs shall be certified under penalty of perjury to be true and correct, and shall contain the required information at the frequency designated in this MRP.

6. Each Report must contain an affirmation in writing that:

   "All analyses were conducted at a laboratory certified for such analyses by and in accordance with current USEPA procedures or as specified in this Monitoring and Reporting Program."

7. Each Report shall contain the following completed declaration:

   "I certify under the penalty of law that this document, including all attachments and supplemental information, was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment.

   Executed on the _____day of _____ at _____

   _____(Signature)

   _____(Title)"

8. The SMRs, and other information requested by the Colorado River Basin Water Board, shall be signed by a principal executive officer or ranking elected official.

9. A duly authorized representative of the Discharger may sign the documents if:

   a. The authorization is made in writing by the person described above;

b. The authorization specified an individual or person having responsibility for the overall operation of the regulated disposal system; and

c. The written authorization is submitted to the Colorado River Basin Water Board's Executive Officer.

10. The Discharger shall attach a cover letter to the SMRs. The information contained in the cover letter shall clearly identify violations of the WDRs; discuss corrective actions taken or planned and the proposed time schedule of corrective actions. Identified violations should include a description of the requirement that was violated and a description of the violation.

11. Daily, weekly, and monthly monitoring shall be included in the monthly monitoring report. Monthly monitoring reports shall be submitted to the Colorado River Basin Water Board by the 15th day of the following month. Quarterly monitoring reports shall be submitted by January 15th, April 15th, July 15th and October 15th. Annual monitoring reports shall be submitted by January 31st of the following year.

12. The Discharger shall comply with the Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under Monitoring and Reporting Program (MRP) R7-2016-0026, and future revisions thereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and pdf monitoring reports to the State Water Resources Control Board GeoTracker database. Documents that are 2.0 MB or larger should be broken down into smaller electronic files, labelled properly and uploaded into GeoTracker.

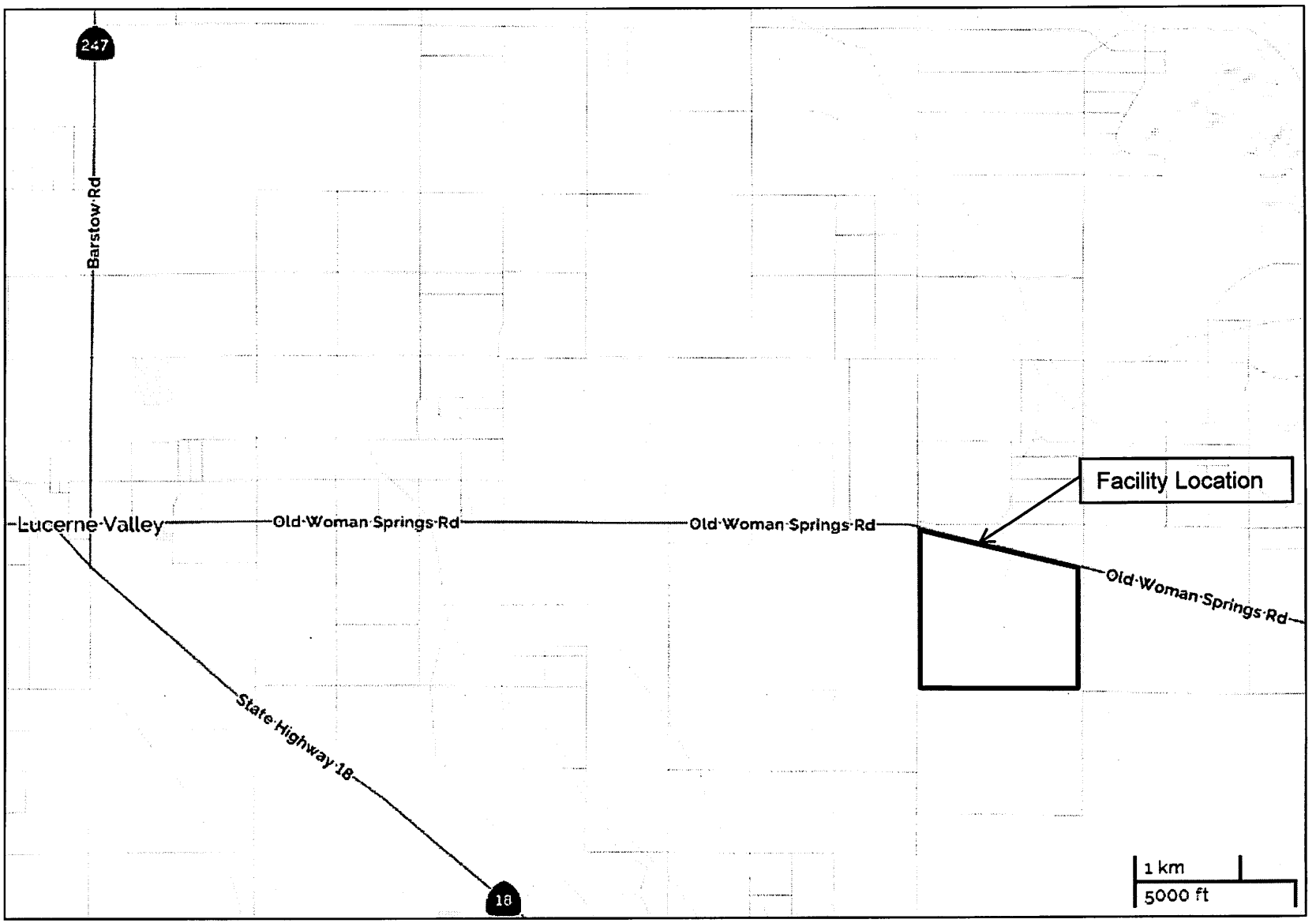
Jose L. Angel

JOSE L. ANGEL P.E.
Executive Officer

6/30/2016

Date

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION



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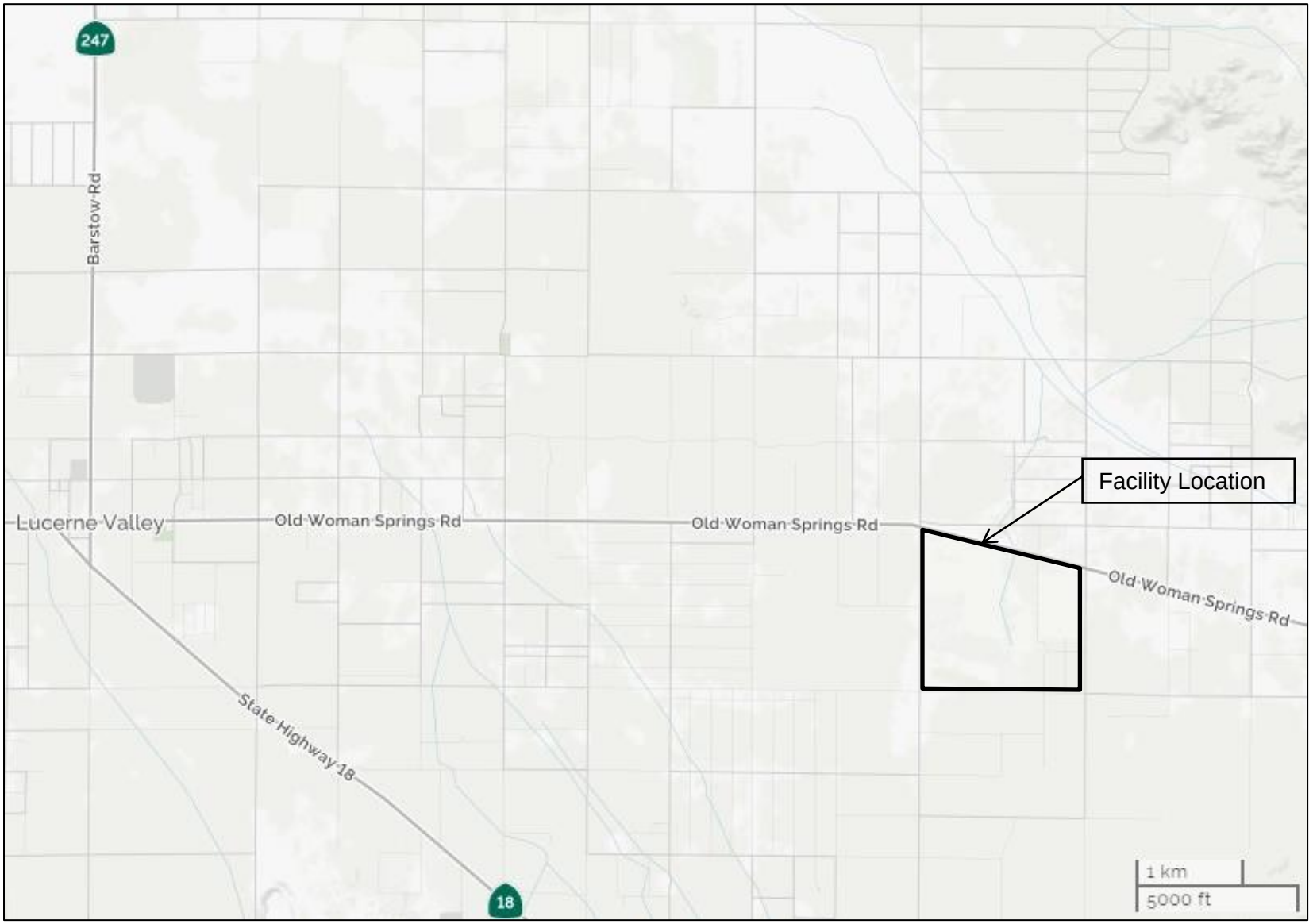
ATTACHMENT A – VICINITY MAP

Board Order R7-2016-0026

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION



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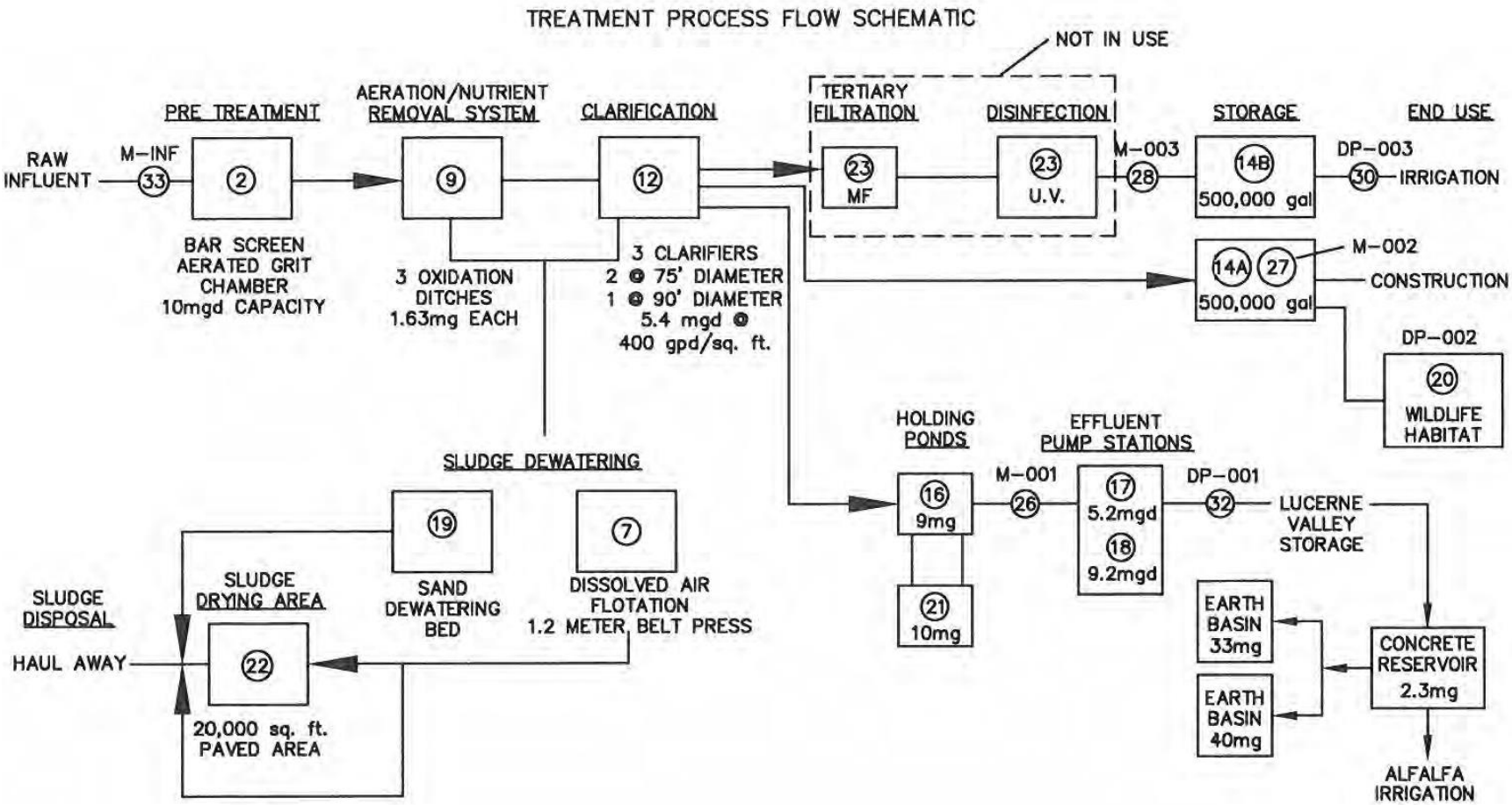

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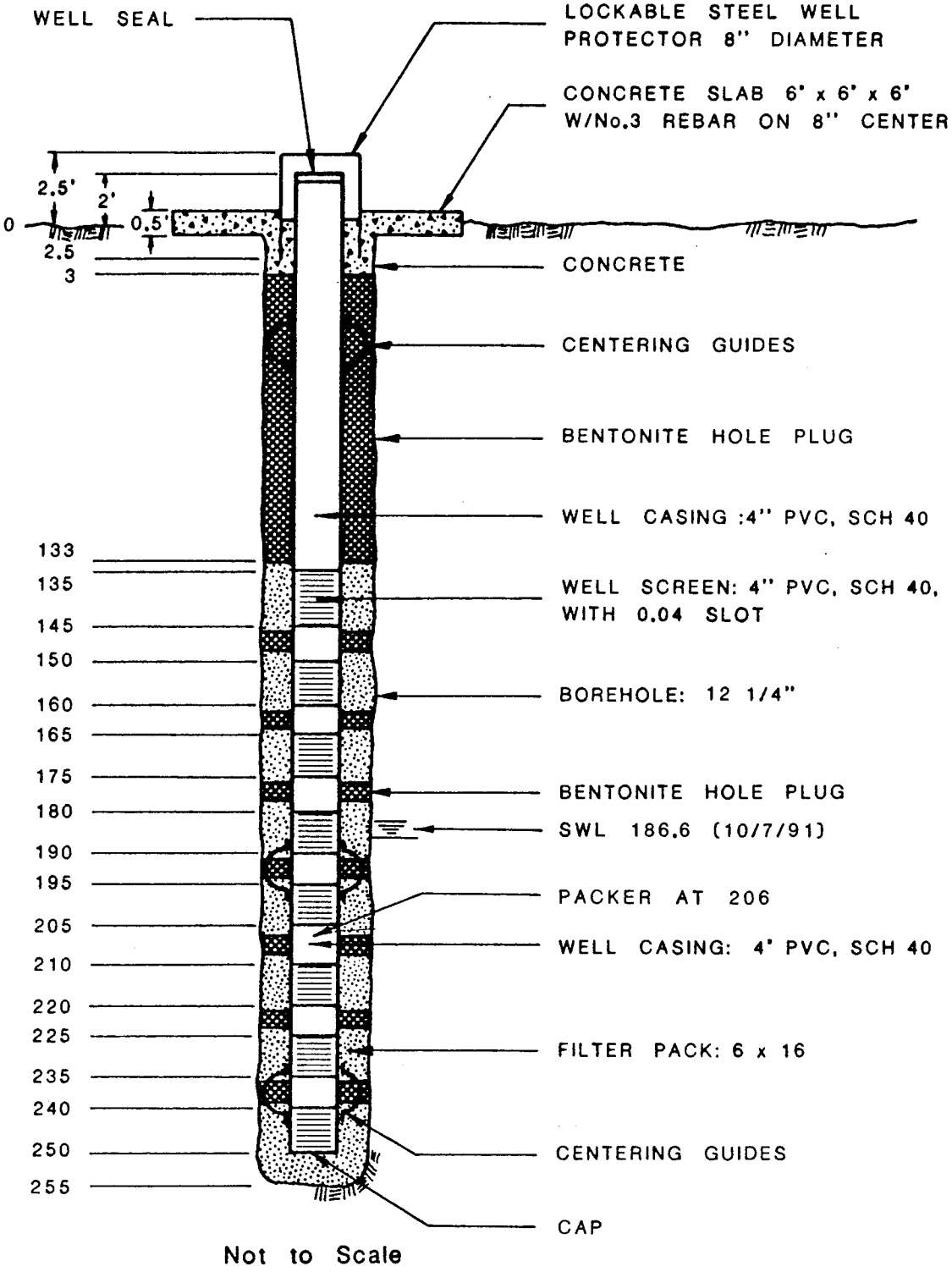
Appendix B

MW-1, MW-2 and MW-3 Well Construction Diagrams



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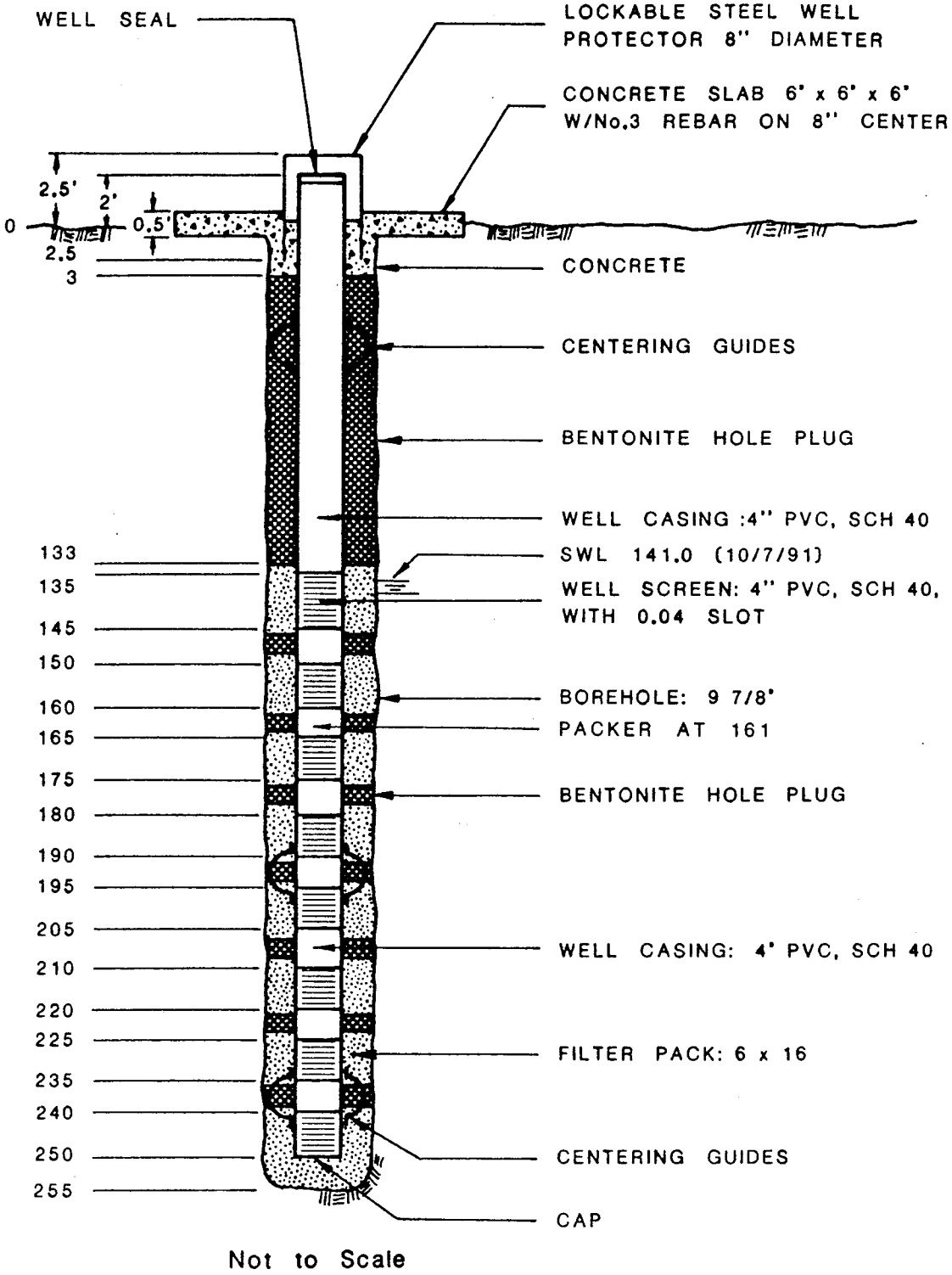
PROJECT No. 58-9660 DATE 1/7/92 PROJ. MGR. R.S. DFTR. M.N.

BIG BEAR REGIONAL WASTEWATER LUCERNE VALLEY, CALIFORNIA	TYPICAL MONITORING WELL CONSTRUCTION DETAILS MW-1	PROJ. NO. 58-9660.01

LAW ENVIRONMENTAL, INC.

DIETERICH POST REORDER NO. 140693



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BIG BEAR REGIONAL WASTEWATER LUCERNE VALLEY, CALIFORNIA	TYPICAL MONITORING WELL CONSTRUCTION DETAILS MW-2	PROJ. NO. 58-9660.01 LAW ENVIRONMENTAL, INC.

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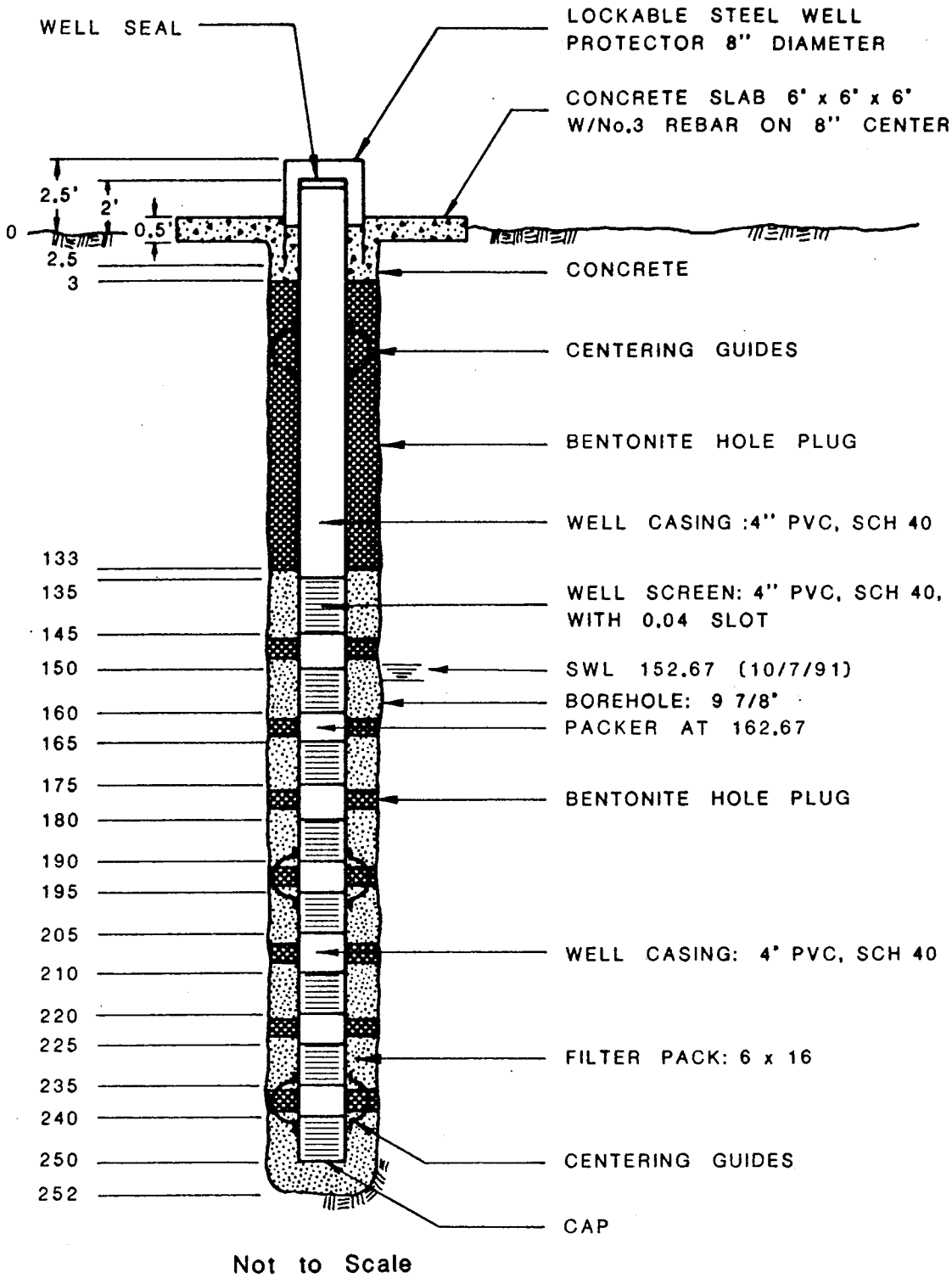

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BIG BEAR REGIONAL WASTEWATER LUCERNE VALLEY, CALIFORNIA	TYPICAL MONITORING WELL CONSTRUCTION DETAILS MW-3	PROJ. NO. 58-9660.01 LAW ENVIRONMENTAL, INC.

DIETERICH POST REORDER NO. 140693

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Big Bear Area Regional Wastewater Agency

Irrigation Management Plan

for the

Lucerne Valley Facility

Prepared for:

Colorado River Region Water Quality Control Board

as Required by Board Order R7-2016-0026

Prepared Under the Responsible Charge of:

Laine E. Carlson, P.E.

California R.C.E. No. 72424, Expires 6/30/2022

4/8/2021

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1 INTRODUCTION AND PURPOSE

Big Bear Area Regional Wastewater Agency (BBARWA) collects and treats the wastewater for its Member Agencies (the City of Big Bear Lake, Big Bear City Community Services District, and San Bernardino County on behalf of Service Area 53B) in the Big Bear Valley in the San Bernardino Mountains of California. BBARWA owns and operates a 4.9 million gallon per day (MGD) capacity wastewater treatment plant (WWTP) located just south of Baldwin Lake on the east side of the Valley. The WWTP currently treats approximately 2.2 MGD of municipal wastewater.

The WWTP discharge is currently regulated by two regulatory boards and discharge permits:

- Santa Ana Region of the California Regional Water Quality Control Board (RWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR), issued on June 24, 2005. The Santa Ana WDR regulates two discharge points in the Big Bear Valley.
- Colorado River Basin RWQCB under WDR Order No. R7-2016-0026 (Colorado River Basin WDR), issued on June 30, 2016. The Colorado River Basin WDR regulates one discharge point in the Lucerne Valley.

The Colorado River Basin WDR and the Lucerne Valley discharge point are the subject of this report.

BBARWA's treated undisinfected secondary effluent is discharged to a 480-acre site in Lucerne Valley (Lucerne Valley Facility) for crop irrigation. Use of treated effluent for crop irrigation at the Lucerne Valley Facility began in 1980 and 100% of the WWTP effluent is currently discharged to this location. The Lucerne Valley Facility also includes two overflow ponds that are used to dispose of excess treated effluent by percolation and evaporation.

As required by Special Provision No. 2 of the recently adopted Colorado River Basin WDR, BBARWA must prepare and submit an Irrigation Management Plan for the Lucerne Valley Facility that includes a water balance and nutrient balance to assure that recycled water is applied at appropriate rates.

This Irrigation Management Plan (Plan) provides background information on the Lucerne Valley Facility, BBARWA's wastewater effluent characteristics, and historic water and nutrient balances. For the purposes of this Plan, the nutrient balance is limited to nitrogen. This plan was originally prepared in 2016 and was updated in 2021 to cover the period from January 2005 to December 2020.

2 LUCERNE VALLEY FACILITY CHARACTERISTICS

2.1 SITE OVERVIEW

The Lucerne Valley Facility is a 480-acre site owned by BBARWA and located near the intersection of Camp Rock Road and Highway 247 (Old Woman Springs Road) in Lucerne Valley, CA, as shown in Figure 1. This site is located approximately 17 miles north of BBARWA's WWTP.

The Lucerne Valley Facility is surrounded by a barbed wire fence to restrict public access to the farm. Warning signs are clearly posted to inform the public that non-disinfected recycled water is used at this site, as shown in Figure 2.

2.1.1 Onsite Wells

There are three monitoring wells located onsite. Monitoring Well 1 is located along the south eastern side of the farm and Monitoring Wells 2 and 3 are located along the north western side of the farm, as shown in Figure 3.

Well 14, shown in Figure 3, is used onsite exclusively for non-potable uses. Bottled water serves as the exclusive potable water source onsite, so there is no potential for cross connection of the recycled water system with a potable water piping system.

All wastewater generated onsite is disposed of using a septic system.

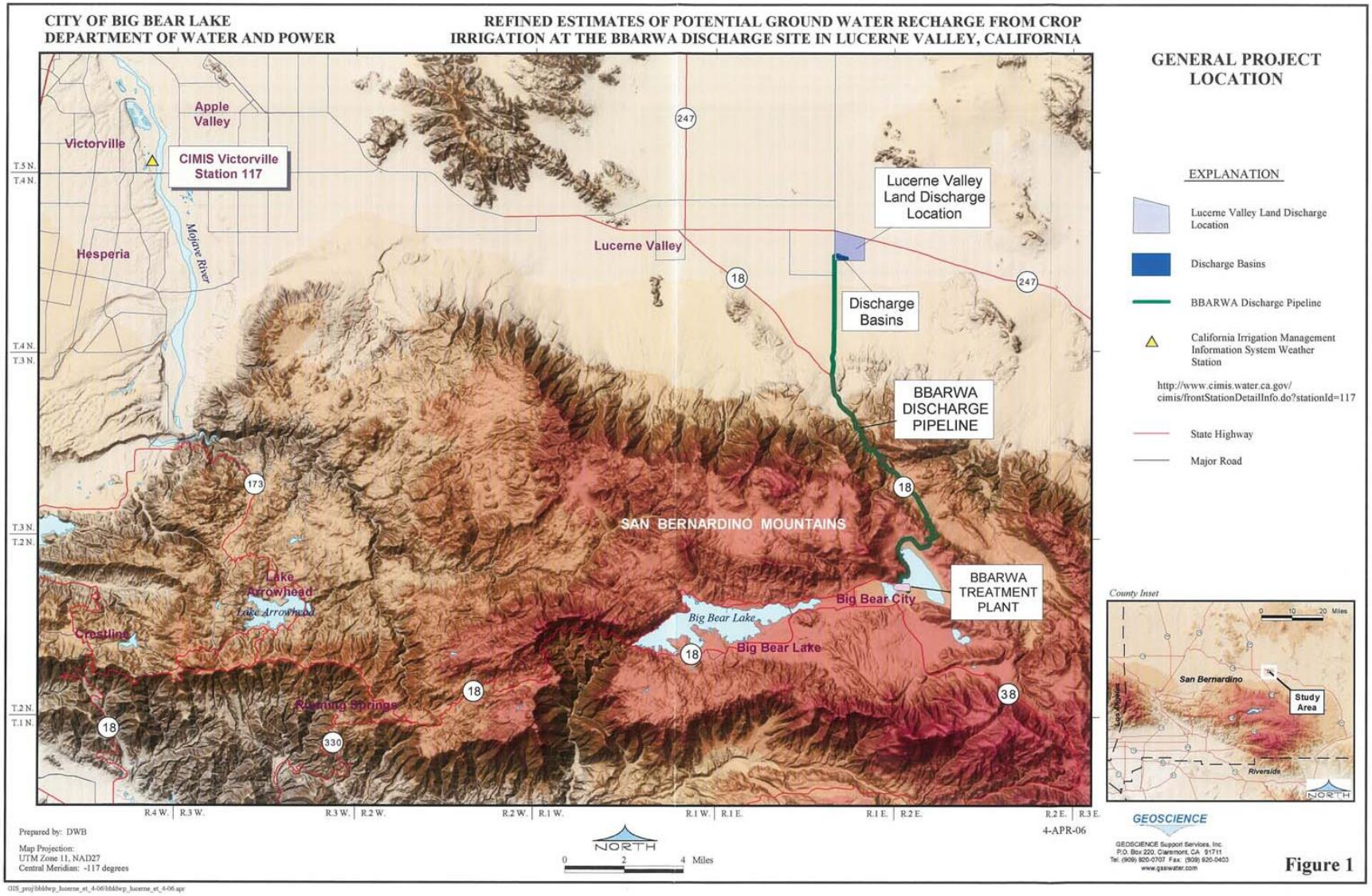


Figure 1: Location of Lucerne Valley Irrigation Site (1)

Figure 2: Warning Signs at Lucerne Valley Facility

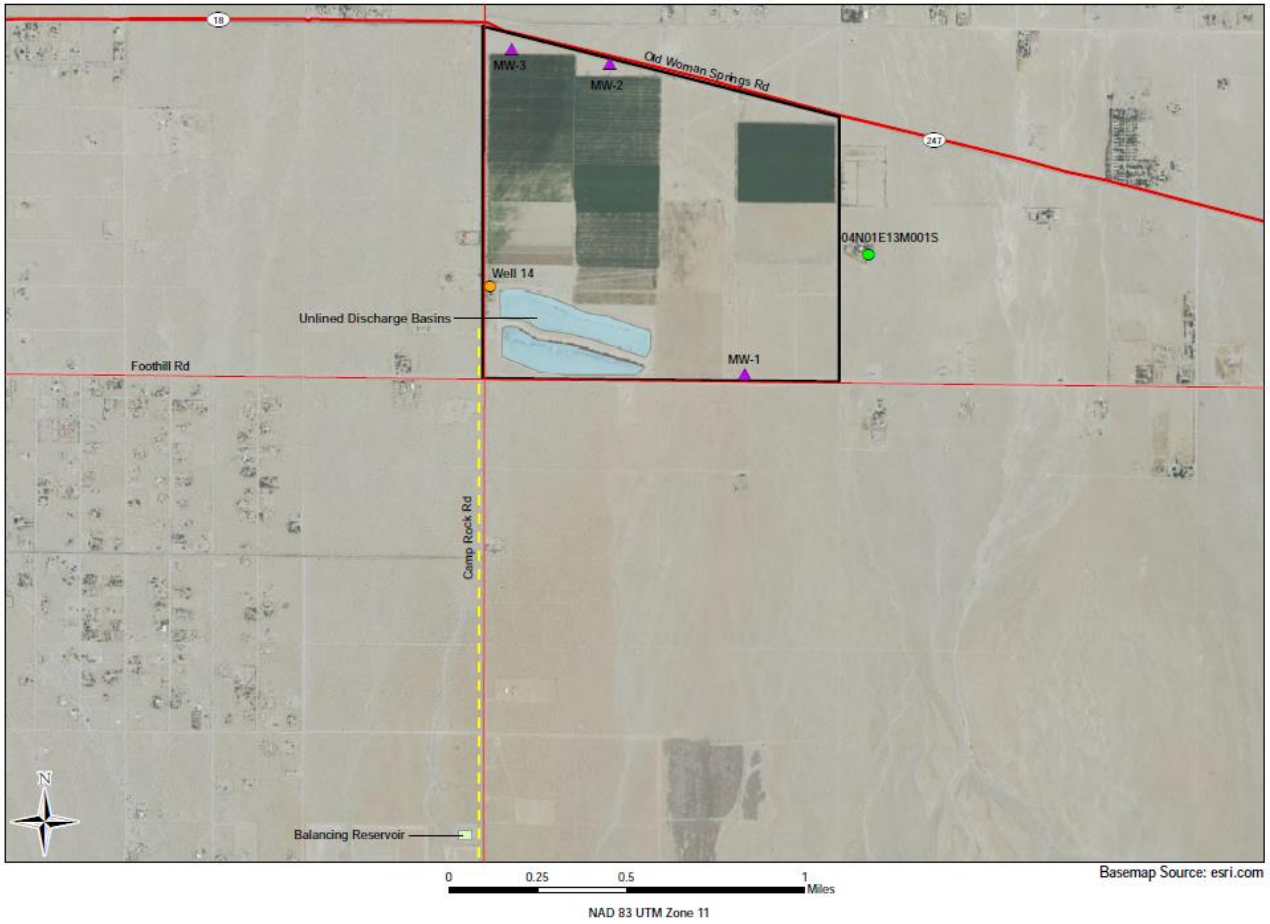


Figure 3: Site Layout and Well Locations (2)

2.2 FARMING OPERATION

The information presented in this section was obtained during a site visit and interview with the farmer and BBARWA staff conducted on September 6, 2016.

The Lucerne Valley Facility has been in operation as a farm since 1980 and is operated by a farmer who leases the land from BBARWA. Alfalfa and a grain mixture consisting of barley, oat and wheat are grown onsite and sold as feed for animals not producing milk for human consumption. Historically, up to 330 acres of the site has been farmed; however, the farmed area was reduced in 2012 to only 190 acres due to reduced water availability associated with drought conditions. The current farmed area remains at 190 acres with no plans to increase the acreage.

2.3 RECYCLED WATER DISTRIBUTION

The recycled water from the BBARWA WWTP flows to a concrete balancing reservoir along Camp Rock Road, shown in Figure 3, then by gravity to the Lucerne Valley Facility. At the Lucerne Valley Facility, the water can be directed to three locations: the West Fields, the East Fields, or the unlined discharge basin (Earth Basin). Two water meters located in the distribution system record flows to both the West and East Fields. Flow to the Earth Basin can be calculated by subtracting the sum of the metered flows to the West and East Fields from the total effluent flow leaving the BBARWA WWTP. The WWTP and field meters are calibrated annually by BBARWA.

During the summer months, all of the water is typically applied to the fields and little to none goes to the Earth Basin. In winter months, and on some other occasions, some or all of the water is routed to the Earth Basins for disposal. This is typically the result of one of the following:

- The recycled water flow is in excess of the crop needs. This occurs primarily in the winter when wastewater flows may be higher than average and crop water demands are lower.
- The concrete balancing reservoir is being drained for inspection or maintenance.
- An herbicide was applied at the BBARWA WWTP near the effluent storage ponds. Flow is diverted from the crops for a day or two to ensure that they are not impacted by the herbicide.

The amount of water applied to the fields and the Earth Basin each month is presented in the Water Balance in Section 4.

2.4 FARMING PRACTICES

Crop rotation is practiced on the farm at the Lucerne Valley Facility. Alfalfa is the primary crop grown on a 5-year cycle. Every five years, the alfalfa is replaced by a grain mixture of barley, oat and wheat to ensure healthy, nutrient-rich soil. This grain mixture is typically planted in late November, typically on a 50-acre portion of the farm at a time. The remaining fields continue to grow alfalfa. When planting crops, the farmer first disks the ground to prepare the soil, irrigates the prepared soil, then disks the ground again before planting the seed for the new crop.

2.4.1 Irrigation Practices

Irrigation is applied via a sprinkler system onsite as determined by the farmer; no automatic irrigation controller is used during the process. Irrigation is performed in sets that vary by the crop being irrigated. Each set covers a section that is approximately 100 ft by ¼ mile, or about 3 acres. The irrigation guidelines the farmer follows are detailed in Table 1. These durations are used throughout the entire year.

Table 1: Typical Irrigation Schedule

Description	Area Irrigated	Duration
Alfalfa	3 Acres	12 Hour Set
Reseeded Area	3 Acres	4 Hour Set
Grain Mixture	3 Acres	6 Hour Set

Precautionary measures are taken to ensure that the irrigation water is maintained onsite. The site is graded to prevent ponding and irrigation runoff from leaving the site. Any irrigation water that turns into runoff flows north to a ditch that is designed to contain the water on the property. Irrigation overspray leaving the property is prevented whenever possible. When the wind is blowing, the sprinkler heads located adjacent to the road are plugged in an effort to prevent the wind from carrying the irrigation water offsite.

2.4.2 Fertilizer Additions

When needed, fertilizer is typically applied with a loading of 100 pounds nitrogen/acre in the form of urea. Fertilizer is usually applied when switching from grain to alfalfa, but is not needed between rounds of alfalfa. Typically, fertilizer is applied on a three-year cycle that corresponds with the crop rotation schedule. However, the last fertilizer application occurred in April 2014, in which 70 acres of crops were fertilized. Available historical fertilizer information can be found in the nitrogen balance, attached as Appendix B.

The farmer's judgement is executed when deciding whether or not to apply the fertilizer. Soil samples were collected in 1999 to determine whether the alfalfa crops were getting the required nutrients, however no such samples have been taken since this 1999 study and the results of this study are unavailable. The farmer bases his decision on the look and feel of the crops. When the crops look yellow, additional fertilizer is added.

2.5 SOIL CHARACTERISTICS

Geophysical and lithologic logs from drilling the monitoring wells at the Lucerne Valley Facility indicate that the soil is composed of reddish brown sand, gravel and silt for the first 140 feet. Layers of unconsolidated sands, gravels, silts and clays extend to a depth of 255 feet below the Lucerne Valley Facility. An excerpt of the geologic profile is provided as Appendix A.

2.6 CLIMATIC CONDITIONS

The climatic conditions for the Lucerne Valley Region were determined using California Irrigation Management Information Systems (CIMIS) data for the Victorville Station (Station 117) and are summarized in Table 2. According to the Mojave Water Agency's 2015 Urban Water Management Plan, Victorville is representative of the regional climate for the surrounding region. However, the Lucerne Valley can be drier, windier and have greater temperature variability than is seen within the city of Victorville (3).

Table 2: Climate Data for the Lucerne Valley Region

Station	Total ET_o (in)	Total Precipitation (in)	Avg Max. Air Temp. (F)	Avg Min. Air Temp (F)	Avg Air Temp. (F)	Avg Wind Speed (mph)
1997	68.4	6.4	74.7	45.9	61.4	6.3
1998	62.0	11.4	71.2	44.2	58.3	7.0
1999	67.8	3.2	74.6	43.7	60.0	6.7
2000	68.4	3.4	75.1	45.3	61.2	6.6
2001	67.3	6.9	74.9	46.5	61.5	6.2
2002	69.6	2.4	75.5	44.8	61.0	5.8
2003	66.6	12.4	75.2	46.3	61.5	6.1
2004	66.2	13.6	74.1	45.4	60.6	5.4
2005	64.6	13.2	73.7	46.4	60.6	5.9
2006	68.1	4.1	74.6	45.2	60.8	6.1
2007	71.2	3.3	75.5	45.9	61.5	6.2
2008	68.7	3.7	75.1	46.0	61.3	6.1
2009	66.1	3.0	74.8	45.7	58.9	6.0
2010	66.2	18.9	73.2	45.4	59.9	6.1
2011	67.1	12.2	73.3	44.4	59.3	6.0
2012	70.2	5.0	76.4	46.9	62.1	6.0
2013	68.9	1.1	75.4	46.2	61.1	5.6
2014	67.7	1.5	77.4	48.1	63.3	5.0
2015	67.7	2.4	76.3	47.9	62.3	5.5
2016	70.3	3.8	76.9	47.6	62.6	5.8
2017	70.0	2.2	77.5	47.1	62.8	5.5
2018	70.6	4.2	77.0	48.5	63.1	5.8
2019	67.9	7.6	74.0	46.9	60.7	6.0
2020	69.7	4.0	77.8	47.6	62.9	5.4
Avg	**68.0**	**7.6**	**75.2**	**46.1**	**61.2**	**6.0**

Source: CIMIS Station 117 (http://www.cimis.water.ca.gov/Default.aspx)

3 BBARWA EFFLUENT CHARACTERISTICS

3.1 EFFLUENT FLOW

BBARWA treats the wastewater of all of its Member Agencies. Following preliminary and secondary treatment, 100% of the effluent flow, including the winter peaks, is delivered to the Lucerne Valley Facility via the pipeline shown in Figure 1. The historic effluent flows beginning in the year 2005 are shown in Figure 4. Note that flows to the Lucerne Valley Facility dropped considerably after 2012 due to drought conditions and have remained lower except for larger rainstorms in 2017 and 2019. Flows increased in 2020 due to a sustained influx of visitors during the COVID-19 pandemic, but are expected to return to previous levels.

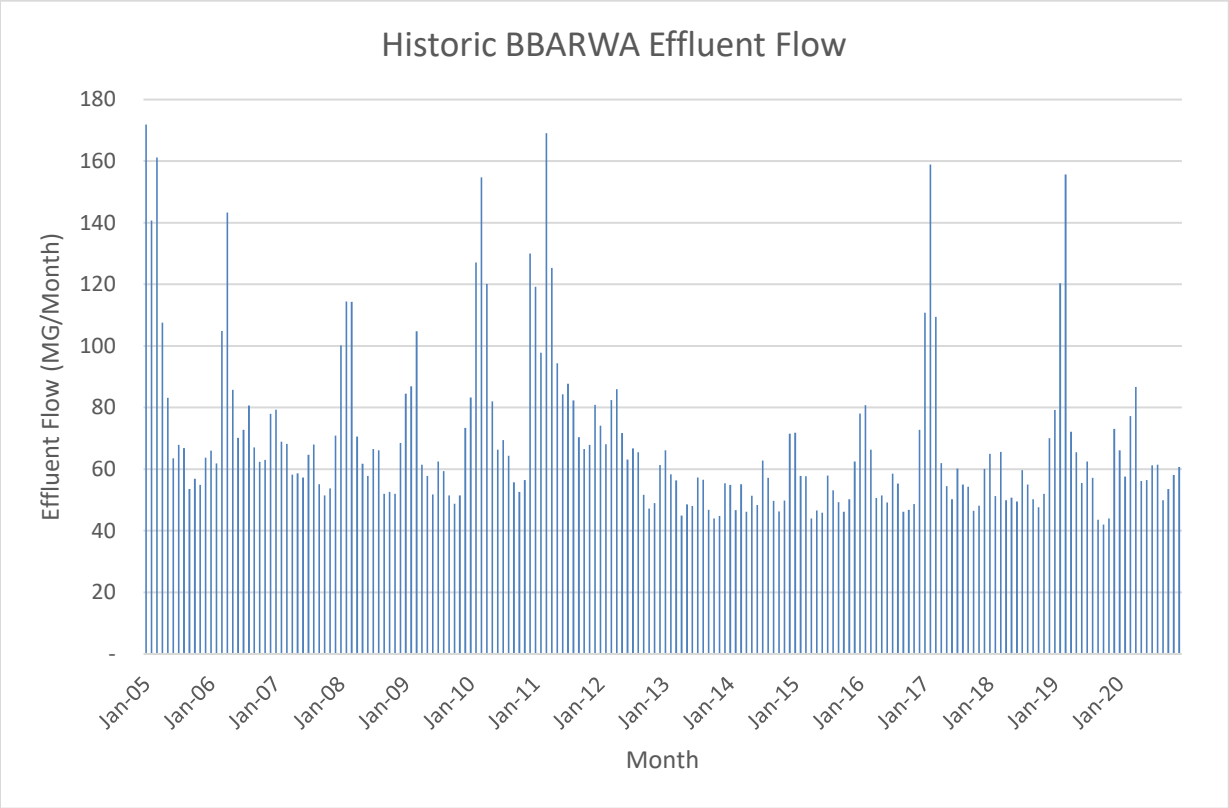


Figure 4: Historic Effluent Flow

3.2 EFFLUENT WATER QUALITY

BBARWA's effluent water quality delivered to the Lucerne Valley Facility is regulated by the Colorado River Region WDR. The quality of the water sent to the Lucerne Valley Facility is generally good and has not historically posed a threat to any of the crops. The farmer reports that the current irrigation practices have not resulted in salt buildup within the soil.

Constituents of concern specified in Colorado River Region WDR include nitrogen and TDS. Historic concentrations for each of these constituents are presented in Figure 5. Concentrations vary widely but have been in compliance historically. There are no planned process changes at the BBARWA WWTP that would impact future nitrogen and TDS concentrations. Despite lower flows in recent years due to drought conditions, the WWTP has successfully achieved nitrogen and TDS effluent compliance.

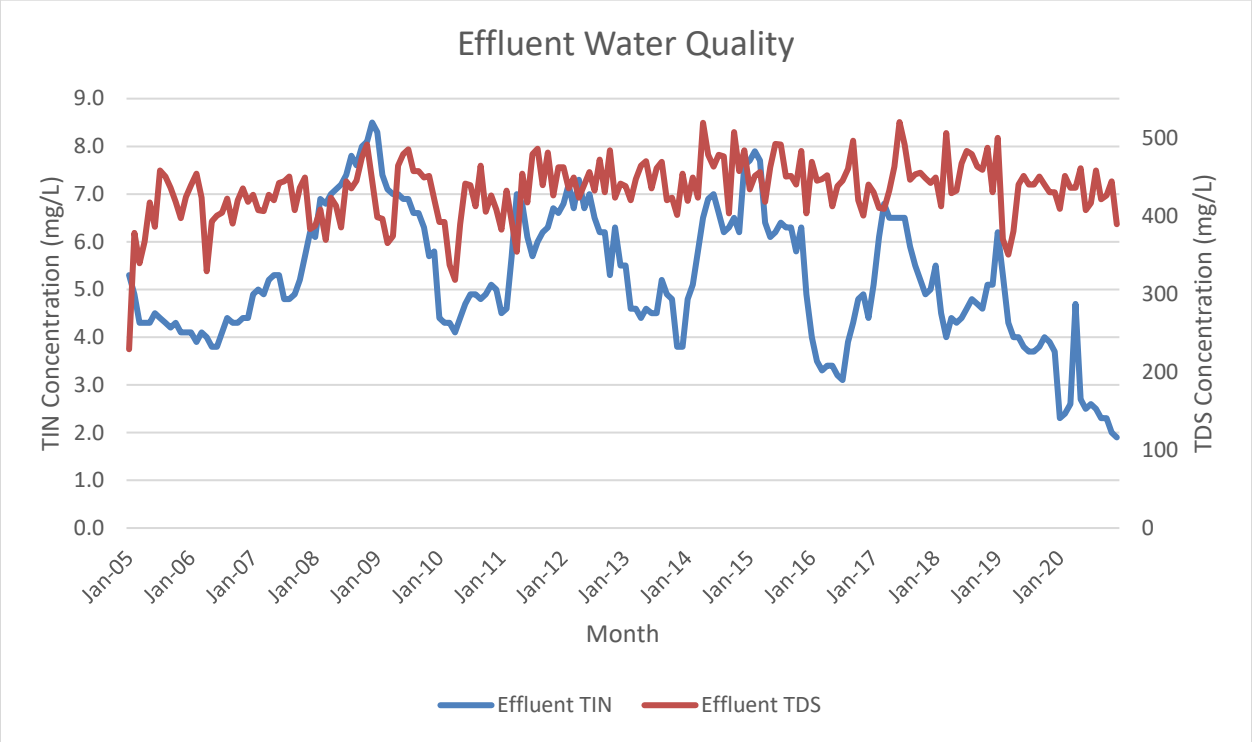


Figure 5: BBARWA Effluent Quality

3.3 SUMMARY OF DISCHARGE PERMIT COMPLIANCE

The effluent limitations specified in the Colorado River Region WDR for the earth basins are outlined in Table 3. During the study period for this report, which spans years 2005-2020, BBARWA's treated effluent discharged to the Lucerne Valley Facility has historically been in compliance with the Colorado River Basin WDR in effect at that time.

Note that an effluent limit for TDS is not included in the current Colorado River Basin WDR. Special Provision No. 1 of the WDR requires BBARWA to conduct a study of the groundwater in the vicinity of the Lucerne Valley Facility and propose an appropriate effluent limit for TDS. That study was completed on December 22, 2017 by Thomas Harder & Co. Groundwater Consulting.

Table 3: WDR Effluent Limitations

Constituent	Units	30-Day Arithmetic Mean	7-Day Arithmetic Mean	Daily Maximum
20°C BOD_5	mg/L	30	45	-
Total Suspended Solids	mg/L	30	45	-
Chloride	mg/L	60	-	80
Sulfate	mg/L	60	-	80
Boron	mg/L	-	-	0.75
Total Nitrogen	mg/L	10	-	-
Average Daily Dry Weather Flow	MGD	4.8	-	-
pH	Unitless	6.0 ≤ pH ≤ 9.0		

As part of Finding 11 of the Colorado River Region WDR, BBARWA must comply with Title 22 CCR Section 60304(d)(4) for irrigating with undisinfected secondary recycled water. BBARWA received approval for their Title 22 Engineering Report on November 3, 1980. Finding 12 of the WDR specifies the conditions under which sheep can graze at the irrigation site. While sheep have grazed on site in the past, there are no longer sheep grazing on site. During the last site visit by Colorado River Basin RWQCB Staff on June 13, 2016, the fence around the Lucerne Valley Facility was found to be damaged due to a tear resulting from an auto accident. This tear has since been repaired as directed by RWQCB staff.

4 WATER AND NITROGEN BALANCE

4.1 CROP IRRIGATION REQUIREMENTS

Crop irrigation requirements were estimated using evapotranspiration (ET_o) data gathered from the California Irrigation Management Information System (CIMIS) Station 117 in Victorville, CA, which is based on grass as the reference crop. Crop specific demand was estimated using Equation 1, where K_c is a seasonal crop coefficient specific to each crop. This K_c value was determined using the FAO Grass-Based Crop Coefficients method outlined in *ASCE Manual No. 70: Evaporation, Evapotranspiration, and Irrigation Water Requirements* (4). Under this methodology, there are four distinct growing periods in each growing cycle: the initial, crop development, midseason, and late season periods. There are three distinct crop coefficients (initial, middle, and end) that are used in tandem with these growing periods to develop a crop coefficient curve. To obtain reference crop coefficients applicable to the climate at the Lucerne Valley Facility, values from the ASCE Manual must be adjusted using the relative humidity and wind speed for the irrigation area. Using the corrected values and the crop coefficient curves (attached as Appendix C), a monthly crop coefficient value can be estimated for each crop. The calculated values for each crop for each month are tabulated in the Water and Nitrogen Balance in Appendix B.

$$ET_c = K_c * ET_o$$

Equation 1: Crop Specific Evapotranspiration Rate

4.1.1 Alfalfa

Alfalfa crop coefficients were determined using *ASCE Manual No. 70*. Based on the data provided in the manual, Alfalfa has two types of growing cycles – the initial cutting cycle and all other cycles. The initial cutting cycle typically lasts 60 days and all other subsequent cycles last 30 days according to *ASCE Manual No. 70* (4). However, the farmer typically performs five to six harvests a year. For the purposes of this report, six alfalfa harvests per year were used with cutting cycles of 60 days each to align with this timeline. The irrigation demand for the crop varies by growing stage due to differing K_c values and varying rainfall but ranges from 1.3 to 8.7 inches of water/acre of alfalfa. This is discussed further in Section 4.1.3.

4.1.2 Grain Blend – Barley, Wheat, Oat

The grain blend crop coefficient was also determined using *ASCE Manual No. 70*. Crop coefficients for barley, wheat and oat were all estimated using the initial period, crop development period, midseason period, and late season period and the initial, middle, and end reference crop coefficients. These coefficients were then averaged over the three crops and corrected for relative humidity and wind speed to provide an estimate for the grain blend crop coefficient. The farmer performs one grain harvest per year and harvests the crop after 90 days, so 90 days was used for the cutting cycle duration. The irrigation demand for the grain blend varies by stage due to the seasonal nature of K_c and varying rainfall, but ranges from 0 to 12.0 inches of water/acre of grain. This is discussed further in Section 4.1.3.

4.1.3 Historic Irrigation at Lucerne Valley Facility

A water balance was developed for the years 2005 to 2020 to determine whether irrigation water is being applied at appropriate rates. BBARWA maintains flow meters that log the amount of irrigation water being applied to the West and East Fields, however the meters have not been functional for many years. New meters for these fields were installed, calibrated, and connected to BBARWA's SCADA system in April 2021 and should provide more accurate data for effluent flow distribution to the fields and earth basin. When meter data for the fields was unavailable, BBARWA maintained daily log books to note whether the effluent was directed to the Earth Basin or to the fields each day (flow is not split between the basin or fields on a daily basis). The WWTP effluent meter flow data was then used to total monthly flows to the Earth Basin and the fields. Flow to each field was allocated in accordance with each field's area relative to the total field area (West Field plus East Field).

Evapotranspiration data from CIMIS Station 117 was used with the estimated crop coefficients (discussed in Section 4.1) to determine total crop water demand and rainfall supplied. Irrigation water and rainfall were summed to obtain the total water applied to the crops. Any water applied above crop demand, whether wastewater effluent or rain water, is regarded as excess irrigation. The excess irrigation for the Lucerne Valley Facility is plotted in Figure 6 and tabulated in Appendix B.

Based on the ET_c water demand methodology discussed in Section 4.1, the historical irrigation analysis indicates that the farmer often over-waters the crops at the Lucerne Valley Facility, particularly during the winter months, in which rainfall is more prevalent. For the purposes of this water balance, it was assumed that 315 acres was farmed through the year 2011. At this point, drought conditions had reduced available recycled water supply resulting in the farmer reducing the farmed acreage to 190 acres in the year 2012. The farmed acreage has remained at 190 acres since the year 2012.

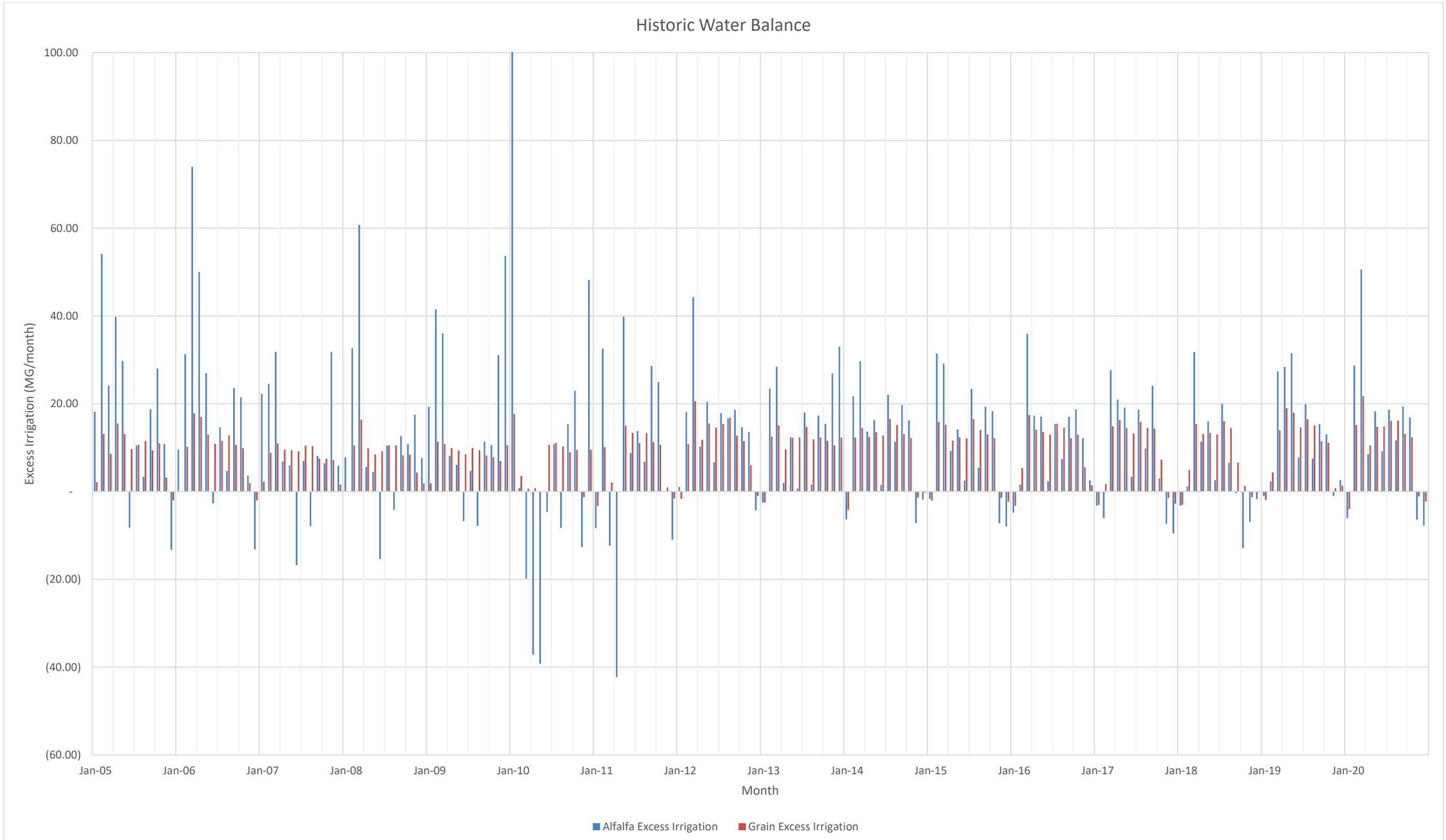


Figure 6. Historic Irrigation at the Lucerne Valley Facility

4.2 CROP NUTRIENT REQUIREMENTS – NITROGEN

4.2.1 Alfalfa

Alfalfa can supply 70-90% of its nitrogen requirements through a symbiotic relationship with nitrogen-fixing Rhizobium bacteria that grow on its roots. These bacteria are able to fix N_2 gas found in air into a form that the alfalfa is able to use. However, alfalfa will preferentially use nitrogen in the soil over nitrogen that can be fixed from the air. If the alfalfa consumes all of the nitrogen content from within the soil, it will resume the nitrogen fixation process to meet its nitrogen needs. (5)

As alfalfa can supply most of the nitrogen it needs, nitrogen requirements for alfalfa crops are not typically specified and fertilizer is not typically needed. However, alfalfa does have the capacity to remove nitrogen from the soil and irrigation water. For this Plan, the nitrogen removal capacity of alfalfa was estimated using the International Plant Nutrition Institute's (IPNI) calculator, which estimates nitrogen removal based on estimated crop yield in tons per acre. The farmer estimates the average yield for alfalfa at the Lucerne Valley Facility is 1 ton per acre. This value was used with the IPNI calculator to determine a nitrogen removal capacity of 51 lb/acre per crop cycle. According to the farmer, there are 6 complete cutting cycles throughout the year for alfalfa. For the purposes of this report, average monthly nitrogen removal capacity was estimated by multiplying the removal per cycle by the number of cycles and then dividing by 12 months. This results in an average alfalfa nitrogen removal capacity of 25.5 lb/acre per month. However, complete nitrogen removal capacity may not always be achieved. According to a UC Davis study, alfalfa will still fix 10-25% of its nitrogen from the air, even when the applied nitrogen concentrations are high (5). To minimize nitrogen leaching, it is recommended that nitrogen be applied at a rate that does not exceed 75-85% of the nitrogen removed in the harvest. This Plan uses an estimated nitrogen removal capacity for alfalfa of 75% of the 25.5 lb/acre per month, or 19.13 lb/acre per month.

For the purposes of this Plan, the average annual nitrogen uptake is used to calculate a constant monthly nitrogen removal capacity. Actual nitrogen uptake by the crops varies by growth stage.

The historic nitrogen loadings applied to the alfalfa crop at the Lucerne Valley Facility is presented in Section 4.2.3.

4.2.2 Grain blend – barley, wheat, oat

Barley, wheat and oat all have differing nitrogen removal capacities. In order to estimate the grain blend's nitrogen removal capacity, the grain blend was assumed to be equal parts barley, wheat and oat, and their individual nitrogen removals were averaged. Based on information from the farmer, each grain harvest yields 2.5 tons per acre, which equates to 84.2 bushels per acre. Nitrogen removal for each crop was estimated using IPNI's calculator for an 84.2 bushels per acre yield crop cycle.

- Barley has an expected nitrogen removal capacity of 83.3 lb N/acre per crop cycle.
- Winter wheat has an expected nitrogen removal capacity of 97.6 lb/acre per crop cycle.
- Oat yield has an expected nitrogen removal capacity of 64.8 lb/acre per crop cycle.

These nitrogen removal capacities were averaged, resulting in an estimated nitrogen removal capacity of 81.9 lb/acre per cycle. With one crop cycle occurring over 90 days, this demand was divided by 3 months to produce an estimated average nitrogen removal capacity of 27.3 lb/acre per month.

For the purposes of this Plan, the average annual nitrogen uptake is used to calculate a constant monthly nitrogen removal capacity. Actual nitrogen uptake by the crops varies by growth stage.

4.2.3 Nitrogen Application and Removal Capacity

A nitrogen balance was constructed for the years 2005 to 2020 for the Lucerne Valley Facility, which focuses on the nitrogen uptake of the alfalfa and grain mixture. The nitrogen content of the BBARWA effluent in the form of Total Inorganic Nitrogen (TIN) was used to estimate the quantity of nitrogen applied to the crops each month. This value was combined with the nitrogen content of any fertilizer applied to the crops and compared with the average crop nitrogen removal capacity presented in Section 4.2 to determine if the crop is receiving more nitrogen than it can remove. The total nitrogen application is compared with the nitrogen removal capacity and is plotted in Figure 7, which shows that the nitrogen removal capacity of the crops at the Lucerne Valley Facility generally exceeds the nitrogen applied to the crops. There are a few instances where higher than average effluent flows (2017) or fertilizer application (2014) result in the nitrogen applied exceeding the nitrogen capacity of the crops. However, in most of these instances, the removal capacity is only slightly less than the applied nitrogen. The crop's nitrogen removal capacity has been significantly greater than the nitrogen applied in recent years, indicating the farmer has made appropriate adjustments to his irrigation practices. BBARWA will continue to monitor the quantity of effluent applied relative to the crop removal capacity and coordinate with the farmer if adjustments need to be made to maintain balance.

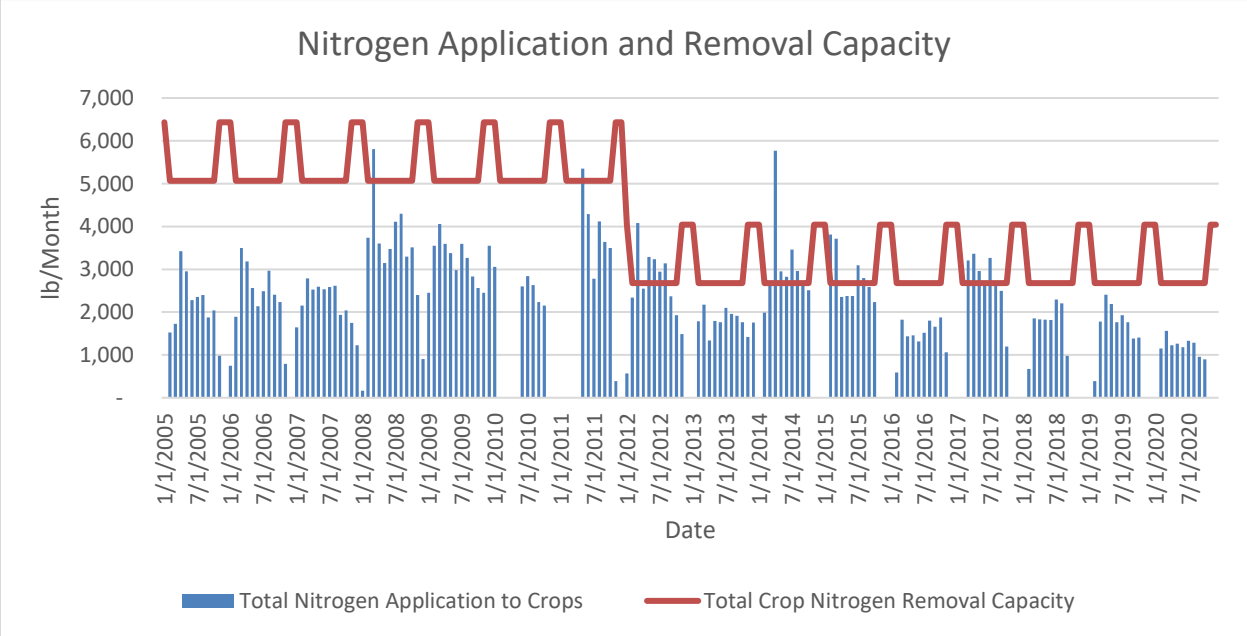


Figure 7: Nitrogen Application and Removal Capacity

5 CONCLUSIONS & RECOMMENDATIONS

The water and nutrient balance analyses indicate that the farmer is managing nutrient application at the Lucerne Valley Facility appropriately and that irrigation water in excess of the minimum crop requirement is often applied.

Based on the water balance conducted for alfalfa and grain (as shown in Figure 6), crops at the Lucerne Valley Facility often receive irrigation water in excess of the minimum crop requirements, particularly in the winter months where rainfall influences this value. In most of these instances, the rainfall provides more water than the crops need, so over-watering occurs even without application of effluent. It can be conservatively assumed that any applied irrigation water not required by the crop will percolate into the underlying groundwater. This incidental percolation is considered in the groundwater quality evaluation conducted by Thomas Harder & Co., as discussed in Section 3.3. In more recent years, the drought has limited irrigation water availability for the Lucerne Valley Facility and has forced the farmer to reduce the irrigated acreage at the site. This has also resulted in reduced occurrences of over-watering.

The nutrient balance for the alfalfa and grain mixture (as shown in Figure 7 and Appendix B) indicates that the crops planted at the Lucerne Valley Facility generally have the capacity to remove more nitrogen than is applied through the effluent and fertilizer, although actual removal rates will vary depending on crop growth cycles. BBARWA will continue to monitor the quantity of effluent applied relative to the crop removal capacity and coordinate with the farmer if adjustments need to be made to maintain a nutrient balance.

This report is intended to meet the requirement to perform an annual water and nutrient balance through 2020.

6 REFERENCES

1. **Williams, Dennis E.** *Refined Estimates of Potential Groundwater Recharge from Crop Irrigation at the BBARWA Discharge Site in Lucerne Valley, California.* s.l. : Geoscience Technical Memorandum, April 4, 2006. p. 10.

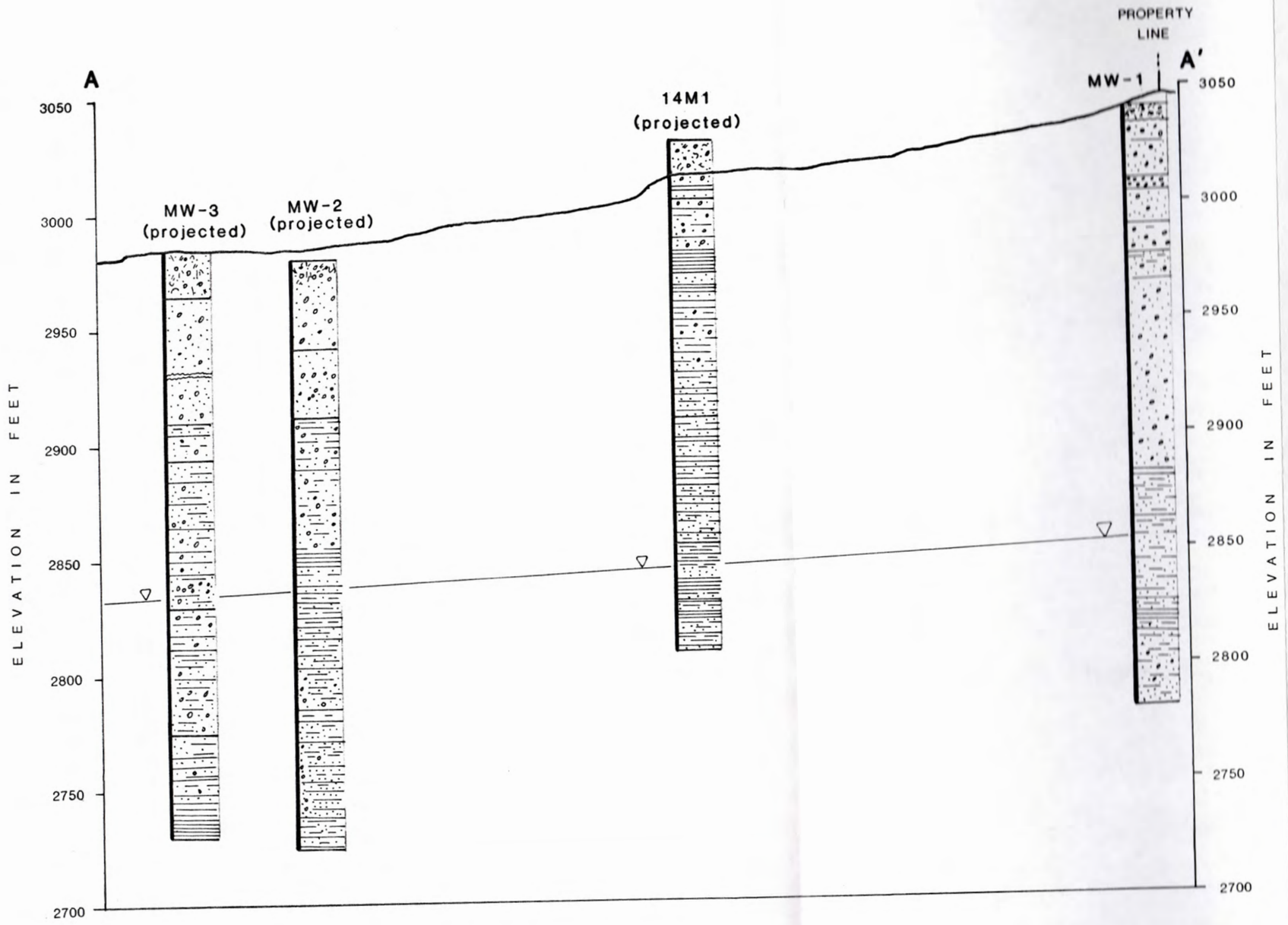
2. **Harder, Thomas.** *Work Plan for a Groundwater Quality Study at the Lucerne Valley Land Discharge Location.* s.l. : Thomas Harder & Co. Work Plan, September 27, 2016. p. 15.

3. **Kennedy/Jenks Consultants.** *2015 Urban Water Management Plan for Mojave Water Agency.* June 9, 2016. pp. 1-14 - 1-16.

4. **Jensen, Marvin E and Allen, Richard G.** *Evaporation, Evapotranspiration, and Irrigation Water Requirements Second Edition.* s.l. : ASCE Manuals and Reports on Engineering Practice No. 70, 2016. pp. 273-282; 471-497.

5. **Matthews, Marshall Campbell and Crohn, David.** *Assessing Nitrogen Uptake of Corn, Winter Forages and Alfalfa.* December 2, 2010. p. 6.

APPENDIX A. SOIL BORING LOGS



LEGEND

- CLAY WITH SAND
- SILT WITH SAND
- SAND AND GRAVEL
- TOP SOIL

MW-1 — MONITORING WELL LOCATION AND NUMBER

▽ WATER LEVEL

0 50 vertical

0 1000 horizontal

Scale in feet

BIG BEAR AREA REGIONAL WASTEWATER MANAGEMENT AGENCY LUCERNE VALLEY	GEOLOGIC SECTION A – A'	PROJ. NO. 58-966001

FIGURE 3

LAW ENVIRONMENTAL, INC.

PROJECT No. 58-966001 DATE 1/17/92 PROJ. MGR. K.S. DFTR. M.G.

APPENDIX B: WATER & NITROGEN BALANCE (2005-2020)

Lucerne Valley Facility - Water and Nitrogen Balance

Date	Month	Monthly Total Effluent Flow (MG)[1]	Earth Basin Estimates from BBARWA (MG)	West Field Flow (MG)[2]	East Field Flow (MG)[3]	Total Flow To Fields (MG)	Calculated Flow to Earth Basin (MG)[4]	Total Planted Acreage	Grain Acreage	Alfalfa Acreage	ETo (in)[5]	Rainfall (in)[6]	Alfalfa K_c[7]	Grain K_c[7]	ET_c Alfalfa (in)[8]	ET_c Grain (in)[8]	Effluent Depth on Total Acreage (in)[9]	Total Water Depth on Acreage (in)[10]	Alfalfa Surplus or Deficit (MG)[11]	Grain Surplus or Deficit (MG)[12]	Combined Surplus or Deficit (MG)[13]	Effluent TIN (mg/L)[14]	Urea Applied from Fertilizer to Fields (lbs)	TIN Loading to Fields (lbs)[15]	TIN Loading to Ponds (lbs)[16]	Alfalfa Nitrogen Removal Capacity (lbs/acre)[17]	Grain Nitrogen Removal Capacity (lbs/acre)[18]	Alfalfa Nitrogen Removal Capacity (lbs)[19]	Grain Nitrogen Removal Capacity (lbs)[20]	Total Nitrogen Removal Capacity (lbs)[21]	Notes
1/1/2005	1	171.92	171.92	-	-	-	171.92	315	50	265	1.72	3.65	0.65	1.21	1.12	2.08	-	3.65	18.19	2.13	20.32	5.3	-	-	7,604	19.1	27.3	5,068	1,365	6,433	
2/1/2005	2	140.72	99.53	22.26	15.12	37.38	103.34	315	50	265	2.16	5.31	1.00	0.00	2.15	-	4.37	9.68	54.18	13.14	67.32	4.9	-	1,528	4,226	19.1	-	5,068	-	5,068	
3/1/2005	3	161.23	113.54	29.46	18.69	48.15	113.07	315	50	265	4.52	0.69	0.66	0.00	2.96	-	5.63	6.32	24.15	8.58	32.73	4.3	-	1,728	4,058	19.1	-	5,068	-	5,068	
4/1/2005	4	107.53	-	54.53	40.95	95.47	12.06	315	50	265	6.32	0.26	0.93	0.00	5.89	-	11.16	11.42	39.82	15.51	55.33	4.3	-	3,426	433	19.1	-	5,068	-	5,068	
5/1/2005	5	83.11	-	54.24	27.94	82.18	0.93	315	50	265	7.89	0.07	0.70	0.00	5.54	-	9.61	9.68	29.76	13.14	42.90	4.3	-	2,949	33	19.1	-	5,068	-	5,068	
6/1/2005	6	63.51	-	35.20	25.52	60.72	2.79	315	50	265	8.74	0.02	0.95	0.00	8.26	-	7.10	7.12	(8.22)	9.67	1.45	4.5	-	2,280	105	19.1	-	5,068	-	5,068	
7/1/2005	7	67.91	-	34.36	29.70	64.06	3.85	315	50	265	9.27	0.37	0.69	0.00	6.40	-	7.49	7.86	10.51	10.67	21.18	4.4	-	2,352	141	19.1	-	5,068	-	5,068	
8/1/2005	8	66.84	-	-	-	66.84	0.00	315	50	265	8.37	0.69	0.96	0.00	8.04	-	7.81	8.50	3.37	11.55	14.92	4.3	-	2,398	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2005	9	53.54	-	-	-	53.54	0.00	315	50	265	6.44	0.65	0.67	0.00	4.30	-	6.26	6.91	18.78	9.38	28.16	4.2	-	1,877	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2005	10	56.91	-	-	-	56.91	0.00	315	50	265	4.30	1.42	0.97	0.00	4.18	-	6.65	8.07	28.05	10.96	39.01	4.3	-	2,042	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2005	11	54.92	26.20	-	-	28.73	26.20	315	50	265	2.88	0.04	0.66	0.37	1.89	1.06	3.36	3.40	10.84	3.18	14.02	4.1	-	983	896	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields.
12/1/2005	12	63.73	63.73	-	-	-	63.73	315	50	265	1.95	0.07	0.98	0.80	1.91	1.56	-	0.07	(13.26)	(2.03)	(15.29)	4.1	-	-	2,181	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate all effluent was sent to the ponds.
1/1/2006	1	66.03	20.05	14.42	7.43	21.85	44.18	315	50	265	2.49	0.39	0.65	1.21	1.62	3.01	2.55	2.94	9.50	(0.09)	9.41	4.1	-	748	1,512	19.1	27.3	5,068	1,365	6,433	
2/1/2006	2	61.83	8.02	39.92	18.16	58.08	3.75	315	50	265	3.18	0.72	1.00	0.00	3.17	-	6.79	7.51	31.27	10.20	41.46	3.9	-	1,890	122	19.1	-	5,068	-	5,068	
3/1/2006	3	104.91	6.67	62.10	40.05	102.16	2.76	315	50	265	4.32	1.17	0.66	0.00	2.83	-	11.94	13.11	73.98	17.80	91.78	4.1	-	3,495	94	19.1	-	5,068	-	5,068	
4/1/2006	4	143.28	64.20	59.14	36.33	95.47	47.81	315	50	265	5.99	1.37	0.93	0.00	5.58	-	11.16	12.53	50.02	17.01	67.03	4.0	-	3,187	1,596	19.1	-	5,068	-	5,068	Higher than typical value for effluent to Earth Basin; possible data error.
5/1/2006	5	85.73	4.79	50.67	30.19	80.87	4.86	315	50	265	8.25	0.09	0.70	0.00	5.80	-	9.46	9.55	26.98	12.96	39.94	3.8	-	2,564	154	19.1	-	5,068	-	5,068	
6/1/2006	6	70.14	2.68	-	-	67.46	2.68	315	50	265	8.88	0.13	0.95	0.00	8.39	-	7.89	8.02	(2.71)	10.88	8.17	3.8	-	2,139	85	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields.
7/1/2006	7	72.78	-	-	-	72.78	0.00	315	50	265	9.38	-	0.69	0.00	6.48	-	8.51	8.51	14.64	11.55	26.19	4.1	-	2,490	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2006	8	80.70	-	-	23.18	80.70	0.00	315	50	265	9.15	-	0.96	0.00	8.78	-	9.44	9.44	4.69	12.81	17.50	4.4	-	2,963	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2006	9	67.11	-	-	26.82	67.11	0.00	315	50	265	6.84	-	0.67	0.00	4.57	-	7.85	7.85	23.60	10.65	34.25	4.3	-	2,408	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2006	10	62.36	-	-	15.27	62.36	0.00	315	50	265	4.43	-	0.97	0.00	4.30	-	7.29	7.29	21.51	9.90	31.41	4.3	-	2,238	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2006	11	62.98	41.35	-	8.77	21.63	41.35	315	50	265	3.08	-	0.66	0.37	2.02	1.13	2.53	2.53	3.64	1.90	5.54	4.4	-	794	1,518	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate some effluent was sent to the ponds. Assumed that the remainder went to the fields.
12/1/2006	12	78.01	78.01	-	-	-	78.01	315	50	265	2.10	0.23	0.98	0.80	2.06	1.69	-	0.23	(13.17)	(1.98)	(15.14)	4.4	-	-	2,865	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.

Lucerne Valley Facility - Water and Nitrogen Balance

Date	Month	Monthly Total Effluent Flow (MG)[1]	Earth Basin Estimates from BBARWA (MG)	West Field Flow (MG)[2]	East Field Flow (MG)[3]	Total Flow To Fields (MG)	Calculated Flow to Earth Basin (MG)[4]	Total Planted Acreage	Grain Acreage	Alfalfa Acreage	ETo (in)[5]	Rainfall (in)[6]	Alfalfa K_c[7]	Grain K_c[7]	ET_c Alfalfa (in)[8]	ET_c Grain (in)[8]	Effluent Depth on Total Acreage (in)[9]	Total Water Depth on Acreage (in)[10]	Alfalfa Surplus or Deficit (MG)[11]	Grain Surplus or Deficit (MG)[12]	Combined Surplus or Deficit (MG)[13]	Effluent TIN (mg/L)[14]	Urea Applied from Fertilizer to Fields (lbs)	TIN Loading to Fields (lbs)[15]	TIN Loading to Ponds (lbs)[16]	Alfalfa Nitrogen Removal Capacity (lbs/acre)[17]	Grain Nitrogen Removal Capacity (lbs/acre)[18]	Alfalfa Nitrogen Removal Capacity (lbs)[19]	Grain Nitrogen Removal Capacity (lbs)[20]	Total Nitrogen Removal Capacity (lbs)[21]	Notes
1/1/2007	1	79.35	39.09	-	10.14	40.26	39.09	315	50	265	2.60	0.08	0.65	1.21	1.70	3.15	4.71	4.79	22.24	2.23	24.47	4.9	-	1,646	1,599	19.1	27.3	5,068	1,365	6,433	West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields.
2/1/2007	2	68.90	17.40	-	19.76	51.50	17.40	315	50	265	3.13	0.50	1.00	0.00	3.12	-	6.02	6.52	24.51	8.85	33.36	5.0	-	2,149	726	19.1	-	5,068	-	5,068	West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields.
3/1/2007	3	68.20	-	-	22.18	68.20	0.00	315	50	265	5.59	0.11	0.66	0.00	3.67	-	7.97	8.08	31.79	10.97	42.76	4.9	-	2,789	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
4/1/2007	4	58.21	-	-	19.36	58.21	0.00	315	50	265	6.50	0.20	0.93	0.00	6.06	-	6.81	7.01	6.83	9.51	16.34	5.2	-	2,526	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
5/1/2007	5	58.59	-	-	15.67	58.59	0.00	315	50	265	8.67	0.07	0.70	0.00	6.09	-	6.85	6.92	5.97	9.40	15.37	5.3	-	2,592	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
6/1/2007	6	57.28	-	-	14.67	57.28	0.00	315	50	265	9.60	0.05	0.95	0.00	9.07	-	6.70	6.75	(16.75)	9.16	(7.59)	5.3	-	2,533	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2007	7	64.64	-	-	20.52	64.64	0.00	315	50	265	9.73	0.13	0.69	0.00	6.72	-	7.56	7.69	6.99	10.44	17.42	4.8	-	2,589	-	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2007	8	67.95	2.60	-	27.16	65.35	2.60	315	50	265	9.10	-	0.96	0.00	8.74	-	7.64	7.64	(7.88)	10.37	2.49	4.8	-	2,618	104	19.1	-	5,068	-	5,068	West field meter was offline. Estimated effluent to earth basin is based on BBARWA records. Assumed the remainder was sent to the fields.
9/1/2007	9	55.08	-	28.76	18.63	47.38	7.69	315	50	265	6.61	-	0.67	0.00	4.41	-	5.54	5.54	8.11	7.52	15.63	4.9	-	1,938	315	19.1	-	5,068	-	5,068	
10/1/2007	10	51.47	-	36.67	10.36	47.03	4.44	315	50	265	4.74	-	0.97	0.00	4.60	-	5.50	5.50	6.45	7.47	13.91	5.2	-	2,041	193	19.1	-	5,068	-	5,068	
11/1/2007	11	53.75	9.46	25.48	11.28	36.77	16.98	315	50	265	2.89	2.02	0.66	0.37	1.90	1.06	4.30	6.32	31.80	7.14	38.94	5.7	-	1,749	808	19.1	27.3	5,068	1,365	6,433	
12/1/2007	12	70.90	32.86	15.71	7.99	23.70	47.20	315	50	265	2.08	0.09	0.98	0.80	2.04	1.67	2.77	2.86	5.90	1.62	7.52	6.2	-	1,226	2,442	19.1	27.3	5,068	1,365	6,433	
1/1/2008	1	100.22	100.22	3.19	0.04	3.23	96.99	315	50	265	2.13	2.09	0.65	1.21	1.39	2.58	0.38	2.47	7.76	(0.15)	7.61	6.1	-	164	4,937	19.1	27.3	5,068	1,365	6,433	
2/1/2008	2	114.47	69.41	43.57	21.31	64.88	49.59	315	50	265	3.20	0.14	1.00	0.00	3.19	-	7.59	7.73	32.67	10.49	43.15	6.9	-	3,736	2,856	19.1	-	5,068	-	5,068	
3/1/2008	3	114.30	9.75	59.70	42.60	102.30	12.00	315	50	265	5.53	0.11	0.66	0.00	3.63	-	11.96	12.07	60.76	16.39	77.15	6.8	-	5,805	681	19.1	-	5,068	-	5,068	
4/1/2008	4	70.54	-	34.31	27.32	61.64	8.91	315	50	265	6.95	0.05	0.93	0.00	6.48	-	7.21	7.26	5.62	9.85	15.47	7.0	-	3,601	520	19.1	-	5,068	-	5,068	
5/1/2008	5	61.77	1.88	37.99	15.16	53.14	8.63	315	50	265	7.99	0.02	0.70	0.00	5.61	-	6.21	6.23	4.47	8.46	12.93	7.1	-	3,149	511	19.1	-	5,068	-	5,068	
6/1/2008	6	57.80	-	73.33	32.68	57.80	0.00	315	50	265	9.41	-	0.95	0.00	8.90	-	6.76	6.76	(15.38)	9.17	(6.20)	7.2	-	3,473	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2008	7	66.51	-	31.24	14.59	66.51	0.00	315	50	265	9.16	-	0.69	0.00	6.32	-	7.78	7.78	10.45	10.56	21.01	7.4	-	4,107	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2008	8	66.07	-	34.28	-	66.07	0.00	315	50	265	8.65	-	0.96	0.00	8.30	-	7.73	7.73	(4.17)	10.49	6.32	7.8	-	4,301	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2008	9	51.94	-	29.56	2.01	51.94	0.00	315	50	265	6.46	-	0.67	0.00	4.31	-	6.07	6.07	12.66	8.24	20.91	7.6	-	3,294	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2008	10	52.64	-	45.47	-	52.64	0.00	315	50	265	4.79	-	0.97	0.00	4.65	-	6.15	6.15	10.81	8.35	19.16	8.0	-	3,514	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2008	11	52.00	10.28	32.71	2.78	35.49	16.51	315	50	265	2.61	-	0.66	0.37	1.72	0.96	4.15	4.15	17.52	4.34	21.85	8.1	-	2,399	1,116	19.1	27.3	5,068	1,365	6,433	
12/1/2008	12	68.55	45.17	4.35	8.39	12.74	55.81	315	50	265	1.79	1.32	0.98	0.80	1.76	1.44	1.49	2.81	7.58	1.86	9.44	8.5	-	904	3,959	19.1	27.3	5,068	1,365	6,433	

Lucerne Valley Facility - Water and Nitrogen Balance

Date	Month	Monthly Total Effluent Flow (MG)[1]	Earth Basin Estimates from BBARWA (MG)	West Field Flow (MG)[2]	East Field Flow (MG)[3]	Total Flow To Fields (MG)	Calculated Flow to Earth Basin (MG)[4]	Total Planted Acreage	Grain Acreage	Alfalfa Acreage	ETo (in)[5]	Rainfall (in)[6]	Alfalfa K_c[7]	Grain K_c[7]	ET_c Alfalfa (in)[8]	ET_c Grain (in)[8]	Effluent Depth on Total Acreage (in)[9]	Total Water Depth on Acreage (in)[10]	Alfalfa Surplus or Deficit (MG)[11]	Grain Surplus or Deficit (MG)[12]	Combined Surplus or Deficit (MG)[13]	Effluent TIN (mg/L)[14]	Urea Applied from Fertilizer to Fields (lbs)	TIN Loading to Fields (lbs)[15]	TIN Loading to Ponds (lbs)[16]	Alfalfa Nitrogen Removal Capacity (lbs/acre)[17]	Grain Nitrogen Removal Capacity (lbs/acre)[18]	Alfalfa Nitrogen Removal Capacity (lbs)[19]	Grain Nitrogen Removal Capacity (lbs)[20]	Total Nitrogen Removal Capacity (lbs)[21]	Notes
1/1/2009	1	84.49	24.09	29.27	6.16	35.43	49.07	315	50	265	2.35	0.07	0.65	1.21	1.53	2.84	4.14	4.21	19.28	1.86	21.14	8.3	-	2,454	3,399	19.1	27.3	5,068	1,365	6,433	
2/1/2009	2	86.91	-	25.56	31.91	57.47	29.44	315	50	265	2.62	1.66	1.00	0.00	2.61	-	6.72	8.38	41.53	11.38	52.90	7.4	-	3,549	1,818	19.1	-	5,068	-	5,068	
3/1/2009	3	104.72	17.35	49.01	19.44	68.45	36.27	315	50	265	4.56	-	0.66	0.00	2.99	-	8.00	8.00	36.07	10.87	46.94	7.1	-	4,056	2,149	19.1	-	5,068	-	5,068	
4/1/2009	4	61.48	-	29.81	7.55	61.48	0.00	315	50	265	6.61	0.10	0.93	0.00	6.16	-	7.19	7.29	8.13	9.89	18.02	7.0	-	3,591	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
5/1/2009	5	57.86	-	-	-	57.86	0.00	315	50	265	8.58	0.11	0.70	0.00	6.03	-	6.77	6.88	6.10	9.33	15.43	7.0	-	3,380	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
6/1/2009	6	51.81	-	-	-	51.81	0.00	315	50	265	7.60	0.19	0.95	0.00	7.18	-	6.06	6.25	(6.74)	8.48	1.74	6.9	-	2,983	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2009	7	62.46	-	-	-	62.46	0.00	315	50	265	9.65	0.01	0.69	0.00	6.66	-	7.30	7.31	4.68	9.93	14.61	6.9	-	3,597	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2009	8	59.35	-	-	-	59.35	0.00	315	50	265	8.38	0.02	0.96	0.00	8.05	-	6.94	6.96	(7.81)	9.45	1.63	6.6	-	3,269	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2009	9	51.44	-	-	-	51.44	0.00	315	50	265	6.70	0.04	0.67	0.00	4.47	-	6.01	6.05	11.38	8.22	19.60	6.6	-	2,833	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2009	10	48.82	-	-	-	48.82	0.00	315	50	265	4.38	0.02	0.97	0.00	4.25	-	5.71	5.73	10.61	7.78	18.39	6.3	-	2,567	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2009	11	51.49	-	-	-	51.49	0.00	315	50	265	2.82	0.15	0.66	0.37	1.85	1.03	6.02	6.17	31.06	6.97	38.03	5.7	-	2,449	-	19.1	27.3	5,068	1,365	6,433	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
12/1/2009	12	73.41	-	-	-	73.41	0.00	315	50	265	1.82	0.66	0.98	0.80	1.79	1.46	8.58	9.24	53.66	10.57	64.23	5.8	-	3,553	-	19.1	27.3	5,068	1,365	6,433	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
1/1/2010	1	83.27	-	-	-	83.27	0.00	315	50	265	1.87	5.56	0.65	1.21	1.22	2.26	9.74	15.30	101.28	17.69	118.98	4.4	-	3,058	-	19.1	27.3	5,068	1,365	6,433	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
2/1/2010	2	127.13	127.13	-	-	-	127.13	315	50	265	2.50	2.60	1.00	0.00	2.49	-	-	2.60	0.80	3.53	4.33	4.3	-	-	4,562	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
3/1/2010	3	154.70	154.70	-	-	-	154.70	315	50	265	4.96	0.50	0.66	0.00	3.25	-	-	0.50	(19.81)	0.68	(19.13)	4.3	-	-	5,552	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
4/1/2010	4	120.12	120.12	-	-	-	120.12	315	50	265	6.18	0.59	0.93	0.00	5.76	-	-	0.59	(37.18)	0.80	(36.38)	4.1	-	-	4,110	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
5/1/2010	5	81.96	81.96	-	-	-	81.96	315	50	265	7.79	0.02	0.70	0.00	5.47	-	-	0.02	(39.23)	0.03	(39.20)	4.4	-	-	3,010	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
6/1/2010	6	66.34	-	-	-	66.34	0.00	315	50	265	8.94	0.05	0.95	0.00	8.45	-	7.76	7.81	(4.63)	10.60	5.96	4.7	-	2,602	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2010	7	69.43	-	-	-	69.43	0.00	315	50	265	9.64	0.05	0.69	0.00	6.66	-	8.12	8.17	10.89	11.09	21.98	4.9	-	2,839	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2010	8	64.32	-	-	-	64.32	0.00	315	50	265	9.06	0.03	0.96	0.00	8.70	-	7.52	7.55	(8.26)	10.25	1.99	4.9	-	2,630	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2010	9	55.72	-	-	-	55.72	0.00	315	50	265	6.65	0.06	0.67	0.00	4.44	-	6.51	6.57	15.36	8.93	24.29	4.8	-	2,232	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2010	10	52.65	-	-	-	52.65	0.00	315	50	265	3.94	0.86	0.97	0.00	3.83	-	6.16	7.02	22.95	9.52	32.47	4.9	-	2,153	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2010	11	56.46	56.46	-	-	-	56.46	315	50	265	2.84	0.11	0.66	0.37	1.87	1.04	-	0.11	(12.64)	(1.26)	(13.90)	5.1	-	-	2,403	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
12/1/2010	12	129.97	129.97	-	-	-	129.97	315	50	265	1.83	8.49	0.98	0.80	1.80	1.47	-	8.49	48.17	9.53	57.70	5.0	-	-	5,423	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.

Lucerne Valley Facility - Water and Nitrogen Balance

Date	Month	Monthly Total Effluent Flow (MG)[1]	Earth Basin Estimates from BBARWA (MG)	West Field Flow (MG)[2]	East Field Flow (MG)[3]	Total Flow To Fields (MG)	Calculated Flow to Earth Basin (MG)[4]	Total Planted Acreage	Grain Acreage	Alfalfa Acreage	ETo (in)[5]	Rainfall (in)[6]	Alfalfa K_c[7]	Grain K_c[7]	ET_c Alfalfa (in)[8]	ET_c Grain (in)[8]	Effluent Depth on Total Acreage (in)[9]	Total Water Depth on Acreage (in)[10]	Alfalfa Surplus or Deficit (MG)[11]	Grain Surplus or Deficit (MG)[12]	Combined Surplus or Deficit (MG)[13]	Effluent TIN (mg/L)[14]	Urea Applied from Fertilizer to Fields (lbs)	TIN Loading to Fields (lbs)[15]	TIN Loading to Ponds (lbs)[16]	Alfalfa Nitrogen Removal Capacity (lbs/acre)[17]	Grain Nitrogen Removal Capacity (lbs/acre)[18]	Alfalfa Nitrogen Removal Capacity (lbs)[19]	Grain Nitrogen Removal Capacity (lbs)[20]	Total Nitrogen Removal Capacity (lbs)[21]	Notes
1/1/2011	1	119.18	119.18	-	-	-	119.18	315	50	265	2.25	0.31	0.65	1.21	1.47	2.72	-	0.31	(8.33)	(3.28)	(11.60)	4.5	-	-	4,476	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
2/1/2011	2	97.78	97.78	-	-	-	97.78	315	50	265	2.94	7.45	1.00	0.00	2.93	-	-	7.45	32.55	10.11	42.66	4.6	-	-	3,753	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
3/1/2011	3	169.12	169.12	-	-	-	169.12	315	50	265	4.91	1.51	0.66	0.00	3.22	-	-	1.51	(12.30)	2.05	(10.25)	5.7	-	-	8,045	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
4/1/2011	4	125.36		-	-	-	125.36	315	50	265	6.35	0.04	0.93	0.00	5.92	-	-	0.04	(42.28)	0.05	(42.23)	7.0	-	-	7,323	19.1	-	5,068	-	5,068	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
5/1/2011	5	94.34	0	52.63	45.42	94.34	0.00	315	50	265	7.85	0.02	0.70	0.00	5.51	-	11.03	11.05	39.83	15.00	54.83	6.8	-	5,354	-	19.1	-	5,068	-	5,068	Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds.
6/1/2011	6	84.26	0	50.52	43.13	84.26	0.00	315	50	265	9.14	0.01	0.95	0.00	8.64	-	9.85	9.86	8.79	13.39	22.18	6.1	-	4,289	-	19.1	-	5,068	-	5,068	Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds.
7/1/2011	7	87.70	0	53.08	5.37	58.46	29.24	315	50	265	9.01	1.30	0.69	0.00	6.22	-	6.83	8.13	13.78	11.04	24.82	5.7	-	2,781	1,391	19.1	-	5,068	-	5,068	Higher than typical value for effluent to Earth Basin; possible data error.
8/1/2011	8	82.30	0	55.86	-	82.30	0.00	315	50	265	9.23	0.18	0.96	0.00	8.86	-	9.62	9.80	6.77	13.31	20.08	6.0	-	4,121	-	19.1	-	5,068	-	5,068	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2011	9	70.39	0	45.37	39.49	70.39	0.00	315	50	265	6.46	0.06	0.67	0.00	4.31	-	8.23	8.29	28.61	11.25	39.87	6.2	-	3,642	-	19.1	-	5,068	-	5,068	Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds.
10/1/2011	10	66.56	0	27.91	40.79	66.56	0.00	315	50	265	4.52	0.07	0.97	0.00	4.39	-	7.78	7.85	24.91	10.66	35.57	6.3	-	3,499	-	19.1	-	5,068	-	5,068	Sum of meter readings indicates negative flow to ponds; assumed zero flow to ponds.
11/1/2011	11	67.90	59.771	3.03	3.92	6.95	60.95	315	50	265	2.43	0.78	0.66	0.37	1.60	0.89	0.81	1.59	(0.03)	0.95	0.92	6.7	-	389	3,408	19.1	27.3	5,068	1,365	6,433	
12/1/2011	12	80.87	80.865	-	-	-	80.87	315	50	265	1.99	0.43	0.98	0.80	1.95	1.60	-	0.43	(10.95)	(1.58)	(12.54)	6.6	-	-	4,454	19.1	27.3	5,068	1,365	6,433	Field Meters were offline but BBARWA records indicate that all effluent went to the ponds.
1/1/2012	1	74.09	64.085	1.76	8.27	10.02	64.07	190	50	140	2.67	0.07	0.65	1.21	1.74	3.23	1.94	2.01	1.03	(1.65)	(0.62)	6.8	-	569	3,636	19.1	27.3	2,678	1,365	4,043	
2/1/2012	2	68.09	22.562	24.14	14.74	38.88	29.20	190	50	140	3.19	0.40	1.00	0.00	3.18	-	7.54	7.94	18.10	10.78	28.88	7.2	-	2,336	1,755	19.1	-	2,678	-	2,678	
3/1/2012	3	82.45	0	40.63	32.34	72.97	9.48	190	50	140	5.36	1.02	0.66	0.00	3.52	-	14.15	15.17	44.28	20.59	64.87	6.7	-	4,080	530	19.1	-	2,678	-	2,678	
4/1/2012	4	85.95	0	18.59	23.20	41.79	44.16	190	50	140	6.44	0.59	0.93	0.00	6.00	-	8.10	8.69	10.23	11.80	22.03	7.3	-	2,546	2,690	19.1	-	2,678	-	2,678	Higher than typical value for effluent to Earth Basin; possible data error.
5/1/2012	5	71.74	0	36.63	22.22	58.85	12.89	190	50	140	8.58	-	0.70	0.00	6.03	-	11.41	11.41	20.45	15.49	35.94	6.7	-	3,290	721	19.1	-	2,678	-	2,678	
6/1/2012	6	63.07	0	26.04	29.37	55.41	7.66	190	50	140	9.51	-	0.95	0.00	8.99	-	10.74	10.74	6.66	14.58	21.24	7.0	-	3,237	447	19.1	-	2,678	-	2,678	
7/1/2012	7	66.72	2.253	25.31	28.98	54.30	12.42	190	50	140	9.62	0.82	0.69	0.00	6.64	-	10.53	11.35	17.88	15.40	33.28	6.5	-	2,945	674	19.1	-	2,678	-	2,678	
8/1/2012	8	65.54	0	29.70	30.91	60.61	4.93	190	50	140	8.35	0.65	0.96	0.00	8.02	-	11.75	12.40	16.66	16.83	33.49	6.2	-	3,136	255	19.1	-	2,678	-	2,678	
9/1/2012	9	51.73	0	29.13	16.71	45.84	5.89	190	50	140	6.70	0.49	0.67	0.00	4.47	-	8.89	9.38	18.63	12.73	31.36	6.2	-	2,372	305	19.1	-	2,678	-	2,678	
10/1/2012	10	47.22	1.79	27.31	16.30	43.62	3.61	190	50	140	4.74	-	0.97	0.00	4.60	-	8.45	8.45	14.64	11.48	26.12	5.3	-	1,929	160	19.1	-	2,678	-	2,678	
11/1/2012	11	48.95	16.422	6.34	21.89	28.22	20.72	190	50	140	2.94	0.03	0.66	0.37	1.93	1.08	5.47	5.50	13.57	6.01	19.57	6.3	-	1,484	1,089	19.1	27.3	2,678	1,365	4,043	
12/1/2012	12	61.38	61.378	-	-	-	61.38	190	50	140	2.06	0.89	0.98	0.80	2.02	1.65	-	0.89	(4.30)	(1.04)	(5.34)	5.5	-	-	2,817	19.1	27.3	2,678	1,365	4,043	

Lucerne Valley Facility - Water and Nitrogen Balance

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1/1/2013	1	66.12	66.119	-	-	-	66.12	190	50	140	2.12	0.72	0.65	1.21	1.38	2.57	-	0.72	(2.52)	(2.51)	(5.02)	5.5	-	-	3,035	19.1	27.3	2,678	1,365	4,043	
2/1/2013	2	58.34	8.902	30.56	15.96	46.52	11.82	190	50	140	3.06	0.20	1.00	0.00	3.05	-	9.02	9.22	23.46	12.51	35.97	4.6	-	1,786	454	19.1	-	2,678	-	2,678	
3/1/2013	3	56.38	0	26.24	30.46	56.70	-0.32	190	50	140	5.56	0.13	0.66	0.00	3.65	-	10.99	11.12	28.41	15.10	43.51	4.6	-	2,176	(12)	19.1	-	2,678	-	2,678	
4/1/2013	4	44.89	0	11.06	25.34	36.40	8.49	190	50	140	7.02	-	0.93	0.00	6.54	-	7.06	7.06	1.96	9.58	11.54	4.4	-	1,337	312	19.1	-	2,678	-	2,678	
5/1/2013	5	48.56	0	23.34	23.35	46.69	1.88	190	50	140	8.23	-	0.70	0.00	5.78	-	9.05	9.05	12.42	12.29	24.71	4.6	-	1,792	72	19.1	-	2,678	-	2,678	
6/1/2013	6	48.08	0	22.15	24.72	46.87	1.21	190	50	140	9.42	-	0.95	0.00	8.90	-	9.09	9.09	0.69	12.33	13.02	4.5	-	1,760	45	19.1	-	2,678	-	2,678	
7/1/2013	7	57.33	0	22.57	33.43	56.00	1.34	190	50	140	8.87	-	0.69	0.00	6.12	-	10.85	10.85	17.98	14.74	32.72	4.5	-	2,103	50	19.1	-	2,678	-	2,678	
8/1/2013	8	56.53	0	19.09	26.10	45.19	11.34	190	50	140	8.68	-	0.96	0.00	8.33	-	8.76	8.76	1.62	11.89	13.51	5.2	-	1,961	492	19.1	-	2,678	-	2,678	
9/1/2013	9	46.76	0	-	-	46.76	0.00	190	50	140	6.75	-	0.67	0.00	4.51	-	9.06	9.06	17.33	12.31	29.63	4.9	-	1,912	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2013	10	44.00	0	-	-	44.00	0.00	190	50	140	4.60	-	0.97	0.00	4.47	-	8.53	8.53	15.44	11.58	27.02	4.8	-	1,763	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2013	11	44.78	0	-	-	44.78	0.00	190	50	140	2.44	-	0.66	0.37	1.60	0.89	8.68	8.68	26.90	10.57	37.47	3.8	-	1,420	-	19.1	27.3	2,678	1,365	4,043	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
12/1/2013	12	55.44	0	-	-	55.44	0.00	190	50	140	2.10	-	0.98	0.80	2.06	1.69	10.75	10.75	33.02	12.30	45.32	3.8	-	1,758	-	19.1	27.3	2,678	1,365	4,043	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
1/1/2014	1	54.93		-	-	-	54.93	190	50	140	2.55	-	0.65	1.21	1.66	3.09	-	-	(6.32)	(4.19)	(10.51)	4.8	-	-	2,200	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.
2/1/2014	2	46.72	0	-	-	46.72	0.00	190	50	140	3.36	-	1.00	0.00	3.34	-	9.06	9.06	21.71	12.29	34.00	5.1	-	1,988	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
3/1/2014	3	55.06	0	-	-	55.06	0.00	190	50	140	4.37	-	0.66	0.00	2.87	-	10.67	10.67	29.67	14.49	44.16	5.8	-	2,665	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
4/1/2014	4	46.21	0	-	-	46.21	0.00	190	50	140	5.98	0.21	0.93	0.00	5.57	-	8.96	9.17	13.67	12.44	26.11	6.5	7,000.0	5,772	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields. Fertilizer application of Nitrogen as Urea based on verbal report from farmer on 9/6/2016.
5/1/2014	5	51.32	0	-	-	51.32	0.00	190	50	140	8.08	0.01	0.70	0.00	5.68	-	9.95	9.96	16.28	13.52	29.80	6.9	-	2,955	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
6/1/2014	6	48.40	0	-	-	48.40	0.00	190	50	140	9.51	-	0.95	0.00	8.99	-	9.38	9.38	1.49	12.74	14.23	7.0	-	2,827	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2014	7	62.78	0	-	-	62.78	0.00	190	50	140	9.26	0.02	0.69	0.00	6.39	-	12.17	12.19	22.03	16.55	38.58	6.6	-	3,458	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2014	8	57.16	0	-	-	57.16	0.00	190	50	140	8.52	0.08	0.96	0.00	8.18	-	11.08	11.16	11.33	15.15	26.48	6.2	-	2,958	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2014	9	49.73	0	-	-	49.73	0.00	190	50	140	6.68	0.01	0.67	0.00	4.46	-	9.64	9.65	19.73	13.10	32.82	6.3	-	2,614	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2014	10	46.29	0	-	-	46.29	0.00	190	50	140	4.86	0.01	0.97	0.00	4.72	-	8.97	8.98	16.20	12.19	28.40	6.5	-	2,511	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2014	11	49.82		-	-	-	49.82	190	50	140	3.02	0.09	0.66	0.37	1.98	1.11	-	0.09	(7.20)	(1.38)	(8.58)	6.2	-	-	2,578	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.
12/1/2014	12	71.49		-	-	-	71.49	190	50	140	1.60	1.09	0.98	0.80	1.57	1.28	-	1.09	(1.82)	(0.26)	(2.09)	7.6	-	-	4,535	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.

Lucerne Valley Facility - Water and Nitrogen Balance

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1/1/2015	1	71.88		-	-	-	71.88	190	50	140	1.94	0.84	0.65	1.21	1.27	2.35	-	0.84	(1.62)	(2.05)	(3.66)	7.7	-	-	4,619	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.
2/1/2015	2	57.81	0	-	-	57.81	0.00	190	50	140	3.40	0.46	1.00	0.00	3.38	-	11.21	11.67	31.48	15.84	47.31	7.9	-	3,811	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
3/1/2015	3	57.75	0	-	-	57.75	0.00	190	50	140	5.39	0.01	0.66	0.00	3.53	-	11.19	11.20	29.15	15.21	44.36	7.7	-	3,711	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
4/1/2015	4	44.04	0	-	-	44.04	0.00	190	50	140	6.55	-	0.93	0.00	6.10	-	8.54	8.54	9.25	11.59	20.84	6.4	-	2,352	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
5/1/2015	5	46.63	0	-	-	46.63	0.00	190	50	140	7.65	0.06	0.70	0.00	5.37	-	9.04	9.10	14.16	12.35	26.51	6.1	-	2,374	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
6/1/2015	6	45.90	0	-	-	45.90	0.00	190	50	140	8.75	0.03	0.95	0.00	8.27	-	8.90	8.93	2.49	12.12	14.61	6.2	-	2,375	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
7/1/2015	7	57.96	0	-	-	57.96	0.00	190	50	140	8.67	0.91	0.69	0.00	5.99	-	11.24	12.15	23.42	16.49	39.91	6.4	-	3,096	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
8/1/2015	8	53.16	0	-	-	53.16	0.00	190	50	140	9.27	0.03	0.96	0.00	8.90	-	10.30	10.33	5.45	14.03	19.48	6.3	-	2,795	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
9/1/2015	9	49.25	0	-	-	49.25	0.00	190	50	140	6.72	0.03	0.67	0.00	4.49	-	9.55	9.58	19.35	13.00	32.35	6.3	-	2,589	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
10/1/2015	10	46.12	0	-	-	46.12	0.00	190	50	140	4.26	0.01	0.97	0.00	4.14	-	8.94	8.95	18.30	12.15	30.45	5.8	-	2,233	-	19.1	-	2,678	-	2,678	BBARWA records indicate no effluent was sent to the ponds. Assumed that all effluent went to the fields.
11/1/2015	11	50.21		-	-	-	50.21	190	50	140	2.90	0.01	0.66	0.37	1.91	1.06	-	0.01	(7.21)	(1.43)	(8.64)	6.3	-	-	2,640	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.
12/1/2015	12	62.45		-	-	-	62.45	190	50	140	2.16	0.02	0.98	0.80	2.12	1.73	-	0.02	(7.98)	(2.33)	(10.31)	4.9	-	-	2,554	19.1	27.3	2,678	1,365	4,043	No records available, assumed all effluent went to ponds.
1/1/2016	1	78.02	78.02	(0.00)	(0.00)	(0.00)	78.02	190	50	140	2.03	0.06	0.65	1.21	1.32	2.46	(0.00)	0.06	(4.80)	(3.25)	(8.06)	4.0	-	(0)	2,604	19.1	27.3	2,678	1,365	4,043	
2/1/2016	2	80.78	60.64	13.78	6.36	20.14	60.64	190	50	140	3.51	0.01	1.00	0.00	3.49	-	3.90	3.91	1.60	5.31	6.91	3.5	-	588	1,771	19.1	-	2,678	-	2,678	
3/1/2016	3	66.28	0.00	45.35	20.93	66.28	0.00	190	50	140	5.16	-	0.66	0.00	3.38	-	12.85	12.85	35.97	17.44	53.42	3.3	-	1,825	-	19.1	-	2,678	-	2,678	
4/1/2016	4	50.68	0.00	34.67	16.00	50.68	0.00	190	50	140	6.26	0.56	0.93	0.00	5.83	-	9.82	10.38	17.30	14.10	31.40	3.4	-	1,438	-	19.1	-	2,678	-	2,678	
5/1/2016	5	51.48	0.00	35.22	16.26	51.48	0.00	190	50	140	7.82	-	0.70	0.00	5.49	-	9.98	9.98	17.05	13.55	30.60	3.4	-	1,461	-	19.1	-	2,678	-	2,678	
6/1/2016	6	49.15	0.00	33.63	15.52	49.15	0.00	190	50	140	9.43	-	0.95	0.00	8.91	-	9.53	9.53	2.33	12.93	15.26	3.2	-	1,313	-	19.1	-	2,678	-	2,678	
7/1/2016	7	58.57	0.00	40.07	18.49	58.57	0.00	190	50	140	10.59	0.01	0.69	0.00	7.31	-	11.35	11.36	15.40	15.43	30.83	3.1	-	1,515	-	19.1	-	2,678	-	2,678	
8/1/2016	8	55.32	0.00	37.85	17.47	55.32	0.00	190	50	140	9.14	-	0.96	0.00	8.77	-	10.72	10.72	7.41	14.56	21.96	3.9	-	1,800	-	19.1	-	2,678	-	2,678	
9/1/2016	9	46.16	0.00	31.59	14.58	46.16	0.00	190	50	140	6.70	-	0.67	0.00	4.47	-	8.95	8.95	17.01	12.15	29.16	4.3	-	1,657	-	19.1	-	2,678	-	2,678	
10/1/2016	10	46.84	0.00	32.05	14.79	46.84	0.00	190	50	140	4.73	0.44	0.97	0.00	4.59	-	9.08	9.52	18.72	12.92	31.65	4.8	-	1,876	-	19.1	-	2,678	-	2,678	
11/1/2016	11	48.63	22.76	17.70	8.17	25.87	22.76	190	50	140	2.91	0.10	0.66	0.37	1.91	1.07	5.01	5.11	12.17	5.50	17.66	4.9	-	1,058	931	19.1	27.3	2,678	1,365	4,043	
12/1/2016	12	72.74	72.74	-	-	-	72.74	190	50	140	2.00	2.63	0.98	0.80	1.96	1.60	-	2.63	2.54	1.39	3.93	4.4	-	-	2,671	19.1	27.3	2,678	1,365	4,043	
1/1/2017	1	110.77	110.77	0.00	0.00	0.00	110.77	190	50	140	2.49	0.78	0.65	1.21	1.62	3.01	0.00	0.78	(3.21)	(3.03)	(6.24)	5.1	-	0	4,714	19.1	27.3	2,678	1,365	4,043	
2/1/2017	2	158.94	158.94	-	-	-	158.94	190	50	140	2.88	1.28	1.00	0.00	2.87	-	-	1.28	(6.03)	1.74	(4.29)	6.1	-	-	8,091	19.1	-	2,678	-	2,678	
3/1/2017	3	109.42	52.91	38.67	17.85	56.52	52.91	190	50	140	5.62	-	0.66	0.00	3.69	-	10.96	10.96	27.64	14.87	42.51	6.8	-	3,207	3,002	19.1	-	2,678	-	2,678	
4/1/2017	4	61.95	0.00	42.39	19.56	61.95	0.00	190	50	140	6.97	-	0.93	0.00	6.49	-	12.01	12.01	20.96	16.30	37.26	6.5	-	3,360	-	19.1	-	2,678	-	2,678	
5/1/2017	5	54.49	0.00	37.28	17.21	54.49	0.00	190	50	140	7.99	0.08	0.70	0.00	5.61	-	10.56	10.64	19.12	14.45	33.57	6.5	-	2,956	-	19.1	-	2,678	-	2,678	
6/1/2017	6	50.25	0.00	34.38	15.87	50.25	0.00	190	50	140	9.36	-	0.95	0.00	8.85	-	9.74	9.74	3.40	13.22	16.62	6.5	-	2,726	-	19.1	-	2,678	-	2,678	
7/1/2017	7	60.22	0.00	41.20	19.02	60.22	0.00	190	50	140	9.80	-	0.69	0.00	6.77	-	11.67	11.67	18.65	15.85	34.50	6.5	-	3,266	-	19.1	-	2,678	-	2,678	
8/1/2017	8	54.97	0.00	37.61	17.36	54.97	0.00	190	50	140	8.47	0.06	0.96	0.00	8.13	-	10.66	10.72	9.82	14.55	24.37	5.9	-	2,706	-	19.1	-	2,678	-	2,678	
9/1/2017	9	54.32	0.00	37.16	17.15	54.32	0.00	190	50	140	6.28	-	0.67	0.00	4.19	-	10.53	10.53	24.08	14.29	38.38	5.5	-	2,493	-	19.1	-	2,678	-	2,678	
10/1/2017	10	46.45	18.93	18.83	8.69	27.52	18.93	190	50	140	4.68	-	0.97	0.00	4.55	-	5.33	5.33	3.00	7.24	10.24	5.2	-	1,194	821	19.1	-	2,678	-	2,678	
11/1/2017	11	48.15	48.15	0.00	0.00	0.00	48.15	190	50	140	2.94	-	0.66	0.37	1.93	1.08	0.00	0.00	(7.34)	(1.46)	(8.81)	4.9	-	0	1,969	19.1	27.3	2,678	1,365	4,043	
12/1/2017	12	60.14	60.14	(0.00)	(0.00)	(0.00)	60.14	190	50	140	2.55	-	0.98	0.80	2.50	2.05	(0.00)	(0.00)	(9.51)	(2.78)	(12.29)	5.0	-	(0)	2,509	19.1	27.3	2,678	1,365	4,043	
1/1/2018	1	64.95	64.95	-	-	-	64.95	190	50	140	2.49	0.78	0.65	1.21	1.62	3.01	-	0.78	(3.21)	(3.03)	(6.24)	5.5	-	-	2,981	19.1	27.3	2,678	1,365	4,043	
2/1/2018	2	51.30	33.35	12.28	5.67	17.94	33.35	190	50	140	3.35	0.15	1.00	0.00	3.33	-	3.48	3.63	1.12	4.93	6.04	4.5	-	674	1,253	19.1	-	2,678	-	2,678	
3/1/2018	3	65.63	10.02	38.05	17.56	55.62	10.02	190	50	140	4.55	0.56	0.66	0.00	2.98	-	10.78	11.34	31.77	15.40	47.16	4.0	-	1,857	334	19.1	-	2,678	-	2,678	
4/1/2018	4	49.92	0.00	34.15	15.76	49.92	0.00	190	50	140	7.18	-	0.93	0.00	6.69	-	9.68	9.68	11.35	13.14	24.49	4.4	-	1,833	-	19.1	-	2,678	-	2,678	
5/1/2018	5	50.74	0.00	34.71	16.02	50.74	0.00	190	50	140	8.06	0.03	0.70	0.00	5.66	-	9.84	9.87	15.98	13.39	29.37	4.3	-	1,821	-	19.1	-	2,678	-	2,678	
6/1/2018	6	49.46	0.00	33.84	15.62	49.46	0.00	190	50	140	9.42	-	0.95	0.00	8.90	-	9.59	9.59	2.60	13.02	15.61	4.4	-	1,816	-	19.1	-	2,678	-	2,678	
7/1/2018	7	59.71	0.00	40.85	18.86	59.71	0.00	190	50	140	9.52	0.26	0.69	0.00	6.57	-	11.57	11.83	20.00	16.07	36.07	4.6	-	2,292	-	19.1	-	2,678	-	2,678	
8/1/2018	8	55.00	0.00	37.63	17.37	55.00	0.00	190	50	140	9.31	-	0.96	0.00	8.94	-	10.66	10.66	6.55	14.47	21.02	4.8	-	2,203	-	19.1	-	2,678	-	2,678	
9/1/2018	9	50.19	25.14	17.14	7.91	25.05	25.14	190	50	140	7.42	-	0.67	0.00	4.95	-	4.86	4.86	(0.37)	6.59	6.22	4.7	-	983	986	19.1	-	2,678	-	2,678	
10/1/2018	10	47.67	47.67	-	-	-	47.67	190	50	140	4.43	0.91	0.97	0.00	4.30	-	-	0.91	(12.89)	1.24	(11.66)	4.6	-	-	1,830	19.1	-	2,678	-	2,678	
11/1/2018	11	51.97	51.97	-	-	-	51.97	190	50	140	3.02	0.16	0.66	0.37	1.98	1.11	-	0.16	(6.94)	(1.28)	(8.22)	5.1	-	-	2,212	19.1	27.3	2,678	1,365	4,043	
12/1/2018	12	70.06	70.06	-	-	-	70.06	190	50	140	1.85	1.36	0.98	0.80	1.82	1.48	-	1.36	(1.73)	(0.17)	(1.90)	5.1	-	-	2,982	19.1	27.3	2,678	1,365	4,043	
1/1/2019	1	79.20	79.2	-	-	-	79.20	190	50	140	2.06	1.07	0.65	1.21	1.34	2.49	-	1.07	(1.04)	(1.93)	(2.97)	6.2	-	-	4,098	19.1	27.3	2,678	1,365	4,043	
2/1/2019	2	120.34	111.6	5.99	2.77	8.76	111.58	190	50	140	2.63	1.52	1.00	0.00	2.62	-	1.70	3.22	2.28	4.37	6.65	5.3	-	388	4,935	19.1	-	2,678	-	2,678	
3/1/2019	3	155.70	106.2	33.87	15.63	49.51	106.20	190	50	140	4.69	0.68	0.66	0.00	3.08	-	9.60	10.28	27.37	13.95	41.32	4.3	-	1,777	3,811	19.1	-	2,678	-	2,678	
4/1/2019	4	72.11	0.0	49.34	22.77	72.11	0.00	190	50	140	6.99	-	0.93	0.00	6.51	-	13.98	13.98	28.37	18.98	47.35	4.0	-	2,407	-	19.1	-	2,678	-	2,678	

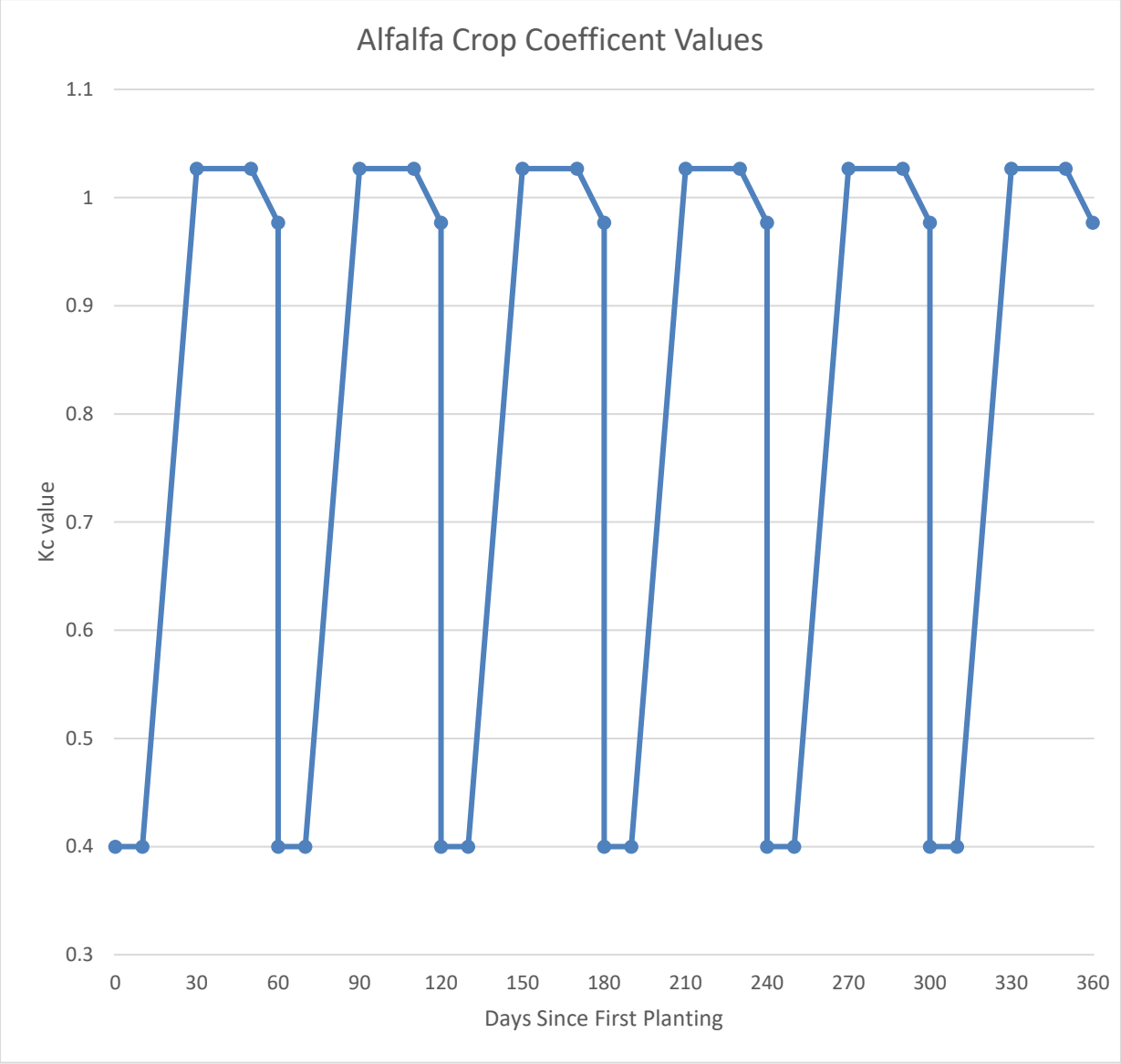
Lucerne Valley Facility - Water and Nitrogen Balance

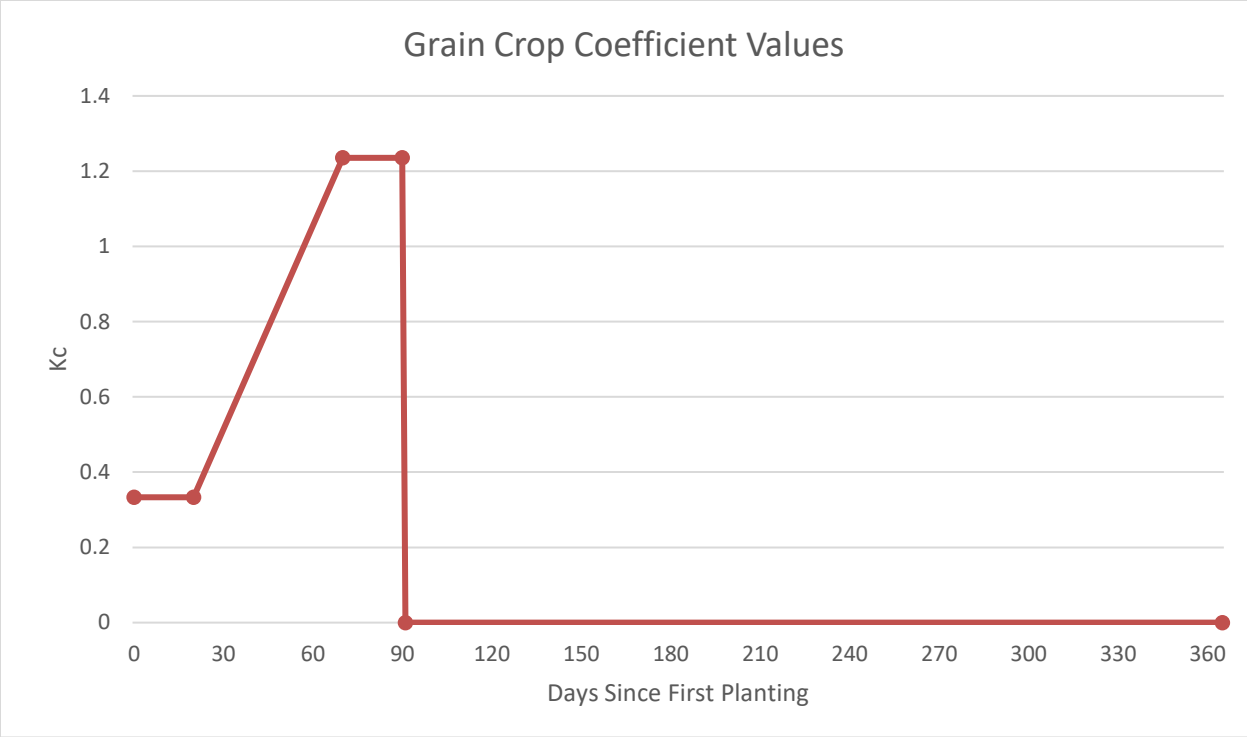
Date	Month	Monthly Total Effluent Flow (MG)[1]	Earth Basin Estimates from BBARWA (MG)	West Field Flow (MG)[2]	East Field Flow (MG)[3]	Total Flow To Fields (MG)	Calculated Flow to Earth Basin (MG)[4]	Total Planted Acreage	Grain Acreage	Alfalfa Acreage	ETo (in)[5]	Rainfall (in)[6]	Alfalfa K_c[7]	Grain K_c[7]	ET_c Alfalfa (in)[8]	ET_c Grain (in)[8]	Effluent Depth on Total Acreage (in)[9]	Total Water Depth on Acreage (in)[10]	Alfalfa Surplus or Deficit (MG)[11]	Grain Surplus or Deficit (MG)[12]	Combined Surplus or Deficit (MG)[13]	Effluent TIN (mg/L)[14]	Urea Applied from Fertilizer to Fields (lbs)	TIN Loading to Fields (lbs)[15]	TIN Loading to Ponds (lbs)[16]	Alfalfa Nitrogen Removal Capacity (lbs/acre)[17]	Grain Nitrogen Removal Capacity (lbs/acre)[18]	Alfalfa Nitrogen Removal Capacity (lbs)[19]	Grain Nitrogen Removal Capacity (lbs)[20]	Total Nitrogen Removal Capacity (lbs)[21]	Notes
5/1/2019	5	65.49	0.0	44.81	20.68	65.49	0.00	190	50	140	7.01	0.52	0.70	0.00	4.92	-	12.70	13.22	31.52	17.94	49.46	4.0	-	2,186	-	19.1	-	2,678	-	2,678	
6/1/2019	6	55.51	0.0	37.98	17.53	55.51	0.00	190	50	140	9.23	-	0.95	0.00	8.73	-	10.76	10.76	7.74	14.61	22.35	3.8	-	1,760	-	19.1	-	2,678	-	2,678	
7/1/2019	7	62.44	0.0	42.72	19.72	62.44	0.00	190	50	140	9.96	-	0.69	0.00	6.88	-	12.10	12.10	19.87	16.43	36.30	3.7	-	1,928	-	19.1	-	2,678	-	2,678	
8/1/2019	8	57.17	0.0	39.12	18.05	57.17	0.00	190	50	140	9.48	-	0.96	0.00	9.10	-	11.08	11.08	7.53	15.04	22.57	3.7	-	1,765	-	19.1	-	2,678	-	2,678	
9/1/2019	9	43.61	0.0	29.84	13.77	43.61	0.00	190	50	140	6.63	0.01	0.67	0.00	4.43	-	8.45	8.46	15.35	11.49	26.84	3.8	-	1,383	-	19.1	-	2,678	-	2,678	
10/1/2019	10	42.04	0.0	28.77	13.28	42.04	0.00	190	50	140	4.86	-	0.97	0.00	4.72	-	8.15	8.15	13.04	11.06	24.10	4.0	-	1,403	-	19.1	-	2,678	-	2,678	
11/1/2019	11	43.99	44.0	-	-	-	43.99	190	50	140	2.81	1.59	0.66	0.37	1.85	1.03	-	1.59	(0.98)	0.76	(0.22)	3.9	-	-	1,432	19.1	27.3	2,678	1,365	4,043	
12/1/2019	12	73.03	73.0	-	-	-	73.03	190	50	140	1.58	2.25	0.98	0.80	1.55	1.27	-	2.25	2.66	1.33	3.99	3.7	-	-	2,255	19.1	27.3	2,678	1,365	4,043	
1/1/2020	1	66.08	66.08	0.00	0.00	0.00	66.08	190	50	140	2.44	-	0.65	1.21	1.59	2.95	0.00	0.00	(6.05)	(4.01)	(10.06)	2.3	-	0	1,268	19.1	27.3	2,678	1,365	4,043	
2/1/2020	2	57.56	0.00	39.39	18.18	57.56	0.00	190	50	140	3.63	0.01	1.00	0.00	3.61	-	11.16	11.17	28.72	15.16	43.88	2.4	-	1,153	-	19.1	-	2,678	-	2,678	
3/1/2020	3	77.20	5.09	49.34	22.77	72.11	5.09	190	50	140	4.14	2.04	0.66	0.00	2.72	-	13.98	16.02	50.57	21.75	72.31	2.6	-	1,565	110	19.1	-	2,678	-	2,678	
4/1/2020	4	86.73	55.49	21.37	9.86	31.23	55.49	190	50	140	5.89	1.67	0.93	0.00	5.49	-	6.05	7.72	8.50	10.49	18.99	4.7	-	1,225	2,177	19.1	-	2,678	-	2,678	
5/1/2020	5	56.10	0.00	38.38	17.72	56.10	0.00	190	50	140	8.63	-	0.70	0.00	6.06	-	10.87	10.87	18.29	14.76	33.05	2.7	-	1,264	-	19.1	-	2,678	-	2,678	
6/1/2020	6	56.48	0.00	38.64	17.84	56.48	0.00	190	50	140	9.03	-	0.95	0.00	8.54	-	10.95	10.95	9.17	14.86	24.03	2.5	-	1,178	-	19.1	-	2,678	-	2,678	
7/1/2020	7	61.27	0.00	41.92	19.35	61.27	0.00	190	50	140	10.09	-	0.69	0.00	6.97	-	11.88	11.88	18.67	16.12	34.80	2.6	-	1,330	-	19.1	-	2,678	-	2,678	
8/1/2020	8	61.45	0.00	42.05	19.41	61.45	0.00	190	50	140	9.22	0.01	0.96	0.00	8.85	-	11.91	11.92	11.67	16.19	27.86	2.5	-	1,282	-	19.1	-	2,678	-	2,678	
9/1/2020	9	49.90	0.00	34.14	15.76	49.90	0.00	190	50	140	6.86	-	0.67	0.00	4.58	-	9.67	9.67	19.36	13.13	32.49	2.3	-	958	-	19.1	-	2,678	-	2,678	
10/1/2020	10	53.57	6.65	32.10	14.82	46.92	6.65	190	50	140	4.79	-	0.97	0.00	4.65	-	9.09	9.09	16.89	12.35	29.23	2.3	-	901	128	19.1	-	2,678	-	2,678	
11/1/2020	11	58.15	58.15	0.00	0.00	0.00	58.15	190	50	140	2.88	0.22	0.66	0.37	1.89	1.06	0.00	0.22	(6.36)	(1.13)	(7.49)	2.0	-	0	971	19.1	27.3	2,678	1,365	4,043	
12/1/2020	12	60.73	60.73	0.00	0.00	0.00	60.73	190	50	140	2.09	-	0.98	0.80	2.05	1.68	0.00	0.00	(7.79)	(2.28)	(10.07)	1.9	-	0	963	19.1	27.3	2,678	1,365	4,043	

Notes:

1. From effluent meter located at the BBARWA Wastewater Treatment Plant.
2. Data prior to 2016 is from the west field meter at the Lucerne Valley Site unless otherwise noted in the "Notes" column. For 2016 - 2020, field flow was estimated in accordance to the size of each field (60 acres in the east field and 130 acres in the west field).
3. Data prior to 2016 is from the east field meter at the Lucerne Valley Site unless otherwise noted in the "Notes" column. For 2016-2020, field flow was estimated in accordance with the size of each field (60 acres in the east field and 130 acres in the west field).
4. Estimated Effluent to Earth Basin = Earth Basin Estimates from BBARWA - West Field Flow - East Field Flow. The sum of the field meter readings is typically lower than the effluent flow meter reading when no flow is being sent to the pond. BBARWA considers this to be caused my compound meter tolerances, but the results produce conservative estimates of the volume of water sent to the Earth Basin.
5. ETo is the reference evapotranspiration. This data is provided as part of the CIMIS data set for Station 117. Source: CIMIS (http://www.cimis.water.ca.gov/)
6. Rainfall data is provided as part of the CIMIS data set for Station 117. Source: CIMIS (http://www.cimis.water.ca.gov/)
7. K_c is the crop characteristics coefficient. This coefficient is seasonally based as it depends on the growth stage for the crop. Methodology follows the Food and Agriculture Organization of the United Nations' (FAO) Grass-Based Crop Coefficients method outlined in ASCE Manuals and Reports on Engineering Practice #70: Evaporation, Evapotranspiration, and Irrigation Water Requirements by Marvin Jensen, Ph.D., NAE and Richard Allen, Ph.D., PE. Calculations for these can be found on the "Alfalfa Kc" and "Grain Kc" tabs repectively.
8. ET_c is the crop evapotranspiration for the specific crop under standard conditions. It represents the water demand for the specific crop during that time period. It is determined using the following formula:
   $ET_c = K_c * ETo$, where K_c is the crop characteristics coefficient. Source: FAO (http://www.fao.org/docrep/x0490e/x0490e0b.htm)
9. Effluent Depth on Total Acreage = (Total Flow to Fields * 1,000,000 gal/MG * 0.1337 ft^3/gal * 12 in/ft)/(Total Planted Acreage * 43,560 ft^2/acre)
10. Total Water Depth on Acreage = Effluent Depth on Total Acreage + Rainfall
11. Alfalfa Surplus or Deficit = [(Total Water Depth on Acreage - ET_c alfalfa) * Alfalfa Acreage * 43,560 ft^2/acre]/(12 in/ft * 0.1337ft^3/gal * 1,000,000 gal/MG)
12. Grain Surplus or Deficit = [(Total Water Depth on Acreage - ET_c grain) * Grain Acreage * 43,560 ft^2/acre]/(12 in/ft * 0.1337ft^3/gal * 1,000,000 gal/MG)
13. Combined Surplus or Deficit = Alfalfa Surplus or Deficit + Grain Surplus or Deficit
14. Effluent Total Inorganic Nitrogen (TIN). Calculated using a flow weighted average. Source: (BBARWA Annual Reports)
15. TIN Loadings to Fields = [Calculated Flow to Fields * 1,000,000 gal/MG * 3.78541 L/gal * Effluent TIN mg/L]/[1,000 mg/g * 453.592 g/lb]
16. TIN Loadings to Ponds = [Calculated Flow to Earth Basin * 1,000,000 gal/MG * 3.78541 L/gal * Effluent TIN mg/L]/[1,000 mg/g * 453.592 g/lb]
17. Alfalfa Nitrogen Removal Capacity was determined using a yield of 1 ton/acre per harvest (Source: BBARWA farmer) with the International Plant Nutrition Institute's (IPNI) crop nutrient calculator ((Source: https://www.ipni.net/ipniweb/app/calc.nsf/0/0962F87B1D2E67718525808C00025B0C). This output is on a per harvest basis, so the number was multiplied by the number of cuttings (6 per the farmer) and then divided by 12 months to determine a monthly value. Additional information can be found on the "Nutrient Requirements" tab.
18. Grain Nitrogen Removal Capacity was determined based on the BBARWA farmer's reported output of 2.5 tons per acre for the grain mixture, which equates to a yield of 84.2 bushels per acre. For the purposes of the estimate, it was assumed that the mixture has equal yields among the barley, winter wheat, and oats. The IPNI calculator was used to estimate nitrogen uptake for each type of grain. The IPNI outputs were calculated for each grain's proportional yield and summed to get an average grain uptake , multiplied by the number of harvests (one per year), and then divided by 3 months (harvest cycle) to provide a monthly estimate. Additional information is found under the "Nutrient Requirements Tab."
19. Alfalfa Nitrogen Removal Capacity (lbs) = Alfalfa Nitrogen Removal Capacity (lb/acre) * Alfalfa Acreage (acres)
20. Grain Nitrogen Removal Capacity (lbs) = Grain Nitrogen Removal Capacity (lb/acre) * Grain Acreage (acres)
21. Total Nitrogen Removal Capacity (lb) = Alfalfa Nitrogen Removal Capacity (lb) + Grain Nitrogen Removal Capacity (lb)

APPENDIX C: CROP COEFFICIENT CURVES




Grain Crop Coefficient Values
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Kc
0
30
60
90
120
150
180
210
240
270
300
330
360
Days Since First Planting

Bear Valley Basin Groundwater Sustainability Plan

Prepared for
Bear Valley Basin Groundwater Sustainability Agency

January 2022

Thomas Harder & Co.
Groundwater Consulting

In Association with:

WSC

Bear Valley Basin Groundwater Sustainability Plan

January 2022

Prepared for

Bear Valley Basin Groundwater Sustainability Agency

Prepared by

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1. Introduction to the Bear Valley Basin Groundwater Sustainability Plan

1.1 Purpose of the Sustainable Groundwater Management Act

In September 2014, the Sustainable Groundwater Management Act (SGMA) was signed into law, with an effective date of January 1, 2015, and codified in the California Water Code, Section 10720 et seq. The legislative intent of SGMA is to, among other goals, provide for sustainable management of alluvial groundwater basins and subbasins defined by the California Department of Water Resources (CDWR), to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide specified local agencies with the Agency and the technical and financial assistance necessary to sustainably manage groundwater. To comply with and satisfy the requirements of SGMA, the following activities are mandated:

- Formation of a Groundwater Sustainability Agency (GSA) by June 30, 2017.
- Development of a Groundwater Sustainability Plan (GSP) by January 31, 2022.
- Implementation of the GSP to achieve quantifiable objectives and sustainability within 20 years (by 2042).
- Annual reporting of groundwater conditions in the basin to the CDWR.
- Periodic (every five years) evaluation of the GSP implementation by the GSA.

This document fulfills the GSP development requirement for the Bear Valley Basin. Specifically, the GSP provides the geographical and managerial context of the Bear Valley Basin, summarizes the groundwater basin setting (including groundwater conditions, water budget, and management areas), describes the criteria used to measure and demonstrate sustainability, reviews the existing groundwater monitoring and management programs, and defines how those actions will be incorporated into the Bear Valley Basin GSP to achieve and maintain sustainability in the future.

1.2 Description of the Bear Valley Groundwater Basin

This GSP covers the entire Bear Valley Groundwater Basin identified as Basin No. 8-009 in the CDWR Bulletin 118 (see Figure 1-1). The groundwater basin underlies the Big Bear Valley and covers approximately 30 square miles within the San Bernardino Mountains in southern San Bernardino County, California. The Big Bear Valley is an east-west trending valley that extends from Big Bear Lake Dam on the west to the eastern portion of Baldwin Lake on the east. The valley is surrounded by a series of local mountain ranges which rise to approximately 7,000 to 8,000 feet above sea level. Average annual precipitation ranges from approximately 35 inches on the western edge of the valley and in the mountains south of Baldwin Lake to 18 inches on the eastern edge of the valley (Flint and Martin, 2012). Big Bear Lake and Baldwin Lake are the

primary surface water features within the Bear Valley Groundwater Basin, and the basin is within the watershed areas of the Big Bear Lake and Baldwin Lake surface water drainage basins. These drainage basins are composed of multiple subbasins which are defined by surface water divides. The numerous creeks within these subbasins drain into Big Bear and Baldwin Lakes; the only significant surface water outflow from the valley is through Bear Valley Dam. Urban areas within the Bear Valley Groundwater Basin include the cities of Big Bear Lake, Fawnskin, Sugarloaf, and Big Bear City. Highways 18 and 38 are the primary driving routes within the valley.

The Bear Valley Basin is generally composed of alluvial deposits which are bound by pre-Tertiary crystalline (basement) rocks of the San Bernardino Mountains. Groundwater is produced from three primary geologic formations: unconsolidated or semi-consolidated alluvial sediments, fractures and weathered zones in granitic bedrock, and fractures and cavities in carbonate bedrock. Groundwater production wells that typically have the highest yields are constructed within the aquifers of the alluvial sediments. Currently, the entire municipal water supply in Big Bear Valley is from groundwater as there is no means of importing water into the area. The perennial yield (i.e. safe yield or sustainable yield) of the Bear Valley Basin has been estimated to be approximately 5,300 acre-feet/year. To date, annual groundwater production has never exceeded the perennial yield estimate and groundwater levels periodically recover to historical high conditions during wet periods. However, due to relatively limited aquifer storage in the basin, groundwater levels can vary widely between periods of relatively high precipitation and periods of low precipitation. As such, it is critical to monitor and manage groundwater levels to ensure adequate supplies during periods of prolonged drought. Since 2003, local agencies have implemented groundwater monitoring and management programs that have been successful at managing groundwater supplies to address periodic drought conditions, including the recent dry period between 2011 and 2017.

1.3 Basin Prioritization

CDWR's Bulletin 118 – Interim Update 2016 (CDWR, 2018) defined 515 groundwater basins and subbasins in California. CDWR is required to prioritize these groundwater basins and subbasins as "high," "medium," "low," or "very low" priority. The SGMA 2019 Basin Prioritization process was conducted to reassess the priority of the groundwater basins following the 2016 basin boundary modification, as required by the Water Code. For the SGMA 2019 Basin Prioritization, DWR followed the process and methods developed for the CASGEM 2014 Basin Prioritization, adjusted as required by SGMA and related legislation. CDWR is required to prioritize basins for the purposes of SGMA, which was enacted, among other things, to provide for the sustainable management of groundwater basins. This reprioritization entailed a reassessment of factors that had been utilized in the CASGEM program to prioritize basins based on groundwater elevation

monitoring. SGMA also required CDWR to continue to prioritize basins based on a consideration of the requirements specified in Water Code Section 10933(b):

1. The population overlying the basin or sub-basin.
2. The rate of current and projected growth of the population overlying the basin or sub-basin.
3. The number of public supply wells that draw from the basin or sub-basin.
4. The total number of wells that draw from the basin or sub-basin.
5. The irrigated acreage overlying the basin or sub-basin.
6. The degree to which persons overlying the basin or sub-basin rely on groundwater as their primary source of water.
7. Any documented impacts on the groundwater within the basin or sub-basin, including overdraft, subsidence, saline intrusion, and other water quality degradation.
8. Any other information determined to be relevant by the department, including adverse impacts on local habitat and local streamflow.

CDWR incorporated new data, to the extent data was available, and the amended the language of Water Code Section 10933(b)(8) (component 8) to include an analysis of adverse impacts on local habitat and local streamflow as part of the SGMA 2019 Basin Prioritization. Evaluation of groundwater basins at a statewide scale does not necessarily capture the local importance of groundwater resources within the smaller-size or lower-use groundwater basins. For many of California's low-use basins, groundwater provides close to 100 percent of the local beneficial uses. Thus, when reviewing the SGMA 2019 Basin Prioritization results, it is important to recognize the findings are not intended to characterize groundwater management practices or diminish the local importance of the smaller-size or lower-use groundwater basins; rather, the results are presented as a statewide assessment of the overall importance of groundwater resources in meeting beneficial uses.

The following information was deemed relevant and considered as part of component 8 for the SGMA 2019 Basin Prioritization based on SGMA:

- Adverse impacts on local habitat and local streamflows
- Adjudicated areas
- Critically overdrafted basins
- Groundwater-related transfers

Additional information about how each of these components were analyzed can be found in the process section of the 2019 SGMA Basin Prioritization Process and Results document.

The Bear Valley Groundwater Basin (Basin Number 8-009) was initially designated by the CDWR as a medium priority basin not subject to conditions of critical overdraft, requiring the formation

of the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA) and preparation of a GSP for the GSA area. Given the fact that natural precipitation is the only source of recharge and water supply to the valley, the BVBGSA member agencies have already been proactive in implementing many of the groundwater monitoring and management elements required by SGMA in an effort to protect this critical resource. As such, the BVBGSA applied for and received a grant from CDWR to fund the preparation of the GSP. Following award of the grant, CDWR reclassified the Bear Valley Basin as a very low priority basin, but encouraged the BVBGSA to continue with the planned preparation of the GSP. Medium priority basins that are not in critical overdraft are scheduled to submit a GSP to CDWR by January 31, 2022.

1.4 Agency Information

The BVBGSA is a "local agency" comprised of the Big Bear City Community Services District (BBCCSD), the City of Big Bear Lake Department of Water and Power (BBLDWP), the Big Bear Regional Wastewater Agency (BBARWA) and the Big Bear Municipal Water District (BBMWD), each a member with water management responsibilities within the Bear Valley Groundwater Basin.

In 2017, the BBCCSD, BBMWD, BBARWA and BBLDWP elected to form a joint powers authority (JPA) to serve as the exclusive GSA for the entire Bear Valley Basin through a joint powers agreement. The Agency was created primarily to fulfill the role and legal obligations of a GSA for the Bear Valley Basin required by SGMA. The Agreement and Agency will continue to serve this role in full force until the governing bodies of the members unanimously elect to terminate the Agreement. Figure 2-1 shows the service area boundaries of each of the Agency parties and the GSA area.

1.4.1 Agencies Names and Mailing Addresses

The following contact information is provided for each member of the Bear Valley Basin Groundwater Sustainability Agency, pursuant to California Water Code §10723.8.

Big Bear City Community Services District
139 E. Big Bear Boulevard
P.O. Box 558
Big Bear, CA 92314
Attention: General Manager

City of Big Bear Lake Department of Water and Power
41972 Garstin Drive
P.O. Box 1929
Big Bear Lake, CA 92315

Attention: General Manager, Department of Water and Power

Big Bear Area Regional Wastewater Agency
121 Palomino Drive
Big Bear, CA 92314
Attention: General Manager

Big Bear Municipal Water District
40524 Lakeview Drive
P.O. Box 2863
Big Bear Lake, CA 92315
Attention: General Manager

1.4.2 Agency Organization and Management Structure

The JPA established the BVBGSA as a single GSA for the entire Bear Valley Basin to provide for the commitments reasonably anticipated to be necessary of ensuring that the Basin is sustainably managed in accordance with the timelines established by SGMA. The BVBGSA is governed by a Board of Directors which is composed of one (1) representative from BBCCSD, one (1) representative from BBARWA, one (1) elected representative from BBMWD and one (1) appointed commissioner from BBLDWP. Each BVBGSA Board member shall be entitled to one vote. A simple majority of the quorum (i.e. two-thirds) is required for any adoption of a motion, resolution, contract authorization or other action of the Board, except that:

1) A majority vote of less than a quorum may vote to adjourn;
2) Any of the following actions shall require a unanimous vote of the entire Board:
   a) Adoption, modification or alteration of the GSP or of the GSA boundaries;
   b) Adoption of assessments, charges or fees;
   c) Admission of additional Members to the BVBGSA;
   d) Setting the amounts of any contribution or fees to be made or paid to the BVBGSA by any Member; and
   e) Issuance of bonds or other indebtedness.

The officers of the BVBGSA includes a Chairperson, a Vice-Chairperson, a Treasurer and a Secretary. Names of the officers appointed to the Board of Directors are provided below:

Bob Ludecke, Chairman

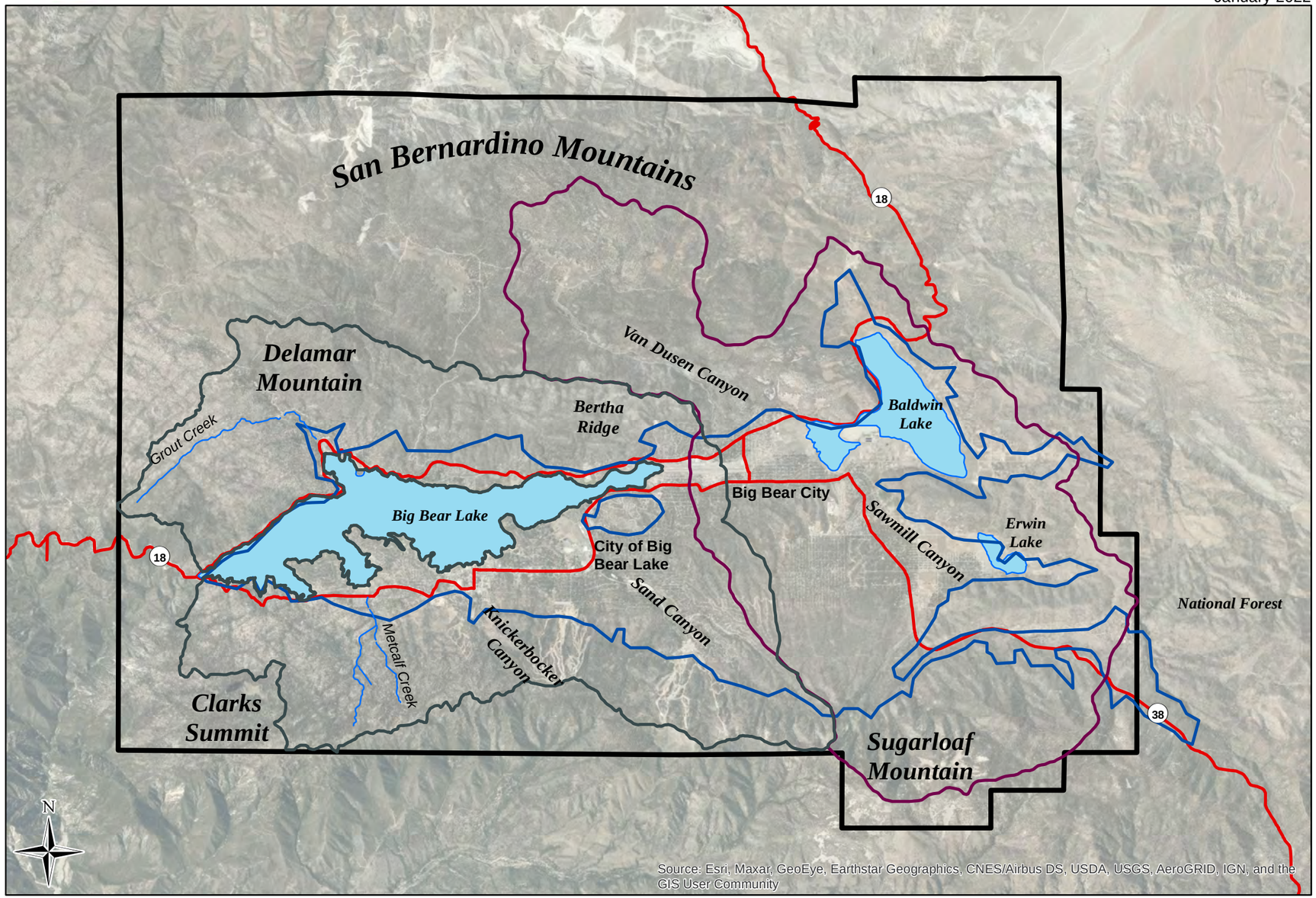
Craig Hjorth, Treasurer

John Green, Vice Chairman

James Miller, Secretary

Bear Valley Basin Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Baldwin Lake Watershed
- Big Bear Lake Watershed
- Drainage Creek
- Highway

Regional Map

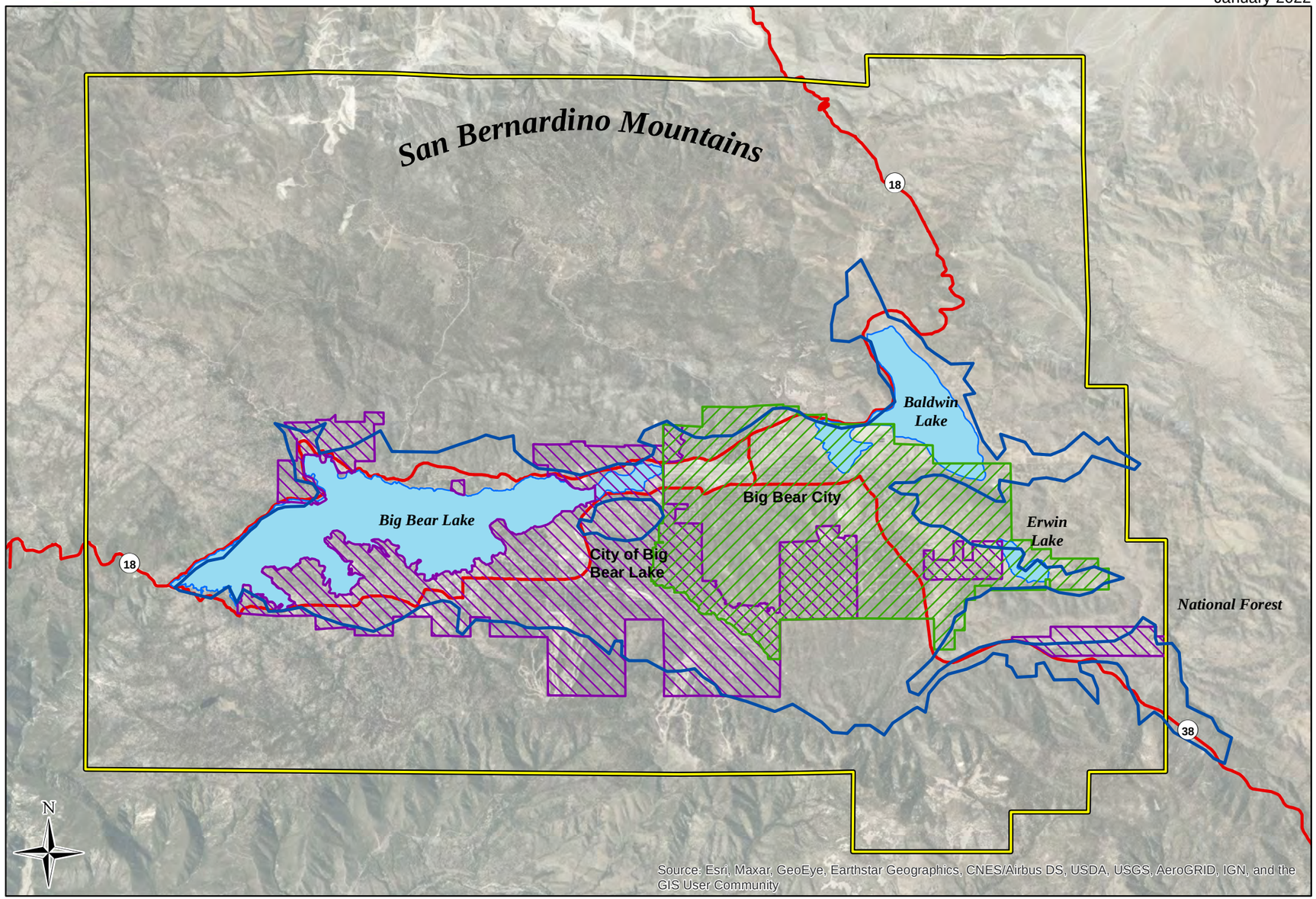
Thomas Harder & Co. Groundwater Consulting

Bear Valley Basin

Figure 1-1

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Big Bear Municipal Water District
- Big Bear City Community Services District Service Area
- Big Bear Lake Department of Water and Power Service Area
- Highway

0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Thomas Harder & Co.
Groundwater Consulting

Bear Valley Basin Jurisdictional Map

Figure 1-2

2. Bear Valley Basin Setting

The Bear Valley Groundwater Basin (No. 8-009) covers approximately 30 square miles within the San Bernardino Mountains in southern San Bernardino County, California (see Figure 2-1). Bear Valley extends from Big Bear Lake Dam on the west to the eastern portion of Baldwin Lake on the east. The basin is characterized by two major watersheds, each which encompasses the two primary surface water features in the area: Big Bear Lake and Baldwin Lake. The area of the Bear Valley Basin is defined by the latest version of California Department of Water Resources (CDWR) Bulletin 118 (CDWR, 2018) and is shown on Figure 2-1.

The Bear Valley Basin area includes the jurisdictional areas of multiple water districts and service entities, including Big Bear Lake Department of Water and Power (BBLDWP), Big Bear City Community Services District (BBCCSD), Big Bear Municipal Water District (BBMWD), and Big Bear Area Regional Wastewater Agency (BBARWA).

2.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model is a description of the groundwater flow system of the Bear Valley Basin and how it interacts with surface water and land use of the area. The conceptual model includes a description of the geologic setting, geologic structure, and boundary conditions including the principal aquifers and aquitards. The hydrogeologic conceptual model of the Bear Valley Basin, as described herein, has been developed in accordance with the requirements of California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 5, Subarticle 2 (§354.14) and in consideration of CDWR's Best Management Practices (BMP) for the preparation of hydrogeologic conceptual models.

2.1.1. Sources of Data

Compilation, review, and analysis of multiple types of data were necessary to develop the hydrogeologic conceptual model and water budget of the Bear Valley Basin. The various types of data included geology, soils/lithology, hydrogeology, surface water hydrology, climate, land use, topography, remote sensing, and groundwater recharge and recovery. Data were obtained from multiple sources:

Geological Data including geologic maps and cross sections were obtained from the United States Geological Survey (USGS) and the California Geological Survey (CGS). Geophysical logs were obtained from reports provided by the City of Big Bear Lake Department of Water and Power (BBLDWP) and Big Bear City Community Services District (BBCCSD).

Lithological Data were obtained from drillers' logs and reports from the CDWR and detailed lithological logs from boreholes and wells drilled in the basin, as provided by BBLDWP and BBCCSD.

Hydrogeological Data including groundwater levels and pumping tests were obtained from the BBLDWP, BBCCSD, and Big Bear Area Regional Wastewater Agency (BBARWA).

Groundwater Quality Data from the BBLDWP, BBCCSD, California State Water Resources Control Board Department of Drinking Water Database, Environmental Data Resources, Inc. EDR Radius Map, and contaminants identified in the California State Water Resources Control Board Geotracker website (Geotracker, 2019).

Well Information including water well construction and well locations were obtained from CDWR driller's logs (private wells) and BBLDWP and BBCCSD (municipal wells).

Groundwater Production Data was obtained from BBLDWP and BBCCSD.

Hydrological (i.e. Surface Water) Data including Big Bear Lake surface water levels, natural inflows, and releases from the dam were obtained from BBMWD. Spring flow data was obtained from BBLDWP and BBCCSD. Information on the Baldwin Lake water balance was obtained from the USGS.

Climate/Precipitation Data was acquired from BBMWD, BBCCSD, the County of San Bernardino, CDWR's California Irrigation Management Information System (CIMIS), and the Western Regional Climate Center website.

Land Use Data was obtained from the CDWR, and the USGS Earth Resources Observation and Science Center. Political boundaries were obtained from the BBLDWP, BBCCSD, and BBMWD.

In addition to the various types of data, numerous historical reports on the geology, hydrogeology and groundwater management of the Bear Valley Basin were reviewed and analyzed. These reports included USGS publications, CDWR reports and bulletins, consultant reports, and academic publications. Publications relied on for the hydrogeological conceptual model and water budget are summarized in the References Section (Section 2.5).

2.1.2. Geologic Setting

Bear Valley Basin is situated at an elevation of approximately 6,740 feet above mean sea level (amsl) in the San Bernardino Mountains in the Transverse Ranges province of Southern California (Figure 2-1). It is located at the west end of a continuous east-west valley-like feature that extends from the west end of Big Bear Lake to the east end of Baldwin Lake. The surrounding mountain

slopes are relatively steep (as much as 70 degrees) and rugged. Prominent mountain peaks and ridges surrounding Big Bear Lake include Delamar Mountain to the north (8,398 feet amsl), Bertha Ridge and Gold Mountain to the northeast (8,201 and 8,235 feet amsl, respectively), Moon Ridge to the southeast (7,583 to 7,866 feet amsl), Sugarloaf Mountain to the southeast (9,952 feet amsl), and Snow Summit and Clark's Summit to the south (8,182 and 7,816 feet amsl; see Plate 1). Big Bear Lake receives surface runoff from several small canyons and valleys, the most prominent of which are Grout Creek to the northwest, Van Dusen Canyon to the northeast, Sawmill Canyon to the southeast, Sand Canyon to the southeast, and Knickerbocker Canyon and Metcalf Creek to the south.

The San Bernardino Mountains formed because of uplift along a complex system of faults, including the San Andreas Fault System, which separates the San Bernardino Mountains from the neighboring San Gabriel Mountains to the west. Most of the tectonic activity that created the mountains occurred during Late Pliocene and Pleistocene times (2.6 million years ago to 12,000 years ago). However, uplift continues to occur at a rate of approximately 30 inches every 100 years. The June 28, 1992 Big Bear earthquake is evidence of the continued tectonic activity in the area.

In the Bear Valley Basin area, the San Bernardino Mountains consist primarily of Mesozoic granitic intrusive rocks, with lesser outcrops of Precambrian and Late Paleozoic metamorphic rock (see Figure 2-2). Geologic formations observed at the land surface and in the subsurface beneath the Bear Valley Basin can be grouped into three primary geologic formations, described below in order of increasing age:

Quaternary Alluvial Deposits – This unit consists of primarily Quaternary age (approximately 2.5 million years ago to present) clay and sandy clay with interbedded sand and gravel layers near Big Bear Lake and coarsens to predominately sand with some gravel and interbedded layers of silt and clay towards Baldwin Lake. Beneath Baldwin Lake, alluvial deposits consist of lacustrine (historical lake) deposits mostly consisting of clay, silt and interbedded sand. The coarse-grained layers make up the water-bearing aquifer in which wells pump from.

Recent alluvium is comprised of permeable sand and gravel with lesser interbedded layers of silt and clay. Most recent alluvium is located above the water table but where it is present, this permeable layer allows for infiltration of rainfall and runoff into the subsurface (Geoscience, 2004; Flint and Martin, 2012).

Tertiary Sedimentary Deposits – These sediments overlie the basement rocks throughout most of the Bear Valley Basin and are Tertiary age (approximately 65 million years ago to 2.6 million years ago). This unit consists primarily of consolidated to semi-consolidated

alluvial fan deposits of gravel, sand and clay. Some municipal wells have been constructed in these Tertiary deposits, but they are less permeable than overlying Quaternary sediments and do not yield significant water. Tertiary sedimentary deposits are exposed at the land surface southeast of Big Bear Lake in the Sugarloaf area, along the base of the hills on the north side of Big Bear Lake, and in the Lake Williams area. This unit is greater than 1,000 ft thick in the Sugarloaf area (Geoscience, 2005).

Pre-Tertiary Bedrock – Basement rocks underlying the Tertiary and Quaternary sediments consist of Cretaceous (65 to 145 million years ago) granitic rocks, Paleozoic (252 to 541 million years ago) sedimentary rocks consisting of limestone, and Proterozoic (older than 541 million years) metamorphosed sedimentary rocks consisting of quartzite and gneiss (Miller, 2004). The permeability of the geologic formations making up the basement rocks is generally very low and they are not considered major water-bearing units in the Bear Valley Basin. However, localized fractures in this bedrock allow for some groundwater production via springs and bedrock wells. The BBLDWP Cherokee Well in Fawnskin produces groundwater from fractures in the granitic rock in this area. BBLDWP's Lassen Well is constructed within fractures in the limestone south of Big Bear Lake.

The most significant fault near the Bear Valley Basin is the San Andreas Fault zone. The San Andreas Fault is a strike-slip fault that bounds the south side of the San Bernardino Mountains. A significant zone of frontal reverse faults exist on the north side of the mountains. These faults account for the uplift in the San Bernardino Mountains (Miller, 1987).

2.1.3. Lateral Basin Boundaries

The lateral boundaries of the Bear Valley Basin are defined by the surface contact between crystalline rocks of the San Bernardino Mountains and surficial alluvial sediments within the valley floors (see Figure 2-2). The westernmost extent of the basin is defined by the Big Bear Lake dam. The total area of the Bear Valley Basin is approximately 30 square miles (19,155 acres).

2.1.4. Bottom of Basin

The physical bottom of the Bear Valley Basin is defined by the interface between the Tertiary sedimentary deposits and the relatively impermeable crystalline basement complex underlying them. Variations in the thickness of alluvial sediments throughout the basin, based on both borehole intercepts and a gravity survey (Flint and Martin, 2012), is shown on Figure 2-3 and Plates 1 and 2). As shown, the alluvial/tertiary sedimentary thickness in some areas of the basin

exceeds 1,500 feet. However, the most permeable sediments, and the most productive aquifers for groundwater supply, are generally in the upper 500 feet of alluvial sediments.

2.1.5. Surface Water Features

The Bear Valley Basin is encompassed by two major watersheds: the Big Bear Lake Watershed at the west end of the basin and the Baldwin Lake Watershed at the east end of the basin.

The Big Bear Lake Watershed covers an area of approximately 38.5 square miles and delineates the area where surface water drains into Big Bear Lake (see Figure 2-4). The Big Bear Lake Watershed has been divided into seven hydrologic subareas: Gray's Landing, Grout Creek, North Shore, Division, Rathbone, Village, and Mill Creek (LeRoy Crandall & Associates, 1987a). The subareas are delineated based on surface water drainage divides.

The Baldwin Lake Watershed covers an area of approximately 34.3 square miles and delineates the area where surface water drains into Baldwin Lake. This watershed is divided into four hydrologic subareas: Erwin, West Baldwin, East Baldwin, and Van Dusen (LeRoy Crandall & Associates, 1987b).

2.1.5.1 Big Bear Lake

Big Bear Lake is a manmade reservoir that is fed by runoff from creeks that drain the mountains and valley floor within the Big Bear Lake watershed (see Figure 2-4). The maximum surface area of the lake is 2,971 acres and, when full, the lake storage capacity is approximately 73,320 acre-ft. At its deepest point at the dam, the lake is approximately 70 feet deep. Lake surface water elevations typically range from 6,743 feet above mean sea level (ft amsl) when full to 6,725 ft amsl during dry periods.

The dam that contains the lake was originally built in 1884 and then rebuilt in 1912 to create a reservoir to meet irrigation needs of downstream growers. The BBMWD manages lake levels in the context of water demands from downstream water rights holders and recreational uses for the local area. Downstream water demands are met through releases of lake water at the dam or from in-lieu water purchase agreements. Local recreational uses of the water include fishing and boating as well as water supply for snowmaking at the local ski resorts.

2.1.5.2 Baldwin Lake

Baldwin Lake is classified as a mountain playa. The lake is usually dry but periodically contains standing water during years of high rainfall. The surface area of this lake is approximately 1,500 acres (Johnson, 1994). During years of high rainfall, the surface water elevation of the lake can reach 6,707 feet (Johnson, 1994) with a corresponding lake depth of approximately 12 feet at

its deepest point. Surface water runoff into Baldwin Lake occurs via Van Dusen Canyon to the northwest and Shay Creek to the south (see Figure 2-4).

Surface water sources to Baldwin Lake are primarily in the form of ephemeral streams with relatively low flow volumes. The only stream where surface water flow has been periodically measured is Shay Creek at its outlet from Shay Pond (see Figure 2-4). During most years, surface water runoff does not reach Baldwin Lake but percolates into the groundwater system. However, during prolonged precipitation, surface water does collect in Baldwin Lake.

All surface water that enters Baldwin Lake is lost to evaporation. The high clay content of the playa sediments prevents vertical migration and the topographical configuration of the lake prevents surface runoff.

2.1.5.3 Lake Erwin

Lake Erwin is a small mountain playa located approximately one mile southeast of Baldwin Lake within the Erwin Hydrologic Subunit (see Figure 2-4). This lake contains water only during periods of high rainfall. The lake is fed from runoff in ephemeral streams that drain the hills to the north and south. The lake is also fed from the east via an unnamed stream that drains out of Gocke Valley to the south. There are no records available regarding surface water inflow to this lake.

2.1.5.4 Springs

Numerous springs feed ephemeral streams in the Big Bear Lake and Baldwin Lake watershed areas. Many of the springs have measurable flow at least part of the year and some are tapped by the BBLDWP and BBCCSD as sources of municipal water supply.

Big Bear Lake Watershed

Prominent springs utilized for water supply in the Big Bear Lake Watershed include Cedar Springs (Grout Creek subunit) and Dogwood Springs (Rathbone subunit) (see Figure 2-4). Water from these springs is captured by the BBLDWP for municipal water supply in the respective hydrologic subunits within which they are located. Annual production from the Cedar Springs (Cedar Dell Slant Wells) between 1990 and 2019 has been 32.5 acre-ft/yr. Annual production from the Dogwood Springs (Dogwood Slant Wells) between 1990 and 2019 has been 123 acre-ft/yr.

Baldwin Lake Watershed

Prominent springs utilized for water supply in the Baldwin Lake Watershed include the Greenspot and Fish Hatchery Springs (Erwin Subunit), and Van Dusen Slant Wells (Van Dusen Subunit).

Greenspot and Fish Hatchery Springs typically flow year-round and are used by BBCCSD for municipal water supply. The Van Dusen Slant Wells enhance a natural spring in Van Dusen Canyon for BBCCSD water supply. Water supply from the combined Green Spot Springs and Van Dusen Slant Wells averages approximately 190 acre-ft/yr.

Shay Pond is a natural surface water body at the southern base of an unnamed ridge that separates it from Baldwin Lake in the northern part of the Erwin Subunit. The nature of this pond is unknown, but it may be fed, in part, from spring flow, surface runoff, and periodically, groundwater intersecting the land surface. Although the pond may have historically been fed from surface water runoff in the ephemeral stream Shay Creek, urban development has altered the course of this stream and it no longer outlets into the pond. Surface water exits Shay Pond via Shay Creek, which flows northwards into Baldwin Lake.

2.2 Areas of Groundwater Recharge and Discharge

2.2.1 Recharge

Groundwater recharge in the Bear Valley Basin occurs from deep percolation of precipitation that falls on the younger alluvium and fractures in the bedrock and infiltration of surface runoff in ephemeral streams and soft bottom washes. The majority of natural recharge occurs in areas where Young Alluvial Fan Deposits are mapped at the land surface (see Figure 2-2).

Numerous studies have been conducted to identify areas favorable for artificial recharge of the aquifer system in the Bear Valley (Geoscience, 1990; Geoscience, 2004a; TH&Co, 2017). Areas that are most promising occur in or near ephemeral stream channels that are characterized geologically by recent alluvium or stream channel sediments (sand and gravel) and where the groundwater table is greater than 50 ft below ground surface (bgs). Areas of favorable recharge identified from previous studies are shown on Figure 2-5. These areas include the Sand Canyon area on the south side of Big Bear Lake in the Rathbone Subunit, the area north of Green Spot Spring in the Erwin Subunit south of Baldwin Lake, and Van Dusen Canyon north of Baldwin Lake. Favorability for recharge has been supported through analysis of both borehole testing and pilot-scale recharge tests (Geoscience, 2004a).

2.2.2 Discharge

The Bear Valley Basin is a closed basin with no natural outlets for groundwater outflow. Natural groundwater discharge within the basin occurs from numerous springs located throughout the basin (see Figure 2-4; Section 2.1.5.4). This spring flow is either captured by local agencies for municipal water supply or discharges into ephemeral washes and infiltrates into the subsurface.

During periods of prolonged above-normal precipitation, it is possible that some uncaptured spring flow from Green Spot Spring enters Baldwin Lake where it eventually evaporates.

Some discharge of groundwater occurs through evapotranspiration in areas where groundwater rises near the land surface during periods of high precipitation. These areas include the immediate Shay Pond area in the Erwin Subunit, parts of west Baldwin Lake, and the outlet of Rathbun Creek to Big Bear Lake.

The primary source of groundwater discharge within the Bear Valley Basin is groundwater pumping (see Section 2.3.2.2). Groundwater pumping is conducted from both municipal and private wells. There are 72 municipal groundwater production wells in the Bear Valley Basin (55 operated by BBLDWP and 15 operated by BBCCSD) (see Figure 2-6). There are numerous private wells located throughout the Bear Valley Basin, as many as 445 private wells have been documented from CDWR driller's logs as of 2019. Some of these wells have been verified in the field. However, the exact number of private wells is not known as many have been destroyed, others are inactive, and some may have been drilled but not properly recorded.

2.3 Principal Aquifer and Aquitards

2.3.1 Aquifer Formations

In general, groundwater is produced from three hydrogeological units in the subsurface beneath the Bear Valley Basin (see Plates 1 and 2):

1. Unconsolidated or semi-consolidated alluvial sediments
2. Fractures in Granitic Bedrock
3. Fractures and cavities in Carbonate Bedrock

Unconsolidated to Semi-Consolidated Alluvial Aquifer

Previous reports for the eastern portion of the Bear Valley Basin have described three individual aquifers within the unconsolidated to semi-consolidated alluvial sediments: an upper, middle, and lower aquifer (Geoscience, 1999). For this report, the prior designations have been extended to the remaining parts of the Bear Valley Basin, based on lithologic characteristics, permeability, and groundwater quality.

The upper aquifer consists of younger alluvium and is characterized by more permeable sand and gravel that occurs primarily within the major drainage channels (e.g. Shay Creek) and in the north central portion of the basin between Big Bear and Baldwin lakes. In general, the upper aquifer is

approximately 50 ft thick. This aquifer is the most permeable of the alluvial aquifer units but is locally unsaturated during dry climatic cycles. This aquifer is considered unconfined.

The middle aquifer consists of older alluvium and older fan deposits and is characterized by locally thick layers of silt and clay with relatively thin layers of sand and gravel. This aquifer extends throughout the basin and is approximately 150 feet thick to greater than 800 feet thick. Most of the municipal wells within the Bear Valley Basin are perforated within the middle aquifer because the sand and gravel layers within this unit are moderately permeable and yield economic quantities of water and the groundwater quality is very good. Groundwater production rates in wells perforated in this aquifer range from approximately 50 gpm to 1,000 gpm. This aquifer is confined.

The lower aquifer is characterized by gravel, coarse sand, pebbles and interbedded sandy clay in north central portion of the basin but is predominantly clay in the southern portion of the basin. While some municipal wells have been completed with perforations extending into the lower aquifer, it is characterized by relatively low permeability and high concentrations of naturally occurring fluoride and arsenic in groundwater at depth, which have prevented utilizing this aquifer for water supply.

Fractured Granitic Bedrock Aquifer

A small number of vertical wells have been constructed within the granitic bedrock on the north side of Bear Valley Basin. The BBLDWP Cherokee Well, in Fawnskin, produces groundwater from fractures in the granitic bedrock. This well is capable of producing discharge rates as high as approximately 60 gallons per minute (gpm), which is lower than most of the wells perforated in the alluvial aquifer system. Some private wells on the north side of Big Bear Lake are also known to be completed in the granitic bedrock. Individual well production rates from these wells are expected to be on the order of those observed in the Cherokee Well, or lower.

Fractured Carbonate Bedrock Aquifer

The BBLDWP operates one well that produces groundwater from the carbonate bedrock (Lassen Well No. 4). This well is located south of Big Bear Lake within the Rathbone Subunit.

2.3.2 Aquifer Physical Properties

The ability of aquifer sediments to transmit and store water is described in terms of the aquifer parameters transmissivity, hydraulic conductivity, and storativity. The most reliable estimates of these parameters are obtained from long-term (e.g. 24-hr or more constant rate) controlled pumping tests in wells. In the absence of this type of test, estimates can be obtained through short-term pumping tests and/or assignment of literature values based on the soil types observed in

driller's logs. Long-term pumping test data was obtained from BBLDWP and BBCCSD. Short-term pumping test data was obtained from driller's logs.

Transmissivity is a measure of the ability of groundwater to flow within an aquifer and is defined as the rate of groundwater flow through a unit width of aquifer under a unit hydraulic gradient (Fetter, 1994). Transmissivity was estimated from short-term pumping test data based on Theis et al., 1963 and the following relationship:

$$T = \frac{S_c \, x \, 2{,}000}{E}$$

Where:

T	=	Transmissivity (gpd/ft);
S_c	=	Specific Capacity (gpm/ft);
E	=	Well Efficiency (assumed to be 0.7)

Transmissivity values at individual wells were converted into hydraulic conductivity (i.e. aquifer permeability) by dividing by the aquifer thickness (in this case the perforation interval of the well). Horizontal hydraulic conductivity values for the alluvial aquifer are summarized in Table 2-1 and shown on Figure 2-7 and range from less than 1 ft/day to approximately 130 ft/day, the higher values indicating more permeable sediments.

Storage properties of the upper aquifer are expressed in terms of specific yield since most of this aquifer is conceptualized as unconfined. Specific yield is the ratio of the volume of water sediment will yield by gravity drainage to the volume of the sediment. The only specific yield value available for the upper aquifer is in the Erwin Subunit, where pumping tests and pilot recharge testing resulted in a value of 0.03 (see Figure 2-8).

The middle aquifer is confined and, as such, storage properties for this aquifer are expressed in terms of storativity. Storativity is a measure of the volume of water an aquifer can release from, or take into, storage per unit of aquifer surface area per unit change in hydraulic head. Storativity is derived from long-term pumping tests where pumping interference is measured in a monitoring well located a known distance from the pumping well. Values for storativity in the middle aquifer range from 0.00003 to 0.0006 (see Table 2-1; Figure 2-8). These values indicate confined aquifer conditions.

No storage property data are available for the lower aquifer or bedrock aquifers.

2.3.3 Geologic Structures that Affect Groundwater Flow

Numerous small unnamed faults have been mapped throughout the Bear Valley Basin (Sadler, 1982; Ron Barto & Associates, 1988). The only fault that has been observed to affect groundwater flow is an inferred fault that extends in a northeast/southwest trend at the west end of Lake Erwin (see Figure 2-2). The fault was inferred based on groundwater level differences on each side of the fault. The Bear Valley Basin is seismically active, as demonstrated from the 1992 Big Bear earthquake. Coincident with that earthquake, groundwater levels in some monitoring wells in the Erwin subunit changed significantly (Geoscience, 2001) and some wells along Baldwin Lake began flowing artesian (Heule, 1992). Thus, seismic activity in the area does impact groundwater flow although the correlation with specific faults is not known.

2.3.4 Aquifer Water Quality

Groundwater quality in the Bear Valley Basin varies across the basin and with depth in the aquifer system. Overall, the native groundwater quality of the upper and middle aquifers from which local agencies produce water is generally very good, with historical total dissolved solids (TDS) measurements generally in the range of 200 to 300 milligrams per liter (mg/L) with no detections above 500 mg/L (see Figure 2-9). Groundwater quality issues in the subbasin include both regional non-point groundwater quality issues and point-source contaminant issues.

Fluoride is a naturally occurring non-point constituent of concern in the Baldwin Lake and Lake William areas (see Figure 2-10). Concentrations of this constituent generally increase with increasing depth in the aquifer system where it is present. Depth-specific water quality sampling in wells near Baldwin Lake (e.g. BBCCSD's Wells 8, 9 and 10) have shown that fluoride concentrations below a depth of approximately 350 feet are generally higher than the maximum contaminant level (MCL) for this constituent of 2 mg/L (Geoscience 2003a, Geoscience, 2003b, and Geoscience, 2003c). This depth generally defines the boundary between the middle aquifer system and lower aquifer system in the Baldwin Lake area. Construction of most of the newer wells in this area is limited to the middle aquifer due to high fluoride in the deep aquifer. One exception is BBCCSD's Well 3B, located at the southwestern edge of Baldwin Lake. Depth-specific isolated aquifer zone testing showed that fluoride concentrations ranged from 6.3 mg/L at a depth of 300 to 320 ft bgs to 9.0 mg/L at a depth of 480 to 500 ft bgs (Geoscience, 2000).

Other naturally occurring groundwater quality constituents of concern have included arsenic, manganese, and uranium. Arsenic has been detected in samples from wells in the Grout Creek subunit (Cherokee Well), Rathbone Subunit (Owen Well) and Mill Creek Subunit (Canvasback test borehole) (see Figure 2-11). The arsenic concentration in the Canvasback test borehole was 88 μg/L and was detected in a depth-specific sample collected from 499 ft bgs (Geoscience,

2003d). Arsenic has not been detected in a shallower well completed near the test hole to a depth of 315 ft bgs, indicating the arsenic concentrations are unique to a deeper aquifer system at the site (Geoscience, 2004b). All other arsenic concentrations detected in the Big Bear Valley have been below the MCL. Uranium has been detected in the Canvasback Well at concentrations above the MCL. Manganese has been detected above its secondary MCL in wells in the Village Subunit and Division Subunit.

For point-source contaminants, there are nine active cleanup sites in the Bear Valley Basin identified on the California Geotracker website (see Figure 2-12; Table 2-2). Seven of the point source contamination sites are associated with leaking underground storage tanks (LUSTs) for which the primary contaminants are gasoline, methyl tert-butyl ether (MTBE), tertiary butyl alcohol (TBA) and/or other oxygenates. There is one Department of Toxic Substance Control (DTSC) site and one land disposal site listed within the basin (see Figure 2-12). Contaminants associated with these sites are not reported on the Geotracker website.

2.3.5 Aquifer Primary Uses

The predominant beneficial use of groundwater in the Bear Valley Basin is municipal water supply. The other beneficial use is private domestic water supply.

2.4 Uncertainty in the Hydrogeologic Conceptual Model

The primary sources of uncertainty in the hydrogeologic conceptual model include:

- Precipitation distribution across the Bear Valley Basin
- The surface water balance of Baldwin Lake
- Areal recharge from precipitation
- Tributary channel infiltration
- The nature of the aquifer system beneath Big Bear Lake.
- Aquifer characteristics of hydraulic conductivity, transmissivity and storativity.

2.5 Groundwater Conditions

2.5.1 Groundwater Occurrence and Flow

Most of the groundwater within the Bear Valley Basin occurs in the permeable sediments that make up the alluvium of the basin. Groundwater in the upper aquifer is unconfined. Groundwater in the older alluvial fan sediments of the middle and lower aquifers are confined. Groundwater also occurs in the secondary porosity features (i.e. fractures and cavities) within the granitic and limestone bedrock.

Groundwater in the Bear Valley Basin flows by gravity drainage from areas of recharge along the flanks of the surrounding mountains towards Big Bear Lake and Baldwin Lake (see Figures 2-13 through 2-16). In the western portion of the basin south of Big Bear Lake, groundwater flows to the northwest towards the lake and towards a groundwater pumping depression in the Village Subunit (see Figures 2-13 and 2-15). In the eastern portion of the Basin south of Baldwin Lake, groundwater flows to the north towards the center of the basin and Baldwin Lake. A slight groundwater pumping depression is present in the northwestern part of the Erwin Subunit (see Figures 2-14 and 2-16). There is also a groundwater flow divide in the north central part of the basin between Big Bear Lake and Baldwin Lake. The divide occurs in the vicinity of the outlet of Van Dusen Canyon where groundwater west of the canyon flows to the west and groundwater east of the canyon flows to the east.

Changes in groundwater levels over time vary from hydrologic subunit to hydrologic subunit as a function of the geology of the area, groundwater production, and precipitation patterns. Monitoring wells with historical groundwater level data are in the Grout Creek, North Shore, Mill Creek, Village, Rathbone, Division, West Baldwin and Erwin hydrologic subunits.

Grout Creek Subunit

Historical groundwater levels in the Grout Creek Subunit are documented for the Seminole Well with a period of record from 1996 to 2019 (see Figure 2-17). This well is relatively shallow (less than 100 feet deep) and perforated in alluvium that is known to be hydrologically connected with Big Bear Lake. Groundwater levels in this well have ranged from approximately 6,738 and 6,755 ft amsl (7 to 24 feet below land surface). Groundwater levels throughout the period of record have been relatively stable and, while dropping during dry climatic cycles, rise to historical high levels during wet precipitation cycles.

Groundwater levels in the bedrock aquifer, as indicated by measurements in the Cherokee Well, are at a similar elevation and range as the Seminole Well, ranging from approximately 6,739 to 6,758 ft amsl. The groundwater level trend has been relatively stable since the start of data collection in 2013.

North Shore Subunit

Groundwater level data are available for two wells that supply water for a recreational vehicle park on the north side of Big Bear Lake (RV Park Well Nos. 1 and 2) (see Figure 2-18). The period of record for these wells is from 1996 to 2019. Static groundwater levels in RV Park Well No. 1 have ranged from approximately 6,750 to 6,785 ft amsl. Since approximately 2011, groundwater levels in this well have shown a slight downward trend, dropping a total of approximately 20 feet.

Static groundwater levels in RV Park Well No. 2 have ranged from approximately 6,780 to 6,820 ft amsl. Groundwater levels in this well have remained relatively stable.

Groundwater levels in the Stanfield Monitoring Well, located on the east side of the North Shore Subunit, have ranged from approximately 6,740 ft amsl to 6,780 ft amsl (see Figure 2-18). Groundwater levels in this monitoring well track very closely with surface water levels in Big Bear Lake indicating that the shallow groundwater level at this location is likely in hydrologic communication with surface water in the lake.

Mill Creek Subunit

Historical groundwater levels are available for three monitoring wells in the Mill Creek Subunit: Metcalf, Canvasback Well and Mallard Well (Figure 2-19). The Canvasback and Mallard wells are nested, with isolated perforations in the Middle and Lower aquifers. Static groundwater levels in most of the wells are around 6,760 ft amsl. The groundwater level in the Lower Aquifer Canvasback well completion is 6,780 ft amsl, approximately 20 feet higher than the Middle Aquifer groundwater level and indicating confined aquifer conditions. Groundwater levels dropped approximately 100 feet at the Canvasback Middle Aquifer monitoring well in 2007 when BBLDWP began pumping the Canvasback production well, located approximately 50 feet from the monitoring well. Due to water quality issues, pumping from the Canvasback production well was discontinued shortly after and groundwater levels returned to their pre-pumping elevation. Groundwater levels in the Mill Creek Subunit are stable.

Village Subunit

The BBLDWP's Pennsylvania and Knickerbocker wells are used as monitoring wells in the Village Subunit (see Figure 2-20). Static groundwater levels in the Pennsylvania Well were as high as 6,730 ft amsl in 1996 before declining steadily to an elevation of approximately 6,690 ft amsl in 2004. After that time, BBLDWP reduced groundwater production in the Village Subunit to allow groundwater levels to recover. Since 2004, groundwater levels have been recovering or steady in both the Pennsylvania and Knickerbocker wells.

Rathbone Subunit

Three wells used for measuring groundwater levels in the Rathbone Subunit are the Sand Canyon Well (irrigation), Rathbone Fire Station Monitoring Well, and Elm Monitoring Well (see Figure 2-21). Groundwater levels in the Sand Canyon well have dropped over time from approximately 7,000 ft amsl in 1992 to approximately 6,920 ft amsl in 2004 and then again in 2019. During above-average precipitation years, the groundwater level rises as much as 60 feet but have not recovered to the historical high level observed in 1992. Groundwater levels in the Middle Aquifer

of the Rathbone Fire Station Well, located downgradient of the Sand Canyon Well, have shown a declining trend, dropping approximately 10 feet from 6,870 ft amsl in 2006 to 6,860 ft amsl in 2019. Groundwater levels measured in 2019 in the Elm Monitoring Well, downgradient from Rathbone Monitoring Well, are approximately five feet lower than groundwater levels measured at the historical high level in 1998.

Division Subunit

Monitoring wells used to measure groundwater levels in the Division Subunit are shown on Figure 2-22. These wells include the McAlister Nested Monitoring Well (Middle and Lower Aquifers), the Riffenburgh Monitoring Well, Division Well No. 4 (inactive production well used as a monitoring well), and Hillendale Monitoring Well. Except for the deep completion of the McAlister Nested Monitoring Well, all of these wells are perforated in the Middle Aquifer.

Groundwater levels in both McAlister Nested Monitoring Wells are similar when the McAlister production well (located approximately 100 feet away) is not pumping. The McAlister production well is perforated in the Middle Aquifer so when it is pumping, the interference in the shallow (Middle Aquifer) completed monitoring well is greater than the deep completion. Aside from an initial groundwater level decline when the McAlister production well was activated in 2006, groundwater levels in the monitoring wells are relatively stable.

The Riffenburgh Monitoring Well, Division Well No. 4 and Hillendale Monitoring Well are all located in the center of Big Bear Valley in the north-central part of the Bear Valley Basin. Prior to 2011, groundwater levels in these wells would periodically drop during dry climatic cycles but would rebound to historical high conditions during above average periods of precipitation. Between 2011 and 2019, a period characterized by historically dry climatic conditions, groundwater levels have remained approximately 20 to 40 feet below the previous historical high.

West Baldwin Subunit

Monitoring wells used to measure groundwater levels in the West Baldwin Subunit are shown on Figure 2-23. These wells include the Greenway, Maltby, and Van Dusen No. 1 monitoring wells. Greenway and Maltby monitoring wells are in the center of Big Bear Valley in the north-central part of the Bear Valley Basin. Van Dusen No. 1 monitoring well is in Van Dusen canyon. Groundwater levels in the Greenway and Maltby monitoring wells follow a similar pattern as the Division monitoring wells to the west, whereby they periodically drop during dry climatic cycles but rebound to historical high conditions during above average periods of precipitation. Since 2011, groundwater levels have remained approximately 20 to 40 feet below the previous historical high due to historically dry climatic conditions.

Erwin Subunit

Monitoring wells used to measure groundwater levels in the Erwin Subunit are shown on Figure 2-24. These wells include the Magnolia, Erwin, Vaqueros, and Monte Vista monitoring wells. Groundwater levels at the Erwin and Vaqueros monitoring wells are sensitive to precipitation events, showing short-duration peaks during these times. Aside from the groundwater level peaks, groundwater levels in Erwin Monitoring Well have returned to historical high conditions, except for the historically dry period from 2011 to 2019, during which they have been approximately 15 feet below historical high conditions. Groundwater levels in the Vaqueros Monitoring Well have been relatively stable. Groundwater levels in the Magnolia Monitoring Well were on a slight downward trend between 2006 and 2011 but began dropping at a faster rate when the Magnolia production well, located approximately 50 feet from the monitoring well, began pumping in 2012.

Groundwater levels in the Monte Vista Monitoring Well, located in the Lake Williams Tributary Subarea of the Erwin Subunit, are responsive to precipitation rates and local pumping. Groundwater levels rose approximately 30 feet in 2005 in response to a significant above-average precipitation year. From 2005 to 2015, groundwater levels declined but then stabilized after 2015 when groundwater production from the nearby Monte Vista production well was discontinued.

2.5.2 Groundwater Storage

Changes in groundwater storage within the Bear Valley Basin have been estimated through analysis of the water budget for the basin. Annual change in groundwater storage in the basin between 1990/91 and 2018/19 is shown in Table 2-4 and is graphically presented on Figure 2-25. Comparison of the groundwater inflow elements of the water budget with the outflow elements shows a cumulative change in groundwater storage over the 29-year period between 1990/91 and 2018/19 of approximately 60,100 acre-ft. The average annual change in storage resulting from the groundwater budget is approximately 2,100 acre-ft/yr over this time period. It is noted that the beginning of the period (1990/91) was the end of a dry climatic cycle and groundwater levels were relatively low. From 1990/91 through 1998/99 was relatively wet resulting in an increase in water in aquifer storage over the time period.

2.5.3 Seawater Intrusion

Seawater intrusion cannot occur in the Bear Valley Basin due to its location with respect to the Pacific Ocean. The Bear Valley Basin is an isolated mountain groundwater basin located approximately 70 miles inland of the Pacific Ocean (see Figure 2-1). This mountain aquifer system is separated hydraulically from the coastal aquifers that are susceptible to seawater intrusion.

2.5.4 Groundwater Quality Issues

The primary groundwater quality issues that could affect the beneficial uses of groundwater in the Bear Valley Basin are naturally occurring fluoride, arsenic, uranium as well as petroleum releases from leaking underground storage tank (LUST) sites. Fluoride has been detected at concentrations above the MCL in lower aquifer groundwater in the Baldwin Lake area, which limits the use of deeper groundwater for municipal supply. Arsenic and uranium detected in groundwater in the Mill Creek subunit prohibits groundwater production in this area for municipal supply without wellhead treatment. For point-source contaminants, there are nine active cleanup sites in the Bear Valley Basin identified on the California Geotracker website (see Figure 2-12; Table 2-2). Seven of the point source contamination sites are associated with LUSTs for which the primary contaminants are gasoline, MTBE, TBA and/or other oxygenates. There is one DTSC site and one land disposal site within the basin (see Figure 2-12). Contaminants associated with these sites are not available.

While manganese has been detected in groundwater in the Village and Division subunits, treatment systems have been implemented to remove the manganese. Fluoride concentrations in groundwater produced from the Baldwin Lake area are mitigated through blending with spring water sources and groundwater from wells with low fluoride concentrations.

2.5.5 Land Subsidence

Analyses of land subsidence in the Bear Valley Basin using satellite data shows very low amounts of land deformation. The USGS analyzed Interferometic Synthetic Aperture Radar (InSAR) data for the time periods 1995 to 1997 and 2004 to 2005. Land deformation was observed in the Village and Rathbone subunit areas, the Sugarloaf area of the Erwin Subunit, and in the area between Big Bear and Baldwin lakes (Flint and Martin, 2012). As much as 1.2 inches of land subsidence was observed in the area between Big Bear and Baldwin lakes between 1995 and 1997. In contrast, as much as 1.2 inches of uplift was observed in the same area between 2004 and 2005. As the time periods include extremes in groundwater level fluctuations in the basin, it is likely that the subsidence and later uplift is elastic and recoverable. Analysis of InSAR data for the period from 2015 through 2018, a period of declining groundwater levels in the Bear Valley Basin, did not result in land subsidence greater than 3 inches in any parts of the basin (the limit of resolution of the data).

2.5.6 Interconnected Surface Water Systems

Groundwater is periodically in hydrologic connection with surface water in Big Bear Lake in the northwest part of the basin (Fawnskin area) and in the eastern part of the lake in the vicinity of BBLDWP's Division wells. In the Fawnskin area, BBLDWP's Seminole Well is constructed with

shallow perforations and is within 500 feet of the high-water line of Big Bear Lake. This well is generally considered to be pumping groundwater that is in direct hydrologic connection with the lake. As such, groundwater produced from this well is treated prior to distribution for municipal supply. Certain older Division Wells, located on the east end of Big Bear Lake, have perforations that begin at 50 ft bgs. Groundwater level trends measured in these wells match surface water elevation changes in Big Bear Lake when groundwater levels are high. During low groundwater level conditions, the surface water elevation changes do not match groundwater level trends suggesting that the hydrologic connection only occurs during high groundwater conditions (TH&Co, 2020). Wells with deeper perforations do not show the connection.

The natural springs at the margins of the Bear Valley Basin appear to be fed from the bedrock aquifer system. All springs utilized for municipal supply by the BBLDWP and BBCCSD are located within areas of bedrock. Flow from the springs is associated with available precipitation and flow rates are highly sensitive to climatic cycles. There is no upgradient groundwater production that would artificially impact the flow of the springs.

Shay Pond is a natural surface water body in the northern part of the Erwin Subunit, as described in Section 3.1.5. Most of the time, the only natural source of water supporting the pond is surface water flow from Shay Creek and surrounding areas. During high groundwater conditions after prolonged periods of above average precipitation, the groundwater may rise above the land surface and provide a source of water to the pond (TH&Co, 2017a). The BBCCSD provides supplemental water to the pond via a well located near the pond.

2.5.7 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems require shallow groundwater or groundwater that discharges at the land surface. Groundwater levels in some areas of the Bear Valley Basin are periodically shallow enough to support groundwater dependent ecosystems. The areas most likely to support groundwater dependent vegetation are at the margins of Big Bear Lake in the Rathbone and Mill Creek Subunits, across much of the Baldwin Lake lakebed, and in the Shay Creek drainage downstream of Erwin Lake (see Figure 2-26).

2.6 Water Budget

2.6.1 Surface Water Budget

The surface water budget for the Bear Valley Basin was developed for the 30-year period from 1990/91 to 2018/19 (see Table 2-3). Inflow terms for the surface water budget include precipitation, natural lake inflows to Big Bear Lake and Baldwin Lake, discharge to the land surface from wells, and groundwater discharge to surface water (i.e. springs). Outflow terms

include areal recharge from precipitation, lake evaporation, tributary channel infiltration, return flow, municipal distribution pipeline losses, evapotranspiration (ET), Big Bear Lake withdrawals, measured releases at the Bear Valley Dam, and discharges to Lucerne Valley from BBARWA.

Ideally, the total surface water inflow to the basin would equal the total surface water outflow, indicating a complete accounting of water at the surface. In reality, there is uncertainty in many of the surface water budget terms for the Bear Valley Basin that does not allow for a perfect surface water accounting. These include estimates for precipitation recharge, tributary channel inflow, and return flow. For the Bear Valley Basin surface water budget, the percent difference between the average annual surface water inflow (89,660 acre-ft; Table 2-3) and average annual outflow (89,686 acre-ft) is less than 0.0001 percent. This represents a very good match between surface water inflows and outflows and indicates that the water budget is a good representation of actual conditions. As additional data become available, it is anticipated that the surface water budget will become more accurate with time.

It is noted that many of the surface water outflow terms are also groundwater inflow (i.e. groundwater recharge) terms.

Details of the individual surface water budget terms are provided in the following sections.

2.6.1.1 Surface Water Inflow

Precipitation

The annual volume of water entering the Bear Valley Basin as precipitation was estimated based on the long-term average annual isohyet map shown on Figure 2-27 and the annual precipitation data reported for the BBCCSD precipitation station and the Big Bear Lake Dam precipitation station (see Figures 2-28 and 2-29). The isohyet map was adapted from Flint and Martin, 2012 to include contoured bands of precipitation ranges. Precipitation volumes were estimated for each band by multiplying the long-term average for any given band by the area of the band. The average precipitation was then varied year by year based on the annual precipitation totals at the two precipitation stations. Annual precipitation variations in the Big Bear Lake watershed was based on precipitation data at the Big Bear Dam station. Annual precipitation variations in the Baldwin Lake watershed were based on precipitation data at the BBCCSD station. Total annual precipitation between 1990/91 and 2018/19 ranged from approximately 19,400 to 154,300 acre-ft/yr with an average of 68,400 acre-ft/yr (see Column A of Table 2-3a).

Natural Lake Inflow

Surface water inflow to the Bear Valley Basin occurs primarily as a combination of surface water runoff in tributary channels that eventually drain into Big Bear Lake and Baldwin Lake and precipitation falling on the lake surfaces (see Columns B and C of Table 2-3a). Inflow into Big Bear Lake is estimated and reported by BBMWD. For years 1990/91 to 2018/19, annual surface water inflow to Big Bear Lake ranged from 1,717 to 48,613 acre-ft/yr with an average of 14,385 acre-ft/yr. Values for the natural inflow to Baldwin Lake are based on the average inflow from a climate/surface water model published in Flint and Martin (2012). The average annual Baldwin Lake inflow was varied from year to year by the ratio between average annual Big Bear Lake inflow and average annual Baldwin Lake inflow.

Water Supply from Wells

Groundwater pumping for municipal supply is conducted by BBLDWP and BBCCSD for the local communities in the Bear Valley Basin. From years 1990/91 to 2018/19, average annual groundwater pumping by BBLDWP was 2,537 acre-ft/yr and average annual pumping by BBCCSD was 623 acre-ft/yr (see Columns D through F of Table 2-3a).

There are numerous private wells throughout the Bear Valley Basin. Assessing groundwater production from these wells is difficult since the Big Bear area is a weekend and vacation destination and many of the homes served by the private wells are not occupied full time. Nevertheless, for estimating purposes, it was assumed that each private well on record served a household and the water use in each household was 53 gallons per capita per day, based on the five year average per capita water use in the BBLDWP service area (BBLDWP, 2020). There are 583 private wells in the Bear Valley Basin documented from CDWR driller's logs. Assuming three persons per household, the average annual private well groundwater production was estimated to be 105 acre-ft/yr.

Spring Flow

A separate accounting of spring flow for the Green Spot Spring and Van Dusen Slant Wells is shown in Table 2-3, Column G, as provided by BBCCSD. Spring flow from these sources has historically ranged from 81 to 289 acre-ft/yr with an annual average of 190 acre-ft/yr. Spring flow is also captured by BBLDWP but is accounted for in the water supply from wells (Column E of Table 2-3a).

2.6.1.2 Surface Water Outflow

Areal Recharge from Precipitation

Areal recharge from precipitation falling on the valley floor was based on a surface water model of the Big Bear Lake and Baldwin Lake surface water drainage basins (Flint and Martin, 2012). The analysis estimated that approximately 7.5 percent of precipitation falling within the combined Big Bear Lake and Baldwin Lake watersheds becomes groundwater recharge (Table 13 of Flint and Martin, 2012). When applied to annual precipitation, the resulting annual groundwater recharge from areal precipitation for the period 1990/91 to 2018/19 ranged from approximately 1,500 acre-ft/yr to 11,600 acre-ft/yr with an average of approximately 5,100 acre-ft/yr (see Column H of Table 2-3b).

Lake Evaporation

Evaporation of surface water in Big Bear Lake is estimated and reported by BBMWD. For years 1990/91 to 2018/19, annual surface water evaporation in Big Bear Lake ranged from approximately 9,000 acre-ft/yr to 12,500 acre-ft/yr with an average of approximately 11,000 acre-ft/yr (see Column I of Table 2-3b). Values for evaporation of surface water in Baldwin Lake are based on the average evaporation used in the climate/surface water model published in Flint and Martin (2012), which was 3,342 acre-ft/yr (see Column J of Table 2-3b).

Tributary Channel Infiltration

During precipitation events, a portion of the runoff that collects in ephemeral soft bottomed streams on the perimeter and within the Bear Valley Basin infiltrates into the subsurface to become groundwater recharge. There are no data from which to make estimates of this recharge. As this is the least known element of the surface water budget, it was adjusted to balance the inflows and outflows. The resulting average annual tributary channel infiltration for the water budget period of record is approximately 730 acre-ft/yr (see Column K of Table 2-3b).

Return Flow

A portion of water applied to the land surface for landscape irrigation infiltrates past the roots zones of the plants and becomes groundwater recharge. Estimates of the volume of applied water that become groundwater recharge are a function of the volume of water used outdoors and an assumption regarding the percentage of applied water that becomes deep percolation. To estimate the percentage of water used outdoors, TH&Co compared estimates of water deliveries to customers in the BBLDWP and BBCCSD to influent measurements at the BBARWA treatment plant. The difference between the volume of water delivered to customers and the inflow to the plant was assumed to be water used outdoors. For BBLDWP, 35 percent of delivered water was

assumed to be used outdoors. For BBCCSD, 10 percent of delivered water was assumed to be used outdoors. Of the outdoor water use, 25 percent was assumed to become deep percolation and groundwater recharge. Average annual combined return flow from the two water purveyors in the Bear Valley Basin for the period from 1990/91 to 2018/19 was 218 acre-ft/yr (see Column L of Table 2-3b).

System Losses

A portion of the total groundwater pumped and delivered by BBLDWP and BBCCSD is lost in transit between the wells and the homes. BBLDWP has tracked pipeline losses over time, which have ranged from approximately 13 percent prior to 1997 to less than 10 percent after 2008. For BBCCSD, a loss rate of 10 percent was assumed. Based on these assumptions, the average annual system loss in the Bear Valley Basin for the 1990/91 to 2018/19 period was 327 acre-ft/yr (see Column M of Table 2-3b).

Evapotranspiration

Evapotranspiration (ET) is the loss of water to the atmosphere from free-water evaporation, soil-moisture evaporation, and transpiration by plants (Fetter, 1994). Evapotranspiration of precipitation is assumed to be the balance between total precipitation and areal recharge and is associated with native vegetation. From water years 1990/91 to 2018/19, evapotranspiration of precipitation was estimated to average approximately 63,000 acre-ft/yr (see Column N of Table 2-3b).

Big Bear Lake Withdrawals

Local ski resorts periodically withdraw water from Big Bear Lake for snow making. For years 1990/91 to 2018/19, annual withdrawals from Big Bear Lake, as provided by the BBMWD, ranged from approximately 200 acre-ft/yr to 750 acre-ft/yr with an average of approximately 440 acre-ft/yr (see Column O of Table 2-3b).

Releases at Bear Valley Dam

The BBMWD releases water from Big Bear Lake at the dam for downstream irrigation demands. For years 1990/91 to 2018/19, annual releases at the dam, as provided by the BBMWD, ranged from zero to approximately 17,500 acre-ft/yr with an average of approximately 2,400 acre-ft/yr (see Column P of Table 2-3b).

BBARWA Discharges to Lucerne Valley

Treated effluent from the BBARWA treatment plant is exported out of the Bear Valley Basin to a discharge site in Lucerne Valley, approximately 12 miles to the north. Based on data provided by BBARWA, annual discharges to Lucerne Valley during the 1990/91 to 2018/19 period have ranged from 1,892 acre-ft/yr to 4,008 acre-ft/yr with an average of 2,684 acre-ft/yr (see Column Q of Table 2-3b).

2.6.2 Groundwater Budget

The groundwater budget describes the sources and estimates the volumes of groundwater inflow and outflow within the Bear Valley Basin (see Table 2-4). A fundamental premise of the groundwater budget is the following relationship:

$$\text{Inflow} - \text{Outflow} = +/- \Delta S$$

Inflow terms include areal recharge from precipitation, recharge in tributary channels, return flow, and water distribution system losses. It is noted that many of the groundwater inflow terms are surface water outflow terms from Table 2-3. Outflow terms include groundwater pumping and evapotranspiration. The difference between the sum of inflow terms and the sum of outflow terms is the change in groundwater storage (ΔS) (see Table 2-4).

2.6.2.1 Sources of Groundwater Recharge

Areal Recharge

Areal recharge from precipitation falling on the valley floor is estimated to be approximately 7.5 percent of precipitation falling within the combined Big Bear Lake and Baldwin Lake watersheds as described in Section 2.3.1.2. Annual groundwater recharge from areal precipitation for the period 1990/91 to 2018/19 ranged from approximately 1,500 acre-ft/yr to 11,600 acre-ft/yr with an average of approximately 5,100 acre-ft/yr (see Column A of Table 2-4).

Tributary Channel Infiltration

During precipitation events, a portion of the runoff that collects in ephemeral soft bottomed streams on the perimeter and within the Bear Valley Basin infiltrates into the subsurface to become groundwater recharge, as described in Section 2.3.1.2. The average annual tributary channel infiltration for the water budget period of record is estimated to be approximately 730 acre-ft/yr (see Column B of Table 2-4).

Return Flow

A portion of water applied to the land surface for landscape irrigation infiltrates past the roots zones of the plants and becomes groundwater recharge, as described in Section 2.3.1.2. Average annual combined return flow from the two water purveyors in the Bear Valley Basin for the period from 1990/91 to 2018/19 was 218 acre-ft/yr (see Column C of Table 2-4).

System Losses

A portion of the total groundwater pumped and delivered by BBLDWP and BBCCSD is lost in transit between the wells and the homes, as described in Section 2.3.1.2. The average annual system loss in the Bear Valley Basin for the 1990/91 to 2018/19 period was 327 acre-ft/yr (see Column D of Table 2-4).

2.6.2.2 Sources of Groundwater Discharge

Municipal Groundwater Pumping

Groundwater pumping for municipal supply is conducted by BBLDWP and BBCCSD for the local communities in the Bear Valley Basin, as described in Section 2.3.1.1. From years 1990/91 to 2018/19, average annual groundwater pumping by BBLDWP was 2,537 acre-ft/yr and average annual pumping by BBCCSD was 623 acre-ft/yr (see Columns E and F of Table 2-4).

Private Groundwater Pumping

Groundwater production from private wells in the Bear Valley Basin was estimated to be approximately 105 acre-ft/yr, as described in Section 2.3.1.1 (see Column G of Table 2-4).

Evapotranspiration

Evapotranspiration directly from the groundwater occurs in areas where groundwater is shallow enough to support riparian vegetation. The areas identified as groundwater dependent ecosystems on Figure 2-26 were assumed to be areas of groundwater ET. The annual ET rate of 52.6 inches was obtained from the CIMIS station at the Big Bear Lake Golf Course in the Rathbone Subunit. Multiplying the ET rate by the area of riparian vegetation (approximately 247 acres) results in an average annual ET of 1,071 acre-ft/yr. The ET was varied by year in proportion to changes in areal recharge from precipitation. The changes in annual ET reflect the ratio between the long-term average annual recharge from precipitation (5,128 acre-ft/yr) and long-term average annual ET (1,071 acre-ft/yr) (see Column H of Table 2-4).

2.6.3 Changes in Groundwater Storage

Comparison of the groundwater inflow elements of the water budget with the outflow elements shows a cumulative change in groundwater storage over the period between 1990/91 to 2018/19 of approximately 60,000 acre-ft (see Table 2-4; Figure 2-25). The average annual change in storage resulting from the groundwater budget is approximately 2,100 acre-ft/yr.

2.6.4 Overdraft

The average annual change in groundwater storage over the period from 1990/91 to 2018/19, which approximates average hydrologic conditions within the Bear Valley Basin, was approximately 2,100 acre-ft/yr. As the average annual change in storage is positive, there is no overdraft of the groundwater basin. The findings from the groundwater budget are consistent with groundwater level trends in monitoring wells in the basin that show groundwater levels recovering to historical high conditions during periods of above normal precipitation (see Figures 2-17 through 2-24).

2.6.5 Water Year Type

All water budget elements and change in groundwater storage presented herein are based on a water year, which begins October 1 and ends September 30. Water year types with respect to hydrologic conditions (i.e. above average, average or below average precipitation conditions based on Figures 2-28 and 2-29) are shown in the historical water budget tables (Tables 2-3 and 2-4).

2.6.6 Sustainable Yield

Sustainable yield is defined in the Sustainable Groundwater Management Act (SGMA) Chapter 2, §10721 (v) as:

The maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result.

The Sustainable Yield of the Bear Valley Basin is a function of the overall water balance of the area. Changes in surface water/groundwater inflow to the basin and surface water/groundwater outflow from the basin impact the Sustainable Yield. A generalized expression of the water balance is as follows:

$$\text{Inflow} - \text{Outflow} = +/- \text{ Change in Storage} \qquad (1)$$

The water balance equation for pre-developed conditions (prior to human occupation) can be further expressed as:

$$(I_{pr} + I_{str} + I_{mb}) - O_{et} = \Delta S \qquad (2)$$

Where:

I_{pr} = Inflow from Areal Recharge of Precipitation

I_{str} = Inflow from Infiltration of Runoff in Stream Beds

I_{mb} = Inflow from Mountain-Block Recharge

O_{et} = Evapotranspiration

ΔS = Change in Groundwater Storage

It is noted that the Bear Valley Basin is assumed to be closed such that there is no subsurface inflow to the basin or subsurface outflow from the basin. Under pre-developed conditions, the groundwater basin would be in a state of equilibrium such that the inflow and outflow would balance and there would be no significant long-term change in storage assuming a static climatic condition. Under this condition, groundwater levels would be relatively stable.

Underdeveloped land use conditions, the water balance changes as groundwater is pumped from the basin for municipal supply. Some of the pumped groundwater used for irrigation infiltrates past the roots of the plants and returns to the groundwater as return flow. Water distribution system losses is another source of recharge to the groundwater underdeveloped land use conditions.

The water balance equation for developed land use conditions can be modified as follows:

$$(I_{pr} + I_{str} + \mathbf{I_{rfgw}} + \mathbf{I_{sl}} + I_{mb}) - (O_{et} + \mathbf{O_p}) = \Delta S \qquad (3)$$

Where:

I_{rfgw} = Inflow from Return Flow of Applied Water from Groundwater Pumping

I_{sl} = Inflow from Water Distribution System Losses

O_p = Outflow from Groundwater Pumping

If the inflow terms exceed the outflow terms, then the groundwater in storage increases (become positive) and groundwater levels rise. If the outflow terms exceed the inflow, then the groundwater in storage decreases (become negative) and groundwater levels drop. It is assumed that the

Sustainable Yield of the Bear Valley Basin is the long-term average groundwater pumping rate, under projected land use conditions, that results in no significant long-term net negative change in groundwater storage in the basin. Based on this premise, the water balance equation can be rearranged and simplified to estimate Sustainable Yield:

$$\text{Sustainable Yield} = \Delta S + O_p \qquad (4)$$

Thus, if the change in groundwater storage over the planning period is zero then the Sustainable Yield is equal to the pumping. This relationship is valid if the following conditions are met:

1. The Sustainable Yield incorporates a hydrology that is representative of a relatively long period of record that includes multiple wet and dry hydrologic cycles.
2. The land use conditions are representative of the time period.

The Sustainable Yield can also be expressed as all components of the water balance not explicitly expressed in Equation 4:

$$\text{Sustainable Yield} = I_{pr} + I_{str} + I_{rfgw} + I_{mb} \qquad (5)$$

Applying Equations 4 and 5 to the historical water budget of the Bear Valley Basin results in a Sustainable Yield of approximately 5,300 acre-ft/yr.

2.6.7 Current Water Budget

The surface water and groundwater budget for the Bear Valley Basin for the most recent water year with available data (2018/19) is shown in Tables 2-3 and 2-4. Total groundwater inflow to the basin for water year 2018/19 was approximately 9,400 acre-ft. Total groundwater outflow from the basin for the same water year was approximately 4,500 acre-ft. The net change in storage during the water year was approximately 4,900 acre-ft.

2.6.8 Historical Water Budget

The historical surface water and groundwater budgets for the Bear Valley Basin are shown in Tables 2-3 and 2-4 and described in Sections 2.3.1 and 2.3.2. Except for spring flow capture, there are no surface water supplies, imported or otherwise, available to the Bear Valley Basin. Water purveyors in the basin are reliant solely on groundwater. While groundwater production within the basin has never exceeded the long-term Sustainable Yield, the availability of groundwater supplies to meet local water demands is dependent on precipitation cycles. During an extended dry period between 1998 and 2004, groundwater levels dropped creating concern that, if allowed

to continue, would result in impacts to BBLDWP's and BBCCSD's infrastructure. As a result, both agencies implemented water conservation programs for their respective service areas that were successful at reducing water demand and associated groundwater pumping. Groundwater levels recovered in the 2004/05 water year because of significant above-average precipitation, but the agencies have continued with water conservation measures to ensure that groundwater levels would be sufficiently recovered before subsequent dry periods. The conservation and reduced groundwater production have been successful at maintaining acceptable operational groundwater levels, even during the historically dry period from 2011 to 2017.

2.6.9 Projected Water Budget

A projected water budget for the Bear Valley Basin has been developed to incorporate planned increases in groundwater production as well as projects and management actions for maintaining sustainability. The projection also incorporates adjustments to ET to account for potential climate change. The projected surface water and groundwater budgets are shown in Tables 2-5 and 2-6.

Climate adjustments were applied to the precipitation, ET, and lake inflows in the surface water budget based on output from the CDWR's CalSim-II model, which provided adjusted historical hydrology for major drainages and imported supplies based on scenarios recommended by the CDWR Climate Change Technical Advisory Group.[1] The historical proxy time periods selected for the Bear Valley Basin projected water budget were 1991 to 2010 for 2021 to 2040 and 1981 to 2010 for 2041 to 2070. Climate change benchmark factors were assigned at two times within the SGMA planning horizon:

1. A 2030 central tendency time period, which provides near-term projections of potential climate change impacts on hydrology, centered on the year 2030, and
2. A 2070 central tendency time period, which provides long-term projections of potential climate change impacts on hydrology, centered on the year 2070.

Adjustments to future precipitation and ET projections based on the 2030 central tendency time period were applied to the period 2021 through 2040. The central tendency precipitation change factor for this period is 0.971. Change factors for 2020 through 2029 and 2031 through 2040 were linearly decreased based on a linear regression from 1 (2020) and 0.971 (2030). The central tendency ET change factor is 1.04. The change factor for 2020 through 2029 and 2031 through 2040 were linearly decreased as described for precipitation.

[1] DWR Climate Change Technical Advisory Group, 2015. Perspectives and Guidance for Climate Change Analysis. DWR Technical Information Record.

Adjustments to future precipitation and ET projections based on the 2070 central tendency time period were applied to years 2041 through 2070. The precipitation change factor for this time period is 0.939 and the ET change factor is 1.04. Change factors for 2041 through 2070 were based on a linear regression from the 2040 interpreted change factor and the 2070 central tendency value.

Application of the climate adjustments to the future water budgets results in a reduction of Sustainable Yield in the Bear Valley Basin over the 50-year SGMA planning horizon. In comparison to the historical Sustainable Yield of 5,300 acre-ft/yr, the forecasted Sustainable Yield for the 2020 to 2040 time period is estimated to reduce to 5,100 acre-ft/yr (see Figure 2-30). Further into the future, the Sustainabile Yield is forecast to reduce to 4,300 acre-ft/y during the 2040 to 2070 time period.

2.7 Management Areas

The water agencies within the Bear Valley Basin have historically managed their groundwater resources in the context of the eleven hydrologic subunits and one tributary subarea shown on Figures 2-4 and 2-30. Each of these hydrologic subunits and the Lake Williams Tributary Subarea will be considered management areas for the purpose of this GSP.

2.7.1 Criteria for Management Areas

The management areas in the Bear Valley Basin have been created to account for the varying geology, hydrogeology, and water resources across the basin. Although the hydrologic subunits on which the management areas are based were originally defined based on surface water drainage divides, each represents a unique set of geological and hydrogeological characteristics, which impact the availability of water resources within the areas. The management areas and their unique characteristics are described as follows:

Big Bear Lake Watershed

Grout Creek – Groundwater production from this management area serves the community of Fawnskin. While it is within the BBLDWP service area, the infrastructure is completely disconnected from the infrastructure in the main part of BBLDWP's service area south of Big Bear Lake. As such Fawnskin is self-sustained by local water supplies, which consist of a combination of captured spring flow (Cedar Springs), groundwater from the alluvial aquifer system (Seminole Well), and groundwater from the fractured bedrock aquifer (Cherokee Well). The sustainable yield of this management area has been previously estimated to be 280 acre-ft/yr (Geoscience, 2006).

North Shore – Groundwater production from wells in this management area serve a local mobile home park. Water supply to this small community is self-sustained by two wells within the park. The sustainable yield of this management area has been previously estimated to be 170 acre-ft/yr (TH&Co, 2010a).

Gray's Landing – The Gray's Landing management area is a 765-acre area on the west side of Big Bear Lake where granitic bedrock outcrops at the land surface throughout almost the entire area. There is a thin strip of alluvial sediments along the margin of Big Bear Lake where some private wells have been identified. However, no municipal groundwater production occurs from this management area.

Mill Creek – No municipal groundwater production currently occurs in the Mill Creek management area due to groundwater quality issues (uranium). Some private wells are known to be in this area. Future development of the groundwater resources of this area may occur in the future but will depend on wellhead treatment to address the water quality. The sustainable yield of this management area has been previously estimated to range from approximately 150 to 430 acre-ft/yr (Geoscience, 2006; Flint and Martin, 2012).

Village – The subsurface beneath this management area consists predominantly of clay and the thin aquifers from which groundwater is produced have limited natural recharge. This management area is separated hydrologically from the adjacent Mill Creek management area to the west by a granitic bedrock outcrop and the subsurface sediments were deposited in a different environment than the more channelized and permeable sediments of the Rathbone management area to the east. The sustainable yield of this management area has been previously estimated to be 250 acre-ft/yr (Geoscience, 2006).

Rathbone – The subsurface sediments in this management area are characterized by narrow sand channels of Rathbun Creek and Sand Canyon bounded by less permeable alluvium in the southern portion grading to increasing silt and clay deposits in the northern portion associated with low energy mountain meadow deposits. Water supply from this management area includes a combination of captured spring flow from the Dogwood Springs and groundwater production from eight active municipal wells and numerous private wells. The sustainable yield of this management area has been previously estimated to be 1,100 acre-ft/yr (Geoscience, 2006).

Division – Groundwater production in this management area occurs from both the upper and middle aquifer system. In the southern portion of the area, the BBLDWP's McAlister Well produces groundwater from the middle aquifer. In the northern part of the subunit, BBLDWP's Division well field produces groundwater primarily from the middle aquifer, but some wells produce groundwater periodically from the upper aquifer during periods of high groundwater levels. The sustainable yield of this management area has been previously estimated to be between 500 and 600 acre-ft/yr (TH&Co, 2010a).

Baldwin Lake Watershed

West Baldwin – This management area covers approximately 2,780 acres and includes Sawmill Canyon on the south and extends to the north to include a significant portion of the basin between Baldwin Lake and Big Bear Lake (see Figure 2-30). Most of BBCCSD's groundwater production for municipal supply occurs in this subunit. BBLDWP has one well in the Sawmill Canyon area, which is planned to be pumped in the future. Almost all groundwater production is from the middle aquifer although some wells are perforated into the lower aquifer. Groundwater quality in the lower aquifer is impacted by naturally occurring fluoride that exceeds the MCL. The sustainable yield of this management area has been previously estimated to be between 150 and 1,000 acre-ft/yr (Geoscience, 1999; Flint and Martin, 2012).

Erwin – The Erwin Management Area covers approximately 8,460 acres in the southeast portion of the Baldwin Lake watershed. Principal surface water features include Fish Hatchery Spring, Green Spot Spring, Shay Creek, Shay Pond, and Erwin Lake. Groundwater is produced primarily out of the middle aquifer and periodically out of the upper aquifer when groundwater levels are shallow. Spring flow from Green Spot Spring is captured for municipal supply. The sustainable yield of this management area has been previously estimated to be approximately 900 acre-ft/yr (Geoscience, 2006).

Lake Williams – The Lake Williams Tributary Subarea of the Erwin Hydrologic Subunit has been identified as a separate management area because it is, for the most part, hydrologically separated from the Erwin Management Area (see Figure 2-30). The Lake Williams Management Area covers approximately 1,226 acres in the southeast part of the Erwin Hydrologic Subunit. The BBLDWP serves the Lake William community, which is isolated from the infrastructure in the rest of BBLDWP's service area. As such, Lake William is self-sustained by local water

supplies, which consist solely of groundwater pumped from the alluvial aquifer system. The sustainable yield of this management area, which includes the Lake William Tributary Subarea and the Arrastre Creek Subarea, is estimated to be approximately 545 acre-ft/yr (Geoscience, 2004c; TH&Co, 2010b).

East Baldwin - The East Baldwin Management Area covers approximately 5,014 acres of the eastern portion of the Baldwin Lake watershed. This management area includes almost all of Baldwin Lake, which is the primary surface water feature. Most of the groundwater production in this management area is from private wells. The BBCCSD operates one well (Well 8) in the western part of the management area. The sustainable yield of this management area has been estimated to be approximately 170 acre-ft/yr (Flint and Martin, 2012).

Van Dusen – The Van Dusen management area covers approximately 4,345 acres of the northwestern part of the Baldwin Lake watershed. This management area is within the Bear Valley Basin GSA but outside of the Bear Valley Basin as defined by the CDWR. Aside from a relatively narrow band of alluvium along the Van Dusen Canyon drainage, the entire management area consists of bedrock. It is included as a management area because the BBCCSD captures water via a couple of slant wells in this area. The Van Dusen Canyon has also been investigated as a potential area for artificial recharge (Geoscience, 2004a). The sustainable yield of this management area has been estimated to be approximately 760 acre-ft/yr (Flint and Martin, 2012).

2.7.2 Monitoring Plan

A network of groundwater monitoring wells has been identified to enable the collection of groundwater levels and groundwater quality necessary to inform decisions with respect to the sustainability of the Bear Valley Basin (see Figure 2-31). Groundwater monitoring wells have been selected for each management area except Gray's Landing and Van Dusen, where no significant groundwater production is currently occurring. A detailed description of the monitoring network and monitoring plan, including data collection protocols and monitoring frequency, is provided in Section 3.5 of this GSP. The monitoring plan also includes an assessment of data gaps and a data management plan.

A subset of groundwater level monitoring features in the monitoring plan have been identified as representative monitoring sites to be relied on for the purpose of assessing progress with respect to groundwater level sustainability in the basin. The representative groundwater level monitoring sites are summarized in Table 2-7 and shown on Figure 2-31. At least one representative groundwater level monitoring site has been identified within the ten currently active management

areas. Where possible based on available wells, representative monitoring sites have been chosen with perforations exclusively in either the Middle or Lower Aquifer.

2.7.3 Coordination with Adjacent Areas

The Bear Valley Basin is an isolated, closed basin with no significant hydrologic interaction with other basins identified in CDWR Bulletin 118. The basin will be managed by one GSA, the BVBGSA. As such, coordination with adjacent basins will not be necessary.

Many of the management areas are relatively isolated hydrologically from one another and groundwater production from one has little impact on the other, despite being in relative proximity (e.g. Grout Creek, North Shore, Gray's Landing, Mill Creek, Village, Rathbone, Van Dusen, and Lake William). Minimum thresholds for the Management Areas that have the potential to be hydrologically connected to adjacent Management Areas have been selected such that, if exceeded, would not cause undesirable results in one or the other. These Management Areas include Division, West Baldwin, Erwin and East Baldwin.

Management of the Bear Valley Basin is adaptive. As management actions and projects are implemented throughout the basin and as additional data are collected through the Bear Valley Basin Monitoring Plan, minimum threshold values and measurable objectives may change. Changes to basin management to address undesirable results will be conducted through the BVBGSA.

Summary of Aquifer Properties

State Well Number	DWR Number or Well Name	Well Owner	Perforation Interval	Total Perforation Length (ft)	Year of Pumping Test	Pumping Test Type	Pumping Duration (hours)	Specific Capacity (gpm/ft)[1]	Transmissivity (gpd/ft)[2]	Hydraulic Conductivity (ft/day)[3]	Storativity
2N/01E-12	Well No. 3B	BBCCSD	130-250; 295-530; 630-790	515	2000	Constant Rate	24	35.70	24,100	6.3	0.00051
2N/02E-7	Well 8 Palomino Well	BBCCSD	90-175; 195-245; 260-360	235	2003	Constant Rate	24	23.00	35,900	20.4	N/A
2N/01E-14B	Well 9 (Greenway Park Site)	BBCCSD	200-362; 470-516	208	2003	Constant Rate	24	2.10	2,030	1.3	N/A
2N/01E-13	Well 10 (Booster Station Site)	BBCCSD	195-295; 545-620	175	2003	Constant Rate	24	4.00	4,680	3.6	N/A
N/A	Canvasback Well	BBLDWP	158-314	156	2005	Constant Rate	24	0.27	360	0.3	0.00060
N/A	Cherokee Borehole	BBLDWP	130-509	379	2005	Constant Rate	24	0.30	220	0.1	N/A
2N/01E-24J01	Maple Lane Well	BBLDWP	230-430; 440-750	510	1989	Constant Rate	24	4.65	9,700	2.5	N/A
N/A	McAlister Well	BBLDWP	130-460; 510-690	510	2004	Constant Rate	24	0.70	580	0.2	0.00003
N/A	Miralago No. 3	N/A	150-350	200	2004	Constant Rate	72	0.70	950	0.6	N/A
N/A	Moonridge Well	BBLDWP	585-910	325	2004	Constant Rate	24	0.20	110	0.05	N/A
N/A	MPA, LLC Well No.1	N/A	N/A	100	2004	Constant Rate	72	0.09	60	0.1	N/A
2N/01E-24N	Owen Well	BBLDWP	360-380; 424-534; 594-624; 760-800; 912-1,002	290	1990	Constant Rate	12	0.50	500	0.2	N/A
2N/01E-27A	Sheephorn	BBLDWP	141-291, 313-501	338	2001	Constant Rate	24	0.70	840	0.3	N/A
2N/01E-24E02	Sawmill	BBLDWP	240-530	290	2012	Constant Rate	24	2.60	5,360	2.5	N/A
N/A	Arrastre Creek Well	BBLDWP	180-265; 280-340	145	2014	Constant Rate	24	0.71	675	0.6	N/A
N/A	Seminole	BBLDWP	20-55	35	2011	Constant Rate	24	10.60	33,800	129.1	N/A

Summary of Aquifer Properties

State Well Number	DWR Number or Well Name	Well Owner	Perforation Interval	Total Perforation Length (ft)	Year of Pumping Test	Pumping Test Type	Pumping Duration (hours)	Specific Capacity (gpm/ft)[1]	Transmissivity (gpd/ft)[2]	Hydraulic Conductivity (ft/day)[3]	Storativity
N/A	Magnolia Production Well	BBLDWP	300-560; 570-650	340	2011	Constant Rate	24	3.30	7,500	2.9	0.016000
2N/01E-15C11	Division Well #2	BBLDWP	50-612	562	1977	Constant Rate	3.33	N/A	6,000	1.4	N/A
2N/01E-15C05	Division Well #5	BBLDWP	50-60; 125-152; 168-275; 307-314; 330-365; 420-430	196	1977	Constant Rate	6	1.50	5,000	3.4	N/A
2N/01E-15C10	Division Well #6	BBLDWP	50-400	350	1978	Constant Rate	4	2.06	3,200	1.2	N/A
2N/01E-21C14	Lakeplant Well #5	BBLDWP	0-50; 150-170; 190-210	90	1977	Constant Rate	240	N/A	5,210	7.7	N/A
N/A	FP-2	BBLDWP	60-120; 156-176; 216-278; 310-370	202	1987	Constant Rate	8	N/A	9,700	6.4	N/A
2N/01E-12N02	Well 1B	BBCCSD	100-312	212	1958	Constant Rate	18	7.19	20,543	13.0	N/A
2N/01E-12Q03	Well 3A	BBCCSD	91-129; 136-166	68	1987	Step-Drawdown	11.5	4.70	13,429	26.4	N/A
2N/02E-18L01	Well 2	BBCCSD	40-218	178	1957	Constant Rate	19.5	0.63	1,800	1.4	N/A
2N/01E-12M03	Well 4A	BBCCSD	42-80; 86-106	58	1987	Step-Drawdown	9	4.16	11,886	27.4	N/A
2N/02E-8Q3	8Q3	N/A	80-120	40	N/A	Constant Rate	N/A	N/A	50	0.2	0.000340
2N/02E-20	HR-2	N/A	20-110	90	1988	Constant Rate	24	0.30	400	0.6	0.000818
2N/02E-20M	20M	N/A	86-186	100	2005	Constant Rate	24	N/A	800	1.1	0.030000
2N/02E-08Q06	W-1	N/A	10-244	234	1992	Constant Rate	96	5.20	3,474	2.0	0.000135

Notes:

[1] gpm/ft = gallons per minute per foot of drawdown
[2] gpd/ft = gallons per day per foot
[3] ft/day = feet per day
[4] N/A = Not Available

Summary of Active Cleanup Sites Within the Bear Valley Basin

Geotracker Global ID	Site Type	Status	Constituent of Concern
80000973	DTSC Cleanup Site	Inactive - Needs Evaluation	NA
L10007155213	Land Disposal Site	Open - Closed/With Monitoring	None
T0607100630	LUST Cleanup Site	Open - Inactive	Gasoline, MTBE, TBA, other fuel oxygenates
T0607100283	LUST Cleanup Site	Open - Remediation	Gasoline, MTBE, TBA, other fuel oxygenates
T0607145144	LUST Cleanup Site	Open - Inactive	Gasoline, MTBE, TBA, other fuel oxygenates
T0607100237	LUST Cleanup Site	Open - Site Assessment	Gasoline
T0607124341	LUST Cleanup Site	Open - Site Assessment	Gasoline
T0607100236	LUST Cleanup Site	Open - Remediation	Gasoline
T0607100176	LUST Cleanup Site	Open - Eligible for Closure	Gasoline

Notes:

LUST = Leaking underground storage tank
DTSC = Department of Toxic Substances
MTBE = Methyl tert-butyl ether
TBA = Tertiary Butyl Alcohol
Source = https://geotracker.waterboards.ca.gov
NA = Not available

Bear Valley Basin Surface Water Budget Inflows

Date	Water Year Type	Inflows (acre-ft)							
		A	B	C	D	E	F	G	
		Precipitation on Land Surface[A]	Natural Lake Inflows		Water Supply from Wells			Spring Flow (Van Dusen and Greenspot)	Total
			Big Bear Lake[B]	Baldwin Lake	BBCCSD	BBLDWP	Private		
1990/91	Average	72,173	11,658	2,789	641	2,996	105	112	90,473
1991/92	Average	74,863	15,543	3,718	509	3,316	105	183	98,237
1992/93	Above Average	154,312	48,613	11,630	199	3,107	105	268	218,234
1993/94	Below Average	55,832	11,015	2,635	332	2,529	105	267	72,714
1994/95	Above Average	105,950	33,340	7,976	224	2,532	105	266	150,392
1995/96	Below Average	54,702	13,119	3,139	421	2,636	105	259	74,380
1996/97	Below Average	64,493	8,757	2,095	640	2,661	105	230	78,981
1997/98	Above Average	111,697	34,629	8,284	294	2,608	105	235	157,852
1998/99	Below Average	34,372	3,774	903	390	2,830	105	279	42,652
1999/00	Below Average	39,017	6,930	1,658	873	2,944	105	235	51,761
2000/01	Below Average	53,104	6,915	1,654	869	2,933	105	165	65,746
2001/02	Below Average	19,394	1,717	411	1,027	2,952	105	124	25,729
2002/03	Below Average	64,379	8,295	1,984	906	2,592	105	95	78,357
2003/04	Below Average	43,093	8,404	2,011	1,004	2,630	105	81	57,327
2004/05	Above Average	148,520	39,600	9,474	420	2,492	105	205	200,815
2005/06	Average	71,620	17,564	4,202	253	2,463	105	289	96,495
2006/07	Below Average	21,426	2,841	680	674	2,665	105	248	28,638
2007/08	Below Average	63,791	14,182	3,393	819	2,457	105	148	84,893
2008/09	Below Average	60,142	9,212	2,204	836	2,321	105	156	74,975
2009/10	Above Average	89,973	32,959	7,885	655	2,193	105	196	133,965
2010/11	Above Average	111,353	16,908	4,045	386	2,110	105	249	135,156
2011/12	Below Average	52,705	8,175	1,956	484	2,246	105	255	65,924
2012/13	Below Average	40,756	3,129	749	752	2,449	105	196	48,135
2013/14	Below Average	42,195	5,776	1,382	778	2,212	142	159	52,643
2014/15	Below Average	56,230	3,677	880	776	2,101	139	121	63,922
2015/16	Below Average	51,421	7,027	1,681	840	2,188	140	91	63,389
2016/17	Above Average	84,166	13,213	3,161	751	2,175	139	127	103,732
2017/18	Below Average	37,687	4,818	1,153	729	2,100	136	130	46,752
2018/19	Above Average	103,392	25,381	6,072	599	2,149	133	154	137,881
Average		68,371	14,385	3,441	623	2,537	112	190	89,660
Totals		1,982,755	417,171	99,802	18,078	73,584	3,237	5,520	2,600,148

Notes:

[A] Estimated based on annual precipitation rates from the Big Bear Lake Dam and Big Bear City Community Services District precipitation stations.

[B] From WSC Big Bear Lake Annual Watermaster Inflows and Outflows, 1977-2018.

[C] Losses reported by BBLDWP. Losses for BBCCSD assumed to be 10%.

Highlighted cells indicates average values.

Bear Valley Basin Surface Water Budget Outflows

Date	Water Year Type	Outflows (acre-ft)											Inflows - Outflows
		H	I	J	K	L	M	N	O	P	Q		
		Areal Recharge from Precipitation[A]	Lake Evaporation		Tributary Channel Infiltration	Return Flow	System Losses[C]	Evapo-transpiration	Big Bear Lake Withdrawals[B]	Releases at Bear Valley Dam[B]	BBARWA Discharges to Lucerne Valley	Total	
			Big Bear Lake[B]	Baldwin Lake									
1990/91	Average	5,413	9,235	3,342	773	235	418	63,398	514	79	2,551	85,957	4,515
1991/92	Average	5,615	10,714	3,342	802	255	404	63,398	404	0	2,237	87,172	11,065
1992/93	Above Average	11,573	11,716	3,342	1,653	233	374	63,398	318	11,823	3,953	108,384	109,850
1993/94	Below Average	4,187	11,784	3,342	598	193	387	63,398	428	2,049	2,801	89,168	-16,454
1994/95	Above Average	7,946	11,861	3,342	1,135	191	376	63,398	211	17,116	3,760	109,336	41,056
1995/96	Below Average	4,103	12,262	3,342	586	203	396	63,398	452	315	2,660	87,716	-13,336
1996/97	Below Average	4,837	11,456	3,342	691	210	418	63,398	417	364	2,679	87,812	-8,831
1997/98	Above Average	8,377	11,464	3,342	1,197	198	365	63,398	318	11,625	2,698	102,982	54,870
1998/99	Below Average	2,578	12,473	3,342	368	215	383	63,398	547	271	2,643	86,218	-43,566
1999/00	Below Average	2,926	11,829	3,342	418	241	417	63,398	430	511	2,550	86,062	-34,302
2000/01	Below Average	3,983	11,299	3,342	569	243	438	63,398	411	562	2,298	86,543	-20,797
2001/02	Below Average	1,455	10,375	3,342	208	249	325	63,398	391	649	2,530	82,921	-57,192
2002/03	Below Average	4,828	9,382	3,342	690	223	289	63,398	472	601	2,373	85,598	-7,241
2003/04	Below Average	3,232	9,025	3,342	462	221	365	63,398	439	715	3,292	84,491	-27,164
2004/05	Above Average	11,139	11,525	3,342	1,591	199	250	63,398	305	420	4,008	96,178	104,637
2005/06	Average	5,372	12,421	3,342	767	192	300	63,398	460	901	2,848	90,001	6,494
2006/07	Below Average	1,607	11,921	3,342	230	217	359	63,398	557	888	2,399	84,917	-56,279
2007/08	Below Average	4,784	11,460	3,342	683	570	299	63,398	289	576	2,699	88,101	-3,208
2008/09	Below Average	4,511	11,233	3,342	644	224	312	63,398	414	740	2,247	87,065	-12,090
2009/10	Above Average	6,748	11,374	3,342	964	71	202	63,398	300	2,969	3,059	92,427	41,537
2010/11	Above Average	8,351	12,028	3,342	1,193	13	179	63,398	609	8,040	3,568	100,721	34,435
2011/12	Below Average	3,953	12,503	3,342	565	202	250	63,398	755	1,116	2,592	88,675	-22,751
2012/13	Below Average	3,057	11,645	3,342	437	283	278	63,398	542	1,626	1,966	86,574	-38,439
2013/14	Below Average	3,165	10,942	3,342	452	318	283	63,398	372	1,014	1,892	85,178	-32,535
2014/15	Below Average	4,217	9,709	3,342	602	320	285	63,398	561	721	1,973	85,128	-21,206
2015/16	Below Average	3,857	9,309	3,342	551	303	293	63,398	445	904	2,134	84,535	-21,147
2016/17	Above Average	6,312	9,777	3,342	902	0	286	63,398	413	664	2,711	87,806	15,926
2017/18	Below Average	2,827	9,391	3,342	404	345	286	63,398	491	900	2,000	83,382	-36,630
2018/19	Above Average	7,754	10,079	3,342	1,108	231	275	63,398	508	446	2,704	89,845	48,035
Average		5,128	11,041	3,342	733	227	327	63,398	440	2,366	2,684	89,686	-26
Totals		148,707	320,192	96,921	21,244	6,597	9,491	1,838,542	12,773	68,605	77,824	2,600,895	-747

Notes:

[A] Estimated based on annual precipitation rates from the Big Bear Lake Dam and Big Bear City Community Services District precipitation stations.

[B] From WSC Big Bear Lake Annual Watermaster Inflows and Outflows, 1977-2019.

[C] Losses reported by BBLDWP. Losses for BBCCSD assumed to be 10%.

Bear Valley Basin Groundwater Budget

Date	Water Year Type	Inflows (acre-ft)					Outflows (acre-ft)					Change in Storage
		A	B	C	D		E	F	G	H		
		Areal Recharge from Precipitation[A]	Tributary Channel Infiltration	Return Flow	System Losses[B]	Total	Groundwater Pumping			ET	Total	
							BBCCSD	BBLDWP	Other[C]			
1990/91	Average	5,413	773	235	418	6,838	641	2,996	105	1,130	4,871	1,967
1991/92	Average	5,615	802	255	404	7,076	509	3,316	105	1,172	5,101	1,975
1992/93	Above Average	11,573	1,653	233	374	13,833	199	3,107	105	2,416	5,827	8,006
1993/94	Below Average	4,187	598	193	387	5,366	332	2,529	105	874	3,839	1,526
1994/95	Above Average	7,946	1,135	191	376	9,648	224	2,532	105	1,659	4,519	5,129
1995/96	Below Average	4,103	586	203	396	5,288	421	2,636	105	857	4,017	1,270
1996/97	Below Average	4,837	691	210	418	6,156	640	2,661	105	1,010	4,415	1,741
1997/98	Above Average	8,377	1,197	198	365	10,137	294	2,608	105	1,749	4,756	5,381
1998/99	Below Average	2,578	368	215	383	3,544	390	2,830	105	538	3,863	-319
1999/00	Below Average	2,926	418	241	417	4,002	873	2,944	105	611	4,532	-530
2000/01	Below Average	3,983	569	243	438	5,233	869	2,933	105	831	4,739	494
2001/02	Below Average	1,455	208	249	325	2,236	1027	2,952	105	304	4,387	-2,151
2002/03	Below Average	4,828	690	223	289	6,030	906	2,592	105	1,008	4,611	1,419
2003/04	Below Average	3,232	462	221	365	4,279	1004	2,630	105	675	4,413	-134
2004/05	Above Average	11,139	1,591	199	250	13,180	420	2,492	105	2,325	5,342	7,838
2005/06	Average	5,372	767	192	300	6,631	253	2,463	105	1,121	3,941	2,690
2006/07	Below Average	1,607	230	217	359	2,413	674	2,665	105	335	3,779	-1,366
2007/08	Below Average	4,784	683	570	299	6,337	819	2,457	105	999	4,379	1,958
2008/09	Below Average	4,511	644	224	312	5,691	836	2,321	105	942	4,204	1,487
2009/10	Above Average	6,748	964	71	202	7,985	655	2,193	105	1,409	4,361	3,624
2010/11	Above Average	8,351	1,193	13	179	9,736	386	2,110	105	1,744	4,345	5,391
2011/12	Below Average	3,953	565	202	250	4,969	484	2,246	105	825	3,659	1,310
2012/13	Below Average	3,057	437	283	278	4,055	752	2,449	105	638	3,944	111
2013/14	Below Average	3,165	452	318	283	4,218	778	2,212	142	661	3,792	426
2014/15	Below Average	4,217	602	320	285	5,424	776	2,101	139	880	3,896	1,529
2015/16	Below Average	3,857	551	303	293	5,003	840	2,188	140	805	3,974	1,030
2016/17	Above Average	6,312	902	0	286	7,500	751	2,175	139	1,318	4,383	3,117
2017/18	Below Average	2,827	404	345	286	3,861	729	2,100	136	590	3,554	306
2018/19	Above Average	7,754	1,108	231	275	9,368	599	2,149	133	1,619	4,501	4,867
Average		5,128	733	227	327	6,415	623	2,537	112	1,071	4,343	2,072
Totals		148,707	21,244	6,597	9,491	186,038	18,078	73,584	3,237	31,045	125,945	

Cumulative Change in Storage: 60,093

Notes:

[A] Estimated based on annual precipitation rates from the Big Bear Lake Dam and Big Bear City Community Services District precipitation stations.

[B] Losses reported by BBLDWP. Losses for BBCCSD assumed to be 10%.

[C] Estimated based on per capita water use. Assumes three people per household.

Projected Future Bear Valley Basin Surface Water Budget

Date	Inflows (acre-ft)								Outflows (acre-ft)										
	A	B	C	D	E	F	G		H	I	J	K	L	M	N	O	P	Q	
	Precipitation on Land Surface[A]	Natural Lake Inflows		Water Supply from Wells			Spring Flow (Van Dusen and Greenspot)	Total	Areal Recharge from Precipitation[A]	Lake Evaporation		Tributary Channel Infiltration	Return Flow	System Losses[C]	Evapotranspiration	Big Bear Lake Withdrawals[B]	Releases at Bear Valley Dam[B]	BBARWA Discharges to Lucerne Valley	Total
		Big Bear Lake[B]	Baldwin Lake	BBCCSD	BBLDWP	Private				Big Bear Lake[B]	Baldwin Lake								
2019/20	72,173	14,000	3,300	1,035	2,150	112	190	92,960	5,052	11,100	3,300	1,108	230	330	63,400	440	2,400	2,700	90,060
2020/21	74,646	12,241	2,928	1,035	2,150	112	200	93,312	5,225	9,272	2,928	812	230	330	63,651	440	2,400	2,700	87,989
2021/22	153,417	15,388	3,681	1,035	2,150	112	188	175,971	10,739	10,799	3,681	794	230	330	63,903	440	2,400	2,700	96,016
2022/23	55,346	49,585	11,863	1,035	2,150	112	194	120,285	3,874	11,855	11,863	1,686	230	330	64,154	440	2,400	2,700	99,533
2023/24	104,721	10,905	2,609	1,035	2,150	112	188	121,720	7,330	11,971	2,609	592	230	330	64,406	440	2,400	2,700	93,008
2024/25	53,909	32,673	7,817	1,035	2,150	112	186	97,882	3,774	12,096	7,817	1,112	230	330	64,657	440	2,400	2,700	95,556
2025/26	63,371	13,381	3,201	1,086	2,258	112	194	83,604	4,436	12,554	3,201	598	230	330	64,908	440	2,400	2,859	91,956
2026/27	109,429	8,582	2,053	1,086	2,258	112	186	123,706	7,660	11,774	2,053	677	230	330	65,160	440	2,400	2,859	93,583
2027/28	33,574	33,590	8,036	1,086	2,258	112	184	78,840	2,350	11,828	8,036	1,161	230	330	65,411	440	2,400	2,859	95,045
2028/29	37,999	3,812	912	1,086	2,258	112	192	46,370	2,660	12,918	912	372	230	330	65,663	440	2,400	2,859	88,784
2029/30	51,564	7,277	1,741	1,086	2,258	112	200	64,236	3,609	12,298	1,741	439	230	330	65,914	440	2,400	2,859	90,260
2030/31	18,775	6,984	1,671	1,140	2,371	112	192	31,245	1,314	11,792	1,671	575	230	330	66,165	440	2,400	3,026	87,943
2031/32	62,139	1,700	407	1,140	2,371	112	188	68,056	4,350	10,869	407	206	230	330	66,417	440	2,400	3,026	88,674
2032/33	41,468	7,714	1,846	1,140	2,371	112	177	54,828	2,903	9,866	1,846	641	230	330	66,668	440	2,400	3,026	88,350
2033/34	142,490	8,824	2,111	1,140	2,371	112	200	157,248	9,974	9,526	2,111	485	230	330	66,920	440	2,400	3,026	95,442
2034/35	68,505	38,808	9,284	1,140	2,371	112	186	120,406	4,795	12,210	9,284	1,559	230	330	67,171	440	2,400	3,026	101,446
2035/36	20,432	17,037	4,076	1,196	2,490	112	184	45,527	1,430	13,209	4,076	744	230	330	67,422	440	2,400	3,201	93,483
2036/37	60,646	2,841	680	1,196	2,490	112	190	68,154	4,245	12,725	680	230	230	330	67,674	440	2,400	3,201	92,154
2037/38	57,002	14,891	3,562	1,196	2,490	112	200	79,453	3,990	12,278	3,562	718	230	330	67,925	440	2,400	3,201	95,074
2038/39	85,015	9,028	2,160	1,196	2,490	112	186	100,187	5,951	12,079	2,160	631	230	330	68,176	440	2,400	3,201	95,599
2039/40	104,894	33,948	8,121	1,196	2,490	112	196	150,957	7,343	12,276	8,121	993	230	330	68,428	440	2,400	3,201	103,762
2040/41	64,363	6,568	1,571	1,196	2,490	112	190	76,491	4,505	12,943	1,571	400	230	330	68,437	440	2,400	3,201	94,457
2041/42	105,575	25,470	6,093	1,196	2,490	112	192	141,129	7,390	12,011	6,093	909	230	330	68,446	440	2,400	3,201	101,451
2042/43	50,711	28,465	6,810	1,196	2,490	112	154	89,937	3,550	12,964	6,810	972	230	330	68,456	440	2,400	3,201	99,353
2043/44	49,552	8,666	2,073	1,196	2,490	112	152	64,240	3,469	12,645	2,073	472	230	330	68,465	440	2,400	3,201	93,725
2044/45	71,395	8,832	2,113	1,196	2,490	112	179	86,317	4,998	12,440	2,113	611	230	330	68,474	440	2,400	3,201	95,237
2045/46	37,923	13,536	3,238	1,196	2,490	112	186	58,682	2,655	12,438	3,238	657	230	330	68,483	440	2,400	3,201	94,072
2046/47	29,432	7,765	1,858	1,196	2,490	112	184	43,036	2,060	11,688	1,858	437	230	330	68,493	440	2,400	3,201	91,136
2047/48	31,693	3,459	827	1,196	2,490	112	144	39,922	2,219	12,059	827	304	230	330	68,502	440	2,400	3,201	90,512
2048/49	34,545	4,868	1,165	1,196	2,490	112	186	44,561	2,418	11,986	1,165	392	230	330	68,511	440	2,400	3,201	91,073
2049/50	67,915	5,001	1,196	1,196	2,490	112	196	78,106	4,754	10,313	1,196	412	230	330	68,520	440	2,400	3,201	91,796
2050/51	70,438	10,725	2,566	1,196	2,490	112	175	87,702	4,931	9,982	2,566	711	230	330	68,530	440	2,400	3,201	93,321
2051/52	145,177	16,786	4,016	1,196	2,490	112	205	169,983	10,162	11,582	4,016	866	230	330	68,539	440	2,400	3,201	101,767
2052/53	52,521	44,238	10,583	1,196	2,490	112	173	111,313	3,676	12,667	10,583	1,505	230	330	68,548	440	2,400	3,201	103,581
2053/54	99,657	10,134	2,424	1,196	2,490	112	175	116,188	6,976	12,743	2,424	550	230	330	68,557	440	2,400	3,201	97,852
2054/55	51,448	36,341	8,694	1,196	2,490	112	207	100,487	3,601	12,828	8,694	1,237	230	330	68,567	440	2,400	3,201	101,528
2055/56	60,649	12,594	3,013	1,196	2,490	112	182	80,237	4,245	13,263	3,013	563	230	330	68,576	440	2,400	3,201	96,261
2056/57	105,028	8,144	1,948	1,196	2,490	112	177	119,095	7,352	12,393	1,948	643	230	330	68,585	440	2,400	3,201	97,522
2057/58	32,316	32,205	7,705	1,196	2,490	112	177	76,200	2,262	12,403	7,705	1,113	230	330	68,594	440	2,400	3,201	98,678
2058/59	36,680	4,227	1,011	1,196	2,490	112	213	45,929	2,568	13,497	1,011	412	230	330	68,604	440	2,400	3,201	92,693
2059/60	49,917	6,445	1,542	1,196	2,490	112	177	61,879	3,494	12,802	1,542	389	230	330	68,613	440	2,400	3,201	93,440
2060/61	18,228	5,532	1,323	1,196	2,490	112	152	29,034	1,276	12,230	1,323	455	230	330	68,622	440	2,400	3,201	90,508
2061/62	18,228	1,305	312	1,196	2,490	112	144	23,788	1,276	11,231	312	158	230	330	68,632	440	2,400	3,201	88,210

Projected Future Bear Valley Basin Surface Water Budget

Date	Inflows (acre-ft)								Outflows (acre-ft)										
	A	B	C	D	E	F	G		H	I	J	K	L	M	N	O	P	Q	
	Precipitation on Land Surface[A]	Natural Lake Inflows		Water Supply from Wells			Spring Flow (Van Dusen and Greenspot)	Total	Areal Recharge from Precipitation[A]	Lake Evaporation		Tributary Channel Infiltration	Return Flow	System Losses[C]	Evapotranspiration	Big Bear Lake Withdrawals[B]	Releases at Bear Valley Dam[B]	BBARWA Discharges to Lucerne Valley	Total
		Big Bear Lake[B]	Baldwin Lake	BBCCSD	BBLDWP	Private				Big Bear Lake[B]	Baldwin Lake								
2062/63	60,504	7,963	1,905	1,196	2,490	112	182	74,352	4,235	10,158	1,905	662	230	330	68,641	440	2,400	3,201	92,202
2063/64	40,494	8,152	1,950	1,196	2,490	112	184	54,579	2,835	9,772	1,950	448	230	330	68,650	440	2,400	3,201	90,256
2064/65	139,549	39,996	9,568	1,196	2,490	112	192	193,104	9,768	12,481	9,568	1,607	230	330	68,659	440	2,400	3,201	108,685
2065/66	67,287	16,686	3,992	1,196	2,490	112	181	91,943	4,710	13,453	3,992	729	230	330	68,669	440	2,400	3,201	98,154
2066/67	20,127	3,324	795	1,196	2,490	112	222	28,267	1,409	12,913	795	269	230	330	68,678	440	2,400	3,201	90,665
2067/68	59,919	12,197	2,918	1,196	2,490	112	163	78,994	4,194	12,416	2,918	588	230	330	68,687	440	2,400	3,201	95,404
2068/69	56,485	9,028	2,160	1,196	2,490	112	186	71,657	3,954	12,171	2,160	631	230	330	68,696	440	2,400	3,201	94,214
2069/70	84,493	28,674	6,860	1,196	2,490	112	165	123,991	5,915	12,326	6,860	839	230	330	68,706	440	2,400	3,201	101,246
Average	64,388	15,108	3,614	1,161	2,416	112	184	86,982	4,507	11,963	3,614	707	230	330	67,477	440	2,400	3,091	94,759

Notes:

[A] Estimated based on annual precipitation rates from the Big Bear Lake Dam and Big Bear City Community Services District precipitation stations.

[B] From WSC Big Bear Lake Annual Watermaster Inflows and Outflows, 1977-2018.

[C] Losses reported by BBLDWP. Losses for BBCCSD assumed to be 10%.

Projected Future Bear Valley Basin Groundwater Budget

Date	Inflows (acre-ft)					Outflows (acre-ft)					Change in Storage
	A	B	C	D		E	F	G	H		
	Areal Recharge from Precipitation[A]	Tributary Channel Infiltration	Return Flow	System Losses[B]	Total	Groundwater Pumping			ET	Total	
						BBCCSD	BBLDWP	Other[C]			
2019/20	5,052	1,108	230	330	6,720	1,185	2,147	112	1,071	4,515	2,205
2020/21	5,225	812	230	330	6,597	1,185	2,147	112	1,075	4,519	2,078
2021/22	10,739	794	230	330	12,093	1,185	2,147	112	1,079	4,523	7,570
2022/23	3,874	1,686	230	330	6,121	1,185	2,147	112	1,084	4,528	1,593
2023/24	7,330	592	230	330	8,483	1,185	2,147	112	1,088	4,532	3,951
2024/25	3,774	1,112	230	330	5,446	1,185	2,147	112	1,092	4,536	910
2025/26	4,436	598	230	330	5,594	1,185	2,147	112	1,096	4,540	1,053
2026/27	7,660	677	230	330	8,897	1,185	2,147	112	1,101	4,545	4,352
2027/28	2,350	1,161	230	330	4,071	1,185	2,147	112	1,105	4,549	-478
2028/29	2,660	372	230	330	3,592	1,185	2,147	112	1,109	4,553	-961
2029/30	3,609	439	230	330	4,608	1,185	2,147	112	1,113	4,557	51
2030/31	1,314	575	230	330	2,449	1,206	2,164	112	1,118	4,600	-2,151
2031/32	4,350	206	230	330	5,115	1,206	2,164	112	1,122	4,604	511
2032/33	2,903	641	230	330	4,104	1,206	2,164	112	1,126	4,608	-504
2033/34	9,974	485	230	330	11,019	1,206	2,164	112	1,130	4,612	6,407
2034/35	4,795	1,559	230	330	6,915	1,206	2,164	112	1,135	4,617	2,298
2035/36	1,430	744	230	330	2,735	1,227	2,190	112	1,139	4,668	-1,933
2036/37	4,245	230	230	330	5,035	1,227	2,190	112	1,143	4,672	363
2037/38	3,990	718	230	330	5,268	1,227	2,190	112	1,147	4,676	591
2038/39	5,951	631	230	330	7,143	1,227	2,190	112	1,152	4,681	2,462
2039/40	7,343	993	230	330	8,896	1,227	2,190	112	1,156	4,685	4,211
2040/41	4,505	400	230	330	5,465	1,249	2,231	112	1,156	4,748	717
2041/42	7,390	909	230	330	8,859	1,249	2,231	112	1,156	4,748	4,111
2042/43	3,550	972	230	330	5,082	1,249	2,231	112	1,156	4,748	333
2043/44	3,469	472	230	330	4,501	1,249	2,231	112	1,157	4,749	-248
2044/45	4,998	611	230	330	6,169	1,249	2,231	112	1,157	4,749	1,420
2045/46	2,655	657	230	330	3,871	1,271	2,283	112	1,157	4,823	-952
2046/47	2,060	437	230	330	3,057	1,271	2,283	112	1,157	4,823	-1,766
2047/48	2,219	304	230	330	3,083	1,271	2,283	112	1,157	4,823	-1,741

Projected Future Bear Valley Basin Groundwater Budget

Date	Inflows (acre-ft)					Outflows (acre-ft)					Change in Storage
	A	B	C	D		E	F	G	H		
	Areal Recharge from Precipitation[A]	Tributary Channel Infiltration	Return Flow	System Losses[B]	Total	Groundwater Pumping			ET	Total	
						BBCCSD	BBLDWP	Other[C]			
2048/49	2,418	392	230	330	3,370	1,271	2,283	112	1,157	4,823	-1,453
2049/50	4,754	412	230	330	5,726	1,271	2,283	112	1,157	4,823	903
2050/51	4,931	711	230	330	6,202	1,271	2,283	112	1,158	4,824	1,378
2051/52	10,162	866	230	330	11,589	1,271	2,283	112	1,158	4,824	6,765
2052/53	3,676	1,505	230	330	5,741	1,271	2,283	112	1,158	4,824	917
2053/54	6,976	550	230	330	8,086	1,271	2,283	112	1,158	4,824	3,262
2054/55	3,601	1,237	230	330	5,399	1,271	2,283	112	1,158	4,824	574
2055/56	4,245	563	230	330	5,368	1,271	2,283	112	1,158	4,824	544
2056/57	7,352	643	230	330	8,555	1,271	2,283	112	1,159	4,825	3,730
2057/58	2,262	1,113	230	330	3,935	1,271	2,283	112	1,159	4,825	-890
2058/59	2,568	412	230	330	3,540	1,271	2,283	112	1,159	4,825	-1,285
2059/60	3,494	389	230	330	4,443	1,271	2,283	112	1,159	4,825	-382
2060/61	1,276	455	230	330	2,291	1,271	2,283	112	1,159	4,825	-2,534
2061/62	1,276	158	230	330	1,994	1,271	2,283	112	1,159	4,825	-2,831
2062/63	4,235	662	230	330	5,457	1,271	2,283	112	1,160	4,826	632
2063/64	2,835	448	230	330	3,842	1,271	2,283	112	1,160	4,826	-983
2064/65	9,768	1,607	230	330	11,936	1,271	2,283	112	1,160	4,826	7,110
2065/66	4,710	729	230	330	5,999	1,271	2,283	112	1,160	4,826	1,173
2066/67	1,409	269	230	330	2,238	1,271	2,283	112	1,160	4,826	-2,589
2067/68	4,194	588	230	330	5,342	1,271	2,283	112	1,160	4,826	516
2068/69	3,954	631	230	330	5,145	1,271	2,283	112	1,160	4,826	319
2069/70	5,915	839	230	330	7,313	1,271	2,283	112	1,161	4,827	2,487
Average	4,507	707	230	330	5,774	1,240	2,228	112	1,140	4,719	1,055
									Cumulative Change in Storage:		36,453

Notes:

[A] Estimated based on annual precipitation rates from the Big Bear Lake Dam and Big Bear City Community Services District precipitation stations.

[B] Losses reported by BBLDWP. Losses for BBCCSD assumed to be 10%.

[C] Estimated based on per capita water use. Assumes three people per household.

Summary of Representative Monitoring Sites (RMS)

Watershed	Management Area	Well Name	RMS Well	X Coordinate (UTM83)	Y Coordinate (UTM83)	Perforation Interval	Aquifer Monitored	Period of Historical Record
Big Bear Lake	Grout Creek	Cherokee Well	Yes	504836.77	3791997.54	130-590	Middle	2013 - 2019
Big Bear Lake	Grout Creek	Seminole	Yes	504963.02	3791800.43	20-55	Middle	1996 - 2019
Big Bear Lake	North Shore	FP-2	Yes	506126.45	3791375.63	60-120; 156-176; 216-278; 310-370	Middle	2014 - 2019
Big Bear Lake	North Shore	RV Park #1	Yes	508012.79	3791011.24	123-183	Middle	1996 - 2019
Big Bear Lake	North Shore	Stanfield Well	No	510627.54	3791036.03	40-150	Upper	1986 - 2019
Big Bear Lake	Division	Hillendale Monitoring Well	Yes	512681.78	3791295.26	65-114	Middle	1990 - 2019
Big Bear Lake	Division	Airport Well	No	513498.59	3791523.88	100-150	Upper	1987 - 2019
Big Bear Lake	Division	Division Well #4	Yes	512212.18	3791177.06	50-475	Middle	1993 - 2019
Big Bear Lake	Division	Riffenburgh Well	No	512057.68	3791015.29	96-466	Composite	2003 - 2019
Big Bear Lake	Division	McAlister Deep Monitoring Well	Yes	512305.87	3789711.98	490-690	Lower	2004 - 2019
Big Bear Lake	Division	McAlister Shallow Monitoring Well	Yes	512305.87	3789711.98	96-446	Middle	2004 - 2019
Big Bear Lake	Division	La Crescenta	No	513892.59	3788634.39	292-342; 366-386; 410-510; 532-552; 556-576	Lower	1993 - 2019
Baldwin Lake	West Baldwin	Van Dusen 1	No	513446.73	3792292.60	N/A	N/A	2006 - 2019
Baldwin Lake	West Baldwin	Greenway Monitoring Well	Yes	514206.20	3791472.21	0-109	Middle	1990 - 2019
Baldwin Lake	West Baldwin	Maltby Monitoring Well	Yes	515123.65	3791763.95	0-72	Middle	1990 - 2019
Baldwin Lake	West Baldwin	Sawmill Canyon	No	514831.83	3789079.54	240-530	Lower	1988 - 2015
Baldwin Lake	West Baldwin	Magnolia Monitoring Well	No	515636.97	3789195.60	300-700	Lower	2005 - 2019
Baldwin Lake	East Baldwin	CSD Well #8	Yes	516995.11	3791852.81	90-175; 195-245; 260-360	Composite	2003 - 2019
Baldwin Lake	Erwin	Vaqueros Monitoring Well	Yes	517535.45	3790086.24	N/A	Middle	1990 - 2019
Baldwin Lake	Erwin	Maple Well	Yes	516125.14	3788987.27	230-430; 440-750	Lower	1990 - 2019
Baldwin Lake	Erwin	Erwin Monitoring Well	No	517997.59	3788718.85	120-320	Composite	1987 - 2019
Baldwin Lake	Lake Williams	Monte Vista Monitoring Well	Yes	521094.65	3787921.43	65-105	Middle	2003 - 2019

Summary of Representative Monitoring Sites (RMS)

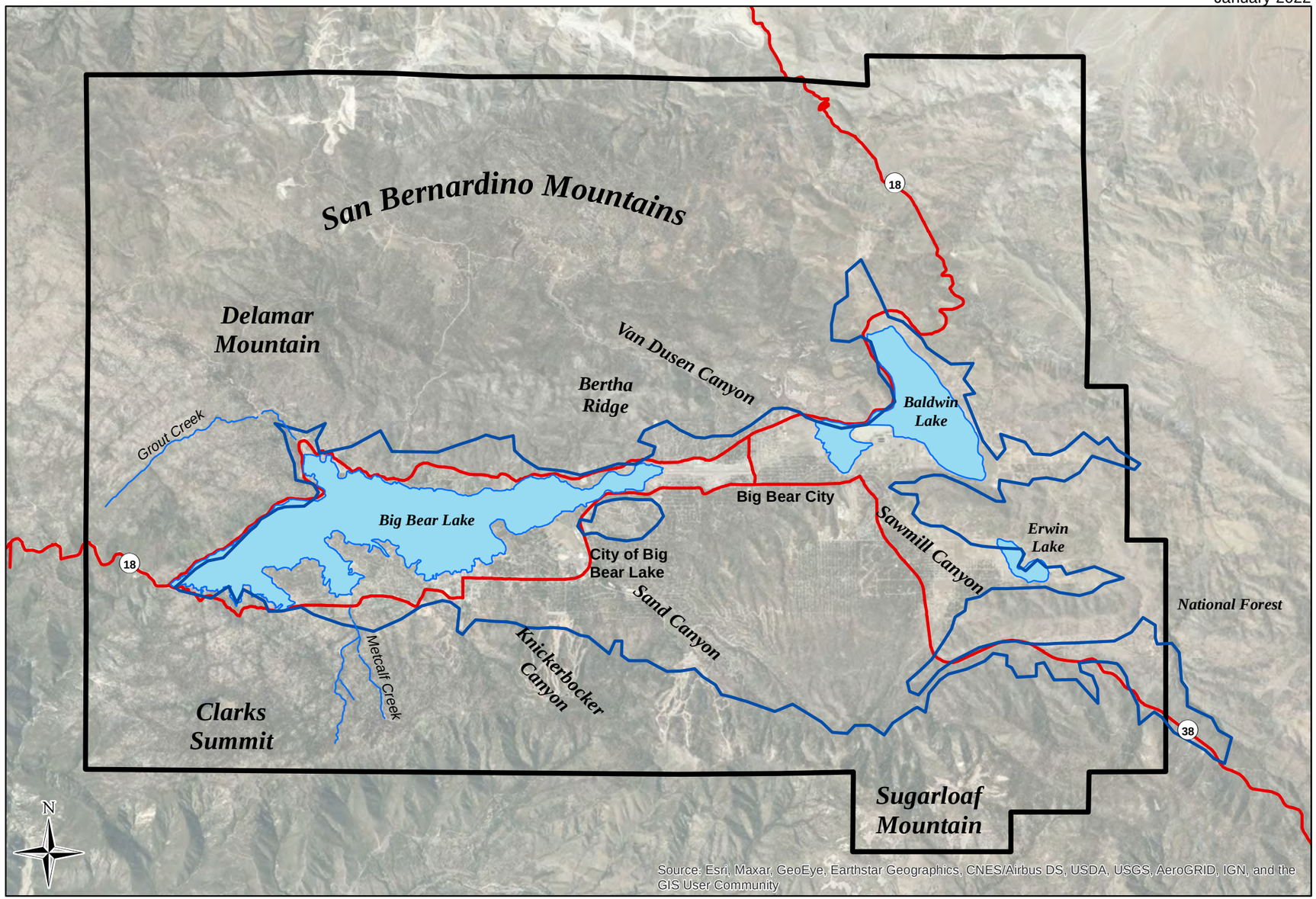
Watershed	Management Area	Well Name	RMS Well	X Coordinate (UTM83)	Y Coordinate (UTM83)	Perforation Interval	Aquifer Monitored	Period of Historical Record
Baldwin Lake	Lake Williams	Camp Oakes Monitoring Well	No	521462.96	3787961.08	80-205	Upper	2003 - 2019
Baldwin Lake	Arrastre	Arrastre Creek Well	No	522635.50	3787562.31	180-265; 280-340	Upper	N/A
Big Bear Lake	Rathbone	Treatment Plant Monitoring Well	No	509951.24	3790268.52	30-150	Upper	1986 - 2020
Big Bear Lake	Rathbone	Rathbun Well (DWP Yard)	Yes	510444.15	3789546.72	N/A	N/A	1986 - 2020
Big Bear Lake	Rathbone	Elm Monitoring Well	No	511499.27	3788957.90	50-123	Middle	1990 - 2019
Big Bear Lake	Rathbone	Moonridge Shallow Well	No	511706.26	3788875.84	80-160	Upper	2003 - 2019
Big Bear Lake	Rathbone	Moonridge Deep Well	No	511706.26	3788875.84	730-820	Lower	2003 - 2012
Big Bear Lake	Rathbone	Sand Canyon #1	Yes	512815.56	3787948.06	50-325	Composite	1993 - 2019
Big Bear Lake	Village	Knickerbocker Well	No	508234.51	3789193.42	220-775	Lower	1989 - 2019
Big Bear Lake	Village	Oak Well	Yes	509515.23	3788737.42	70-110; 144-154; 170-290; 312-352	N/A	1993 - 2019
Big Bear Lake	Mill Creek	Mallard Lane Deep Monitoring Well	Yes	506458.72	3789609.64	500-620	Lower	2003 - 2019
Big Bear Lake	Mill Creek	Mallard Lane Shallow Monitoring Well	Yes	506458.72	3789609.64	100-435	Middle	2003 - 2019
Big Bear Lake	Mill Creek	Canvasback Deep Monitoring Well	Yes	506132.96	3789435.20	415-485	Lower	2003 - 2019
Big Bear Lake	Mill Creek	Canvasback Shallow Monitoring Well	Yes	506132.96	3789435.20	160-315	Upper	2003 - 2019
Big Bear Lake	Mill Creek	Metcalf Monitoring Well	No	505864.26	3788646.59	45-185	Upper	1986 - 2019

Note:

N/A = Not available

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Drainage Creek
- Highway

Regional Map

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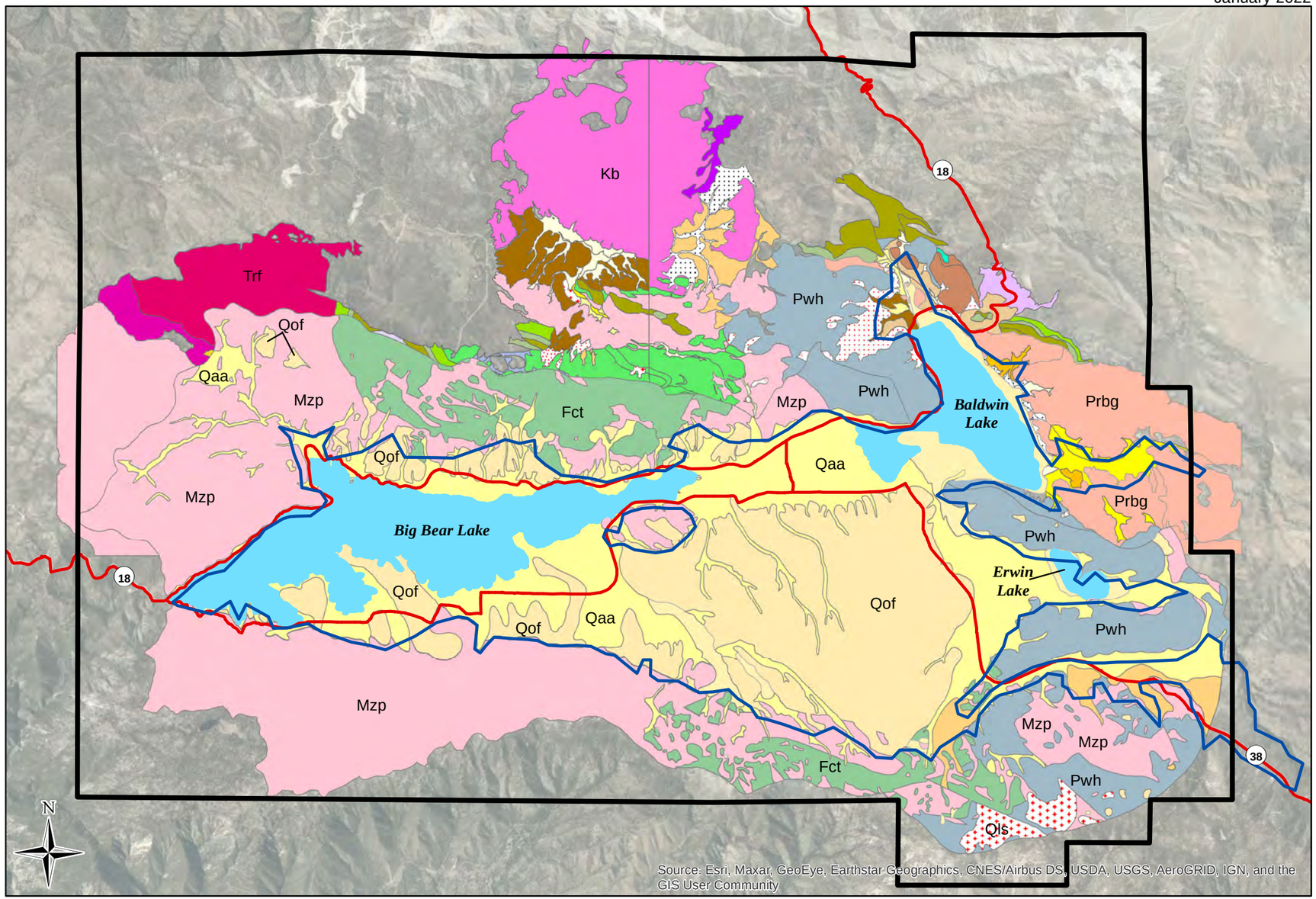
Bear Valley Basin

Figure 2-1

Bear Valley Basin Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Geologic Units

- Qaa — Quarternary Alluvium
- Qls — Land Slide Deposits
- Qof — Old Deposits of Alluvial Fans
- Kb — Monzogranite of John Bull Flat
- Mzp — Undifferentiated Mesozoic Granitic Rocks
- Tfr — Monzonite of Fawnskin
- Fct — Undifferentiated Carbonate Rocks of Sadler, 1981
- Pwh — Quartzite of Wildhorse Meadows
- Prbg — Baldwin Gneiss
- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Big Bear Municipal Water District
- Highway

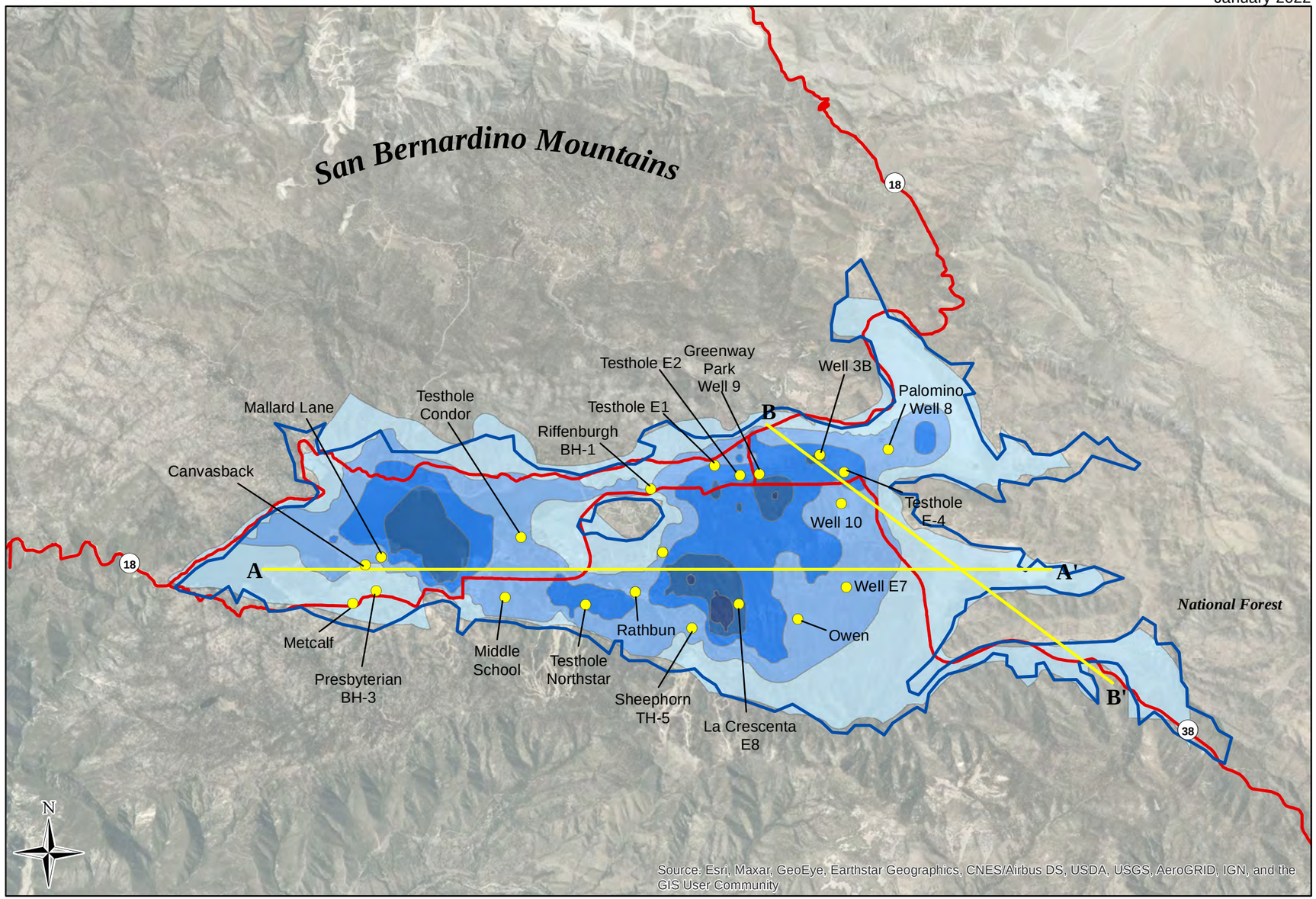
Thomas Harder & Co. Groundwater Consulting

Bear Valley Basin Geology Map

Figure 2-2

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

- Control Well
- Alluvial Thickness (ft bgs)
  - 0 to 500
  - 500 to 1,000
  - 1,000 to 1,500
  - 1,500 to 2,000
  - Greater than 2,000
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Cross Section
- Highway

Alluvial thickness after USGS, 2012, Geohydrology of Big Bear Valley, California. Thickness of alluvial deposits is based on gravity data.

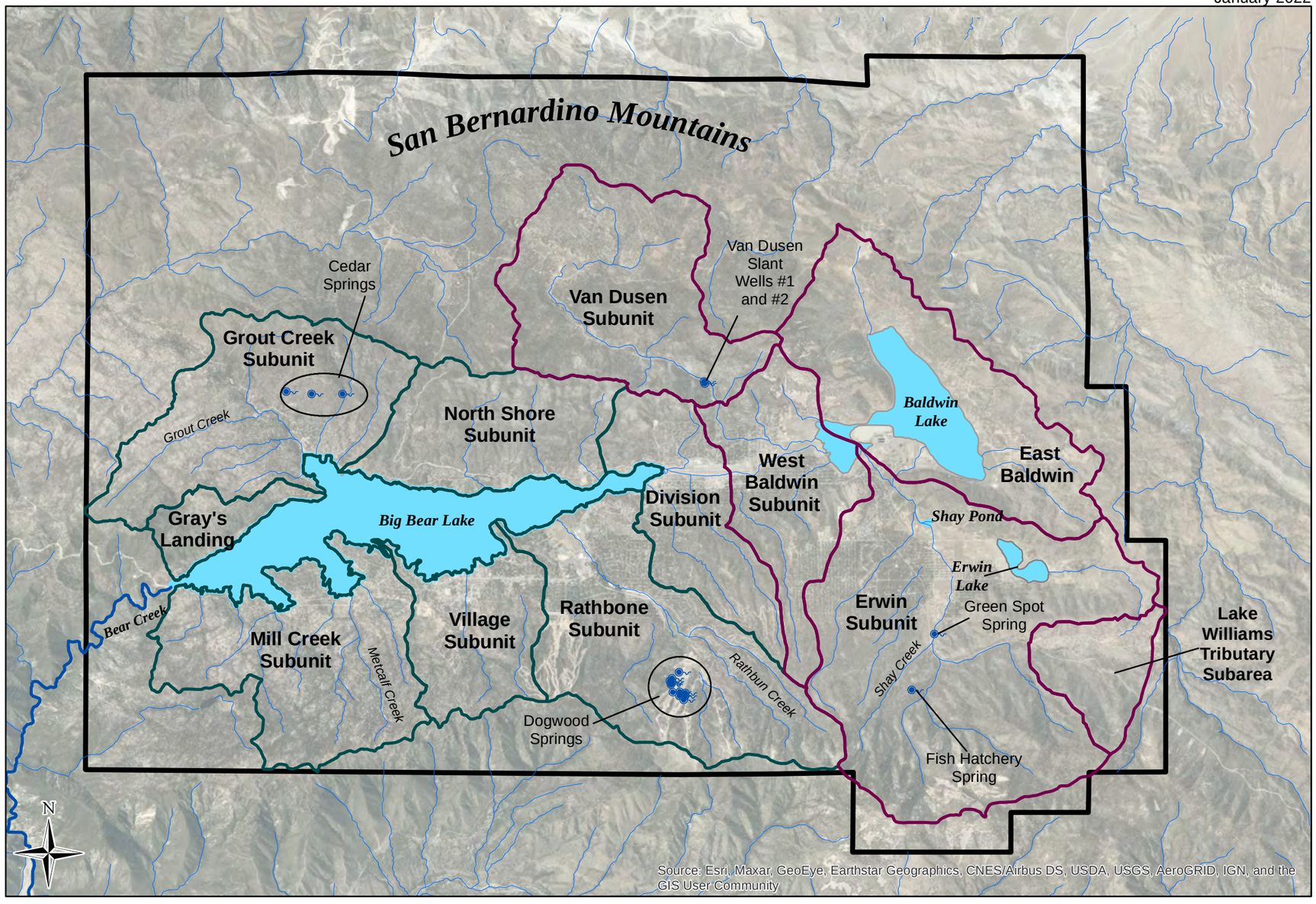
Thomas Harder & Co. Groundwater Consulting

Groundwater Basin Alluvial Thickness

Figure 2-3

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Spring / Slant Well
- Major Hydrologic Feature
- Drainage/Creek
- Baldwin Lake Watershed
- Big Bear Lake Watershed
- Bear Valley Basin Groundwater Sustainability Agency Boundary

0 0.5 1 2 Miles

NAD 83 UTM Zone 11

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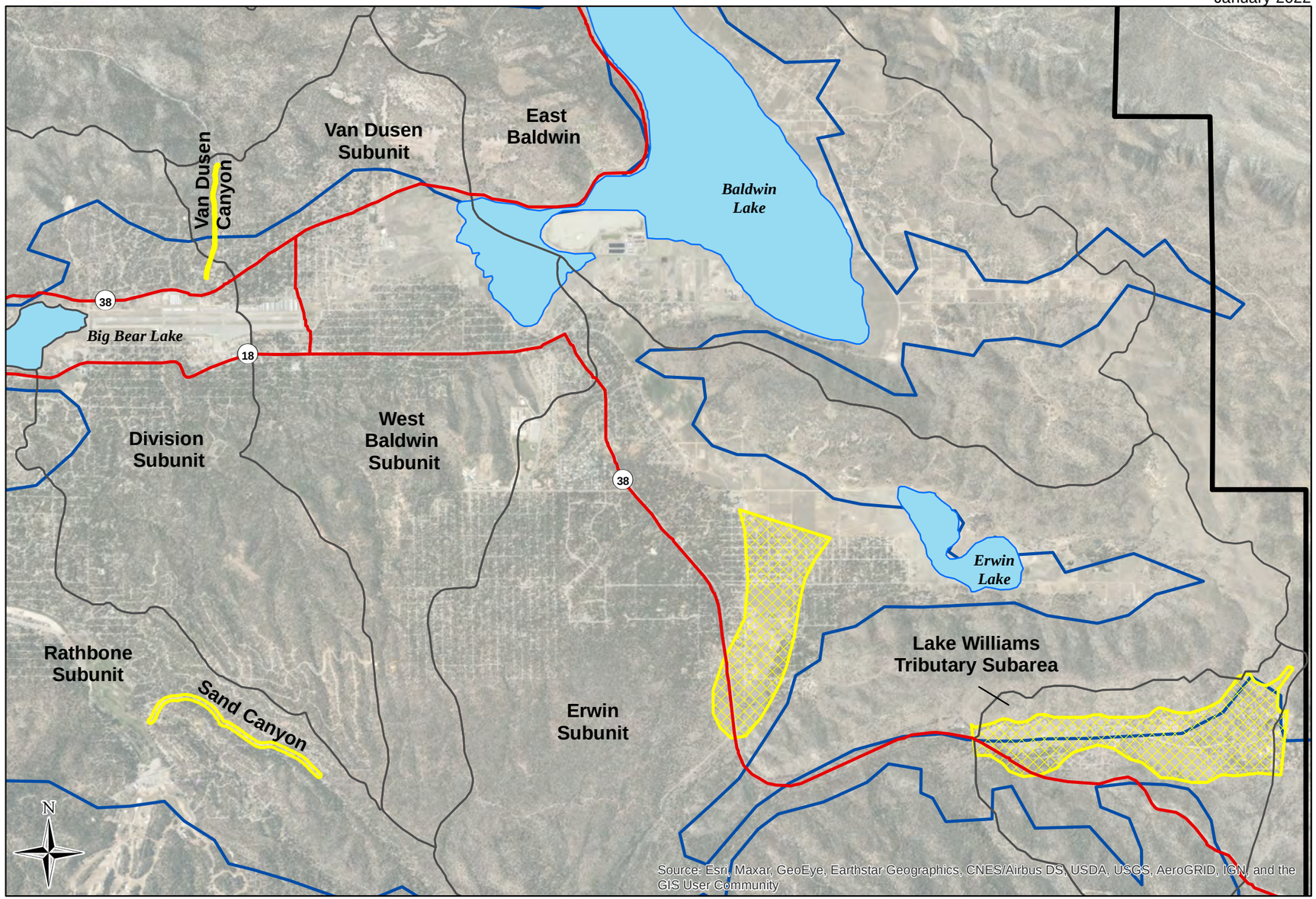
Bear Valley Basin
Surface Water Features

Figure 2-4

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Area of Favorable Recharge
- Hydrologic Subunit
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Highway

0 0.5 1 2 Miles

NAD 83 UTM Zone 11

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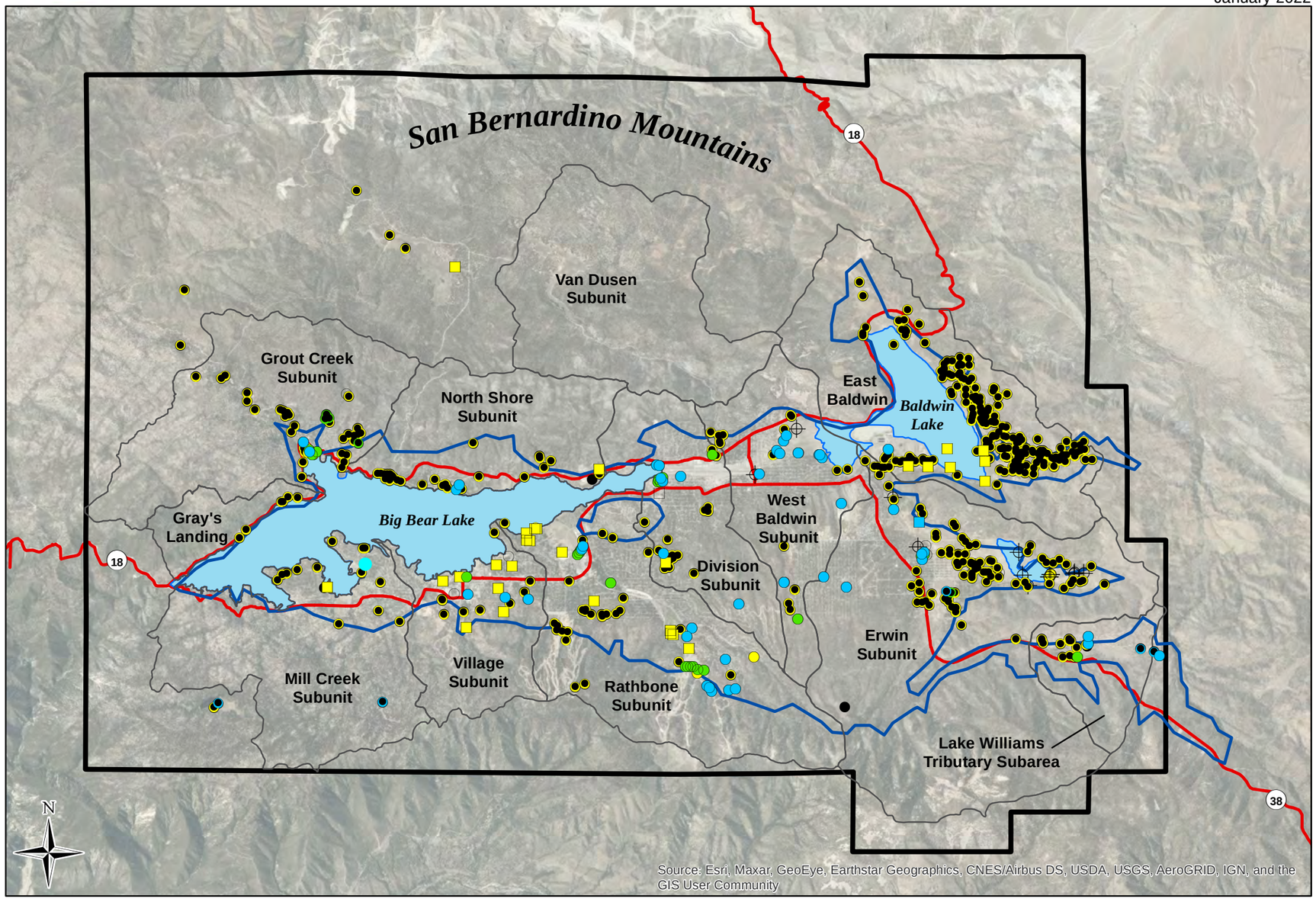
Bear Valley Basin
Areas of Favorable Recharge

Figure 2-5

Bear Valley Basin Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Well Type

- Municipal
- Private
- Irrigation
- Unknown

Well Status

- Pumping
- Non-pumping
- Unknown
- Hydrologic Subunit
- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Highway

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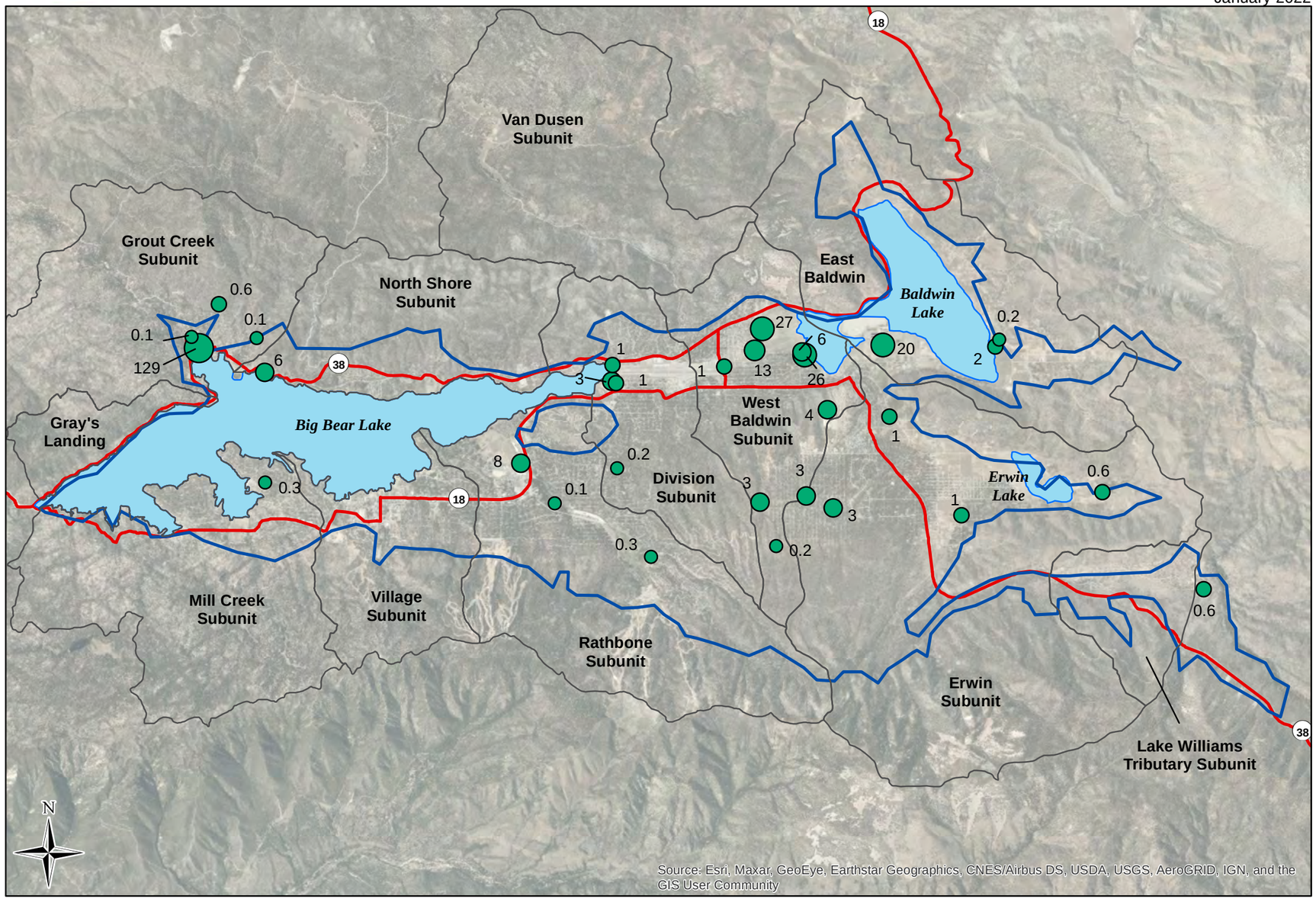
Bear Valley Basin Well Location Map

Figure 2-6

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Hydraulic Conductvity (ft/day)

- < 0.5
- 0.5 - 2
- 2 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- > 100

Hydrologic Subunit

Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)

Bear Valley Basin Groundwater Sustainability Agency Boundary

Highway

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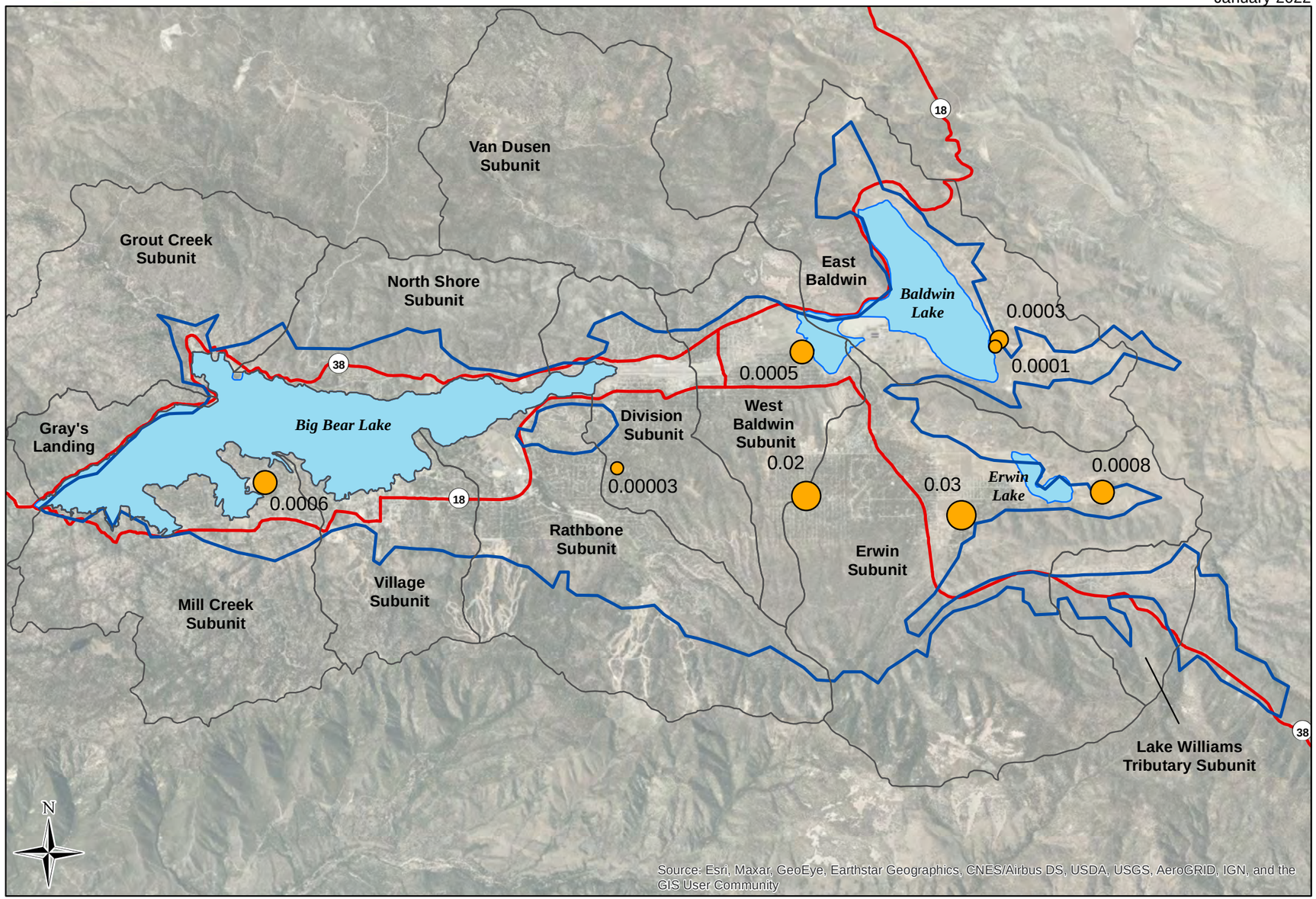
Bear Valley Basin
Aquifer Hydraulic Conductivity from Pumping Tests

Figure 2-7

Bear Valley Basin Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Storativity

- 0.00003 - 0.0001
- 0.0001 - 0.0005
- 0.0005 - 0.001
- 0.001 - 0.03

Hydrologic Subunit

Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)

Bear Valley Basin Groundwater Sustainability Agency Boundary

Highway

Bear Valley Basin Aquifer Storativity Values from Pumping Tests

Figure 2-8

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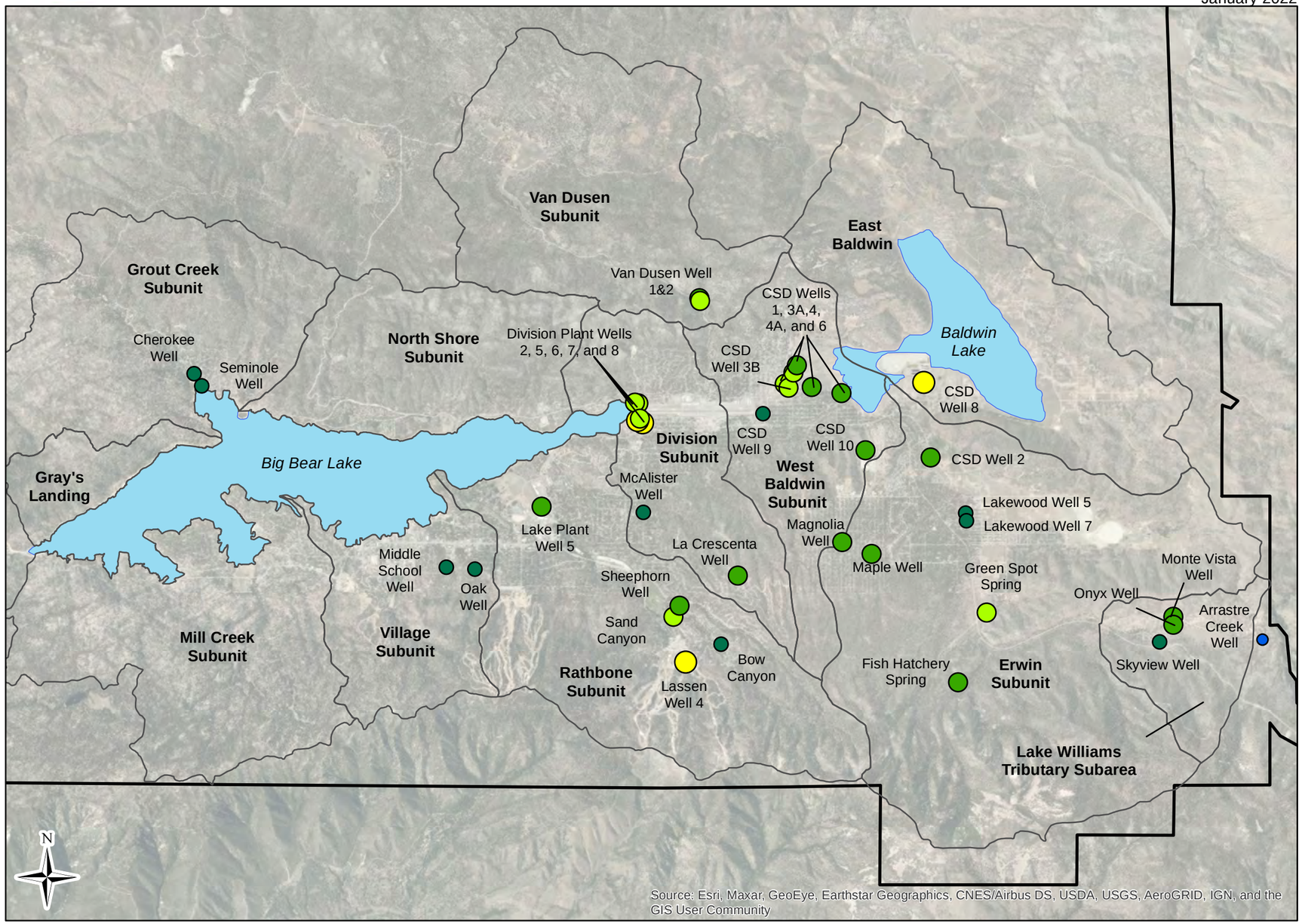
Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

Total Dissolved Solids (mg/L) - 2017

- < 100
- 100 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- Hydrologic Subunit
- Bear Valley Basin Groundwater Sustainability Agency

Note:

Total Dissolved Solids Secondary MCL = 500 mg/L

Source:
California Water Boards: State Water Resources Water Quality Analyses Data Library

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Groundwater Consulting

0 1 2 4 Miles

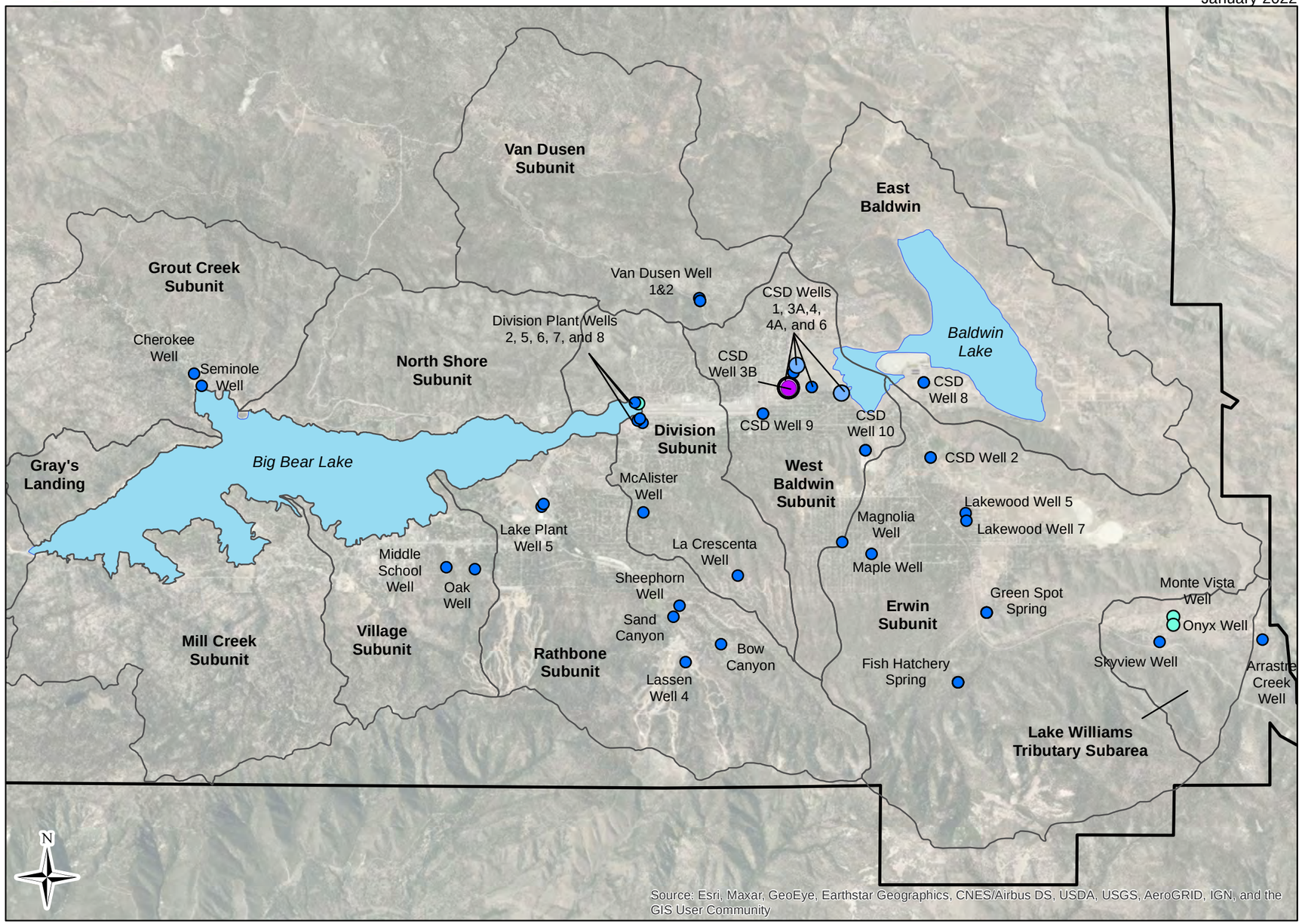
NAD 83 State Plane Zone 4

Groundwater Quality - Total Dissolved Solids

Figure 2-9

Bear Valley Basin Groundwater Sustainability Plan

January 2022



Map Features

Fluoride (mg/L) - 2017

- < 1.0
- 1.1 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0

Hydrologic Subunit

Bear Valley Basin Groundwater Sustainability Agency

Note:

Fluoride MCL = 2.0 mg/L

Source:
California Water Boards: State Water Resources Water Quality Analyses Data Library

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Groundwater Consulting

0 1 2 4 Miles

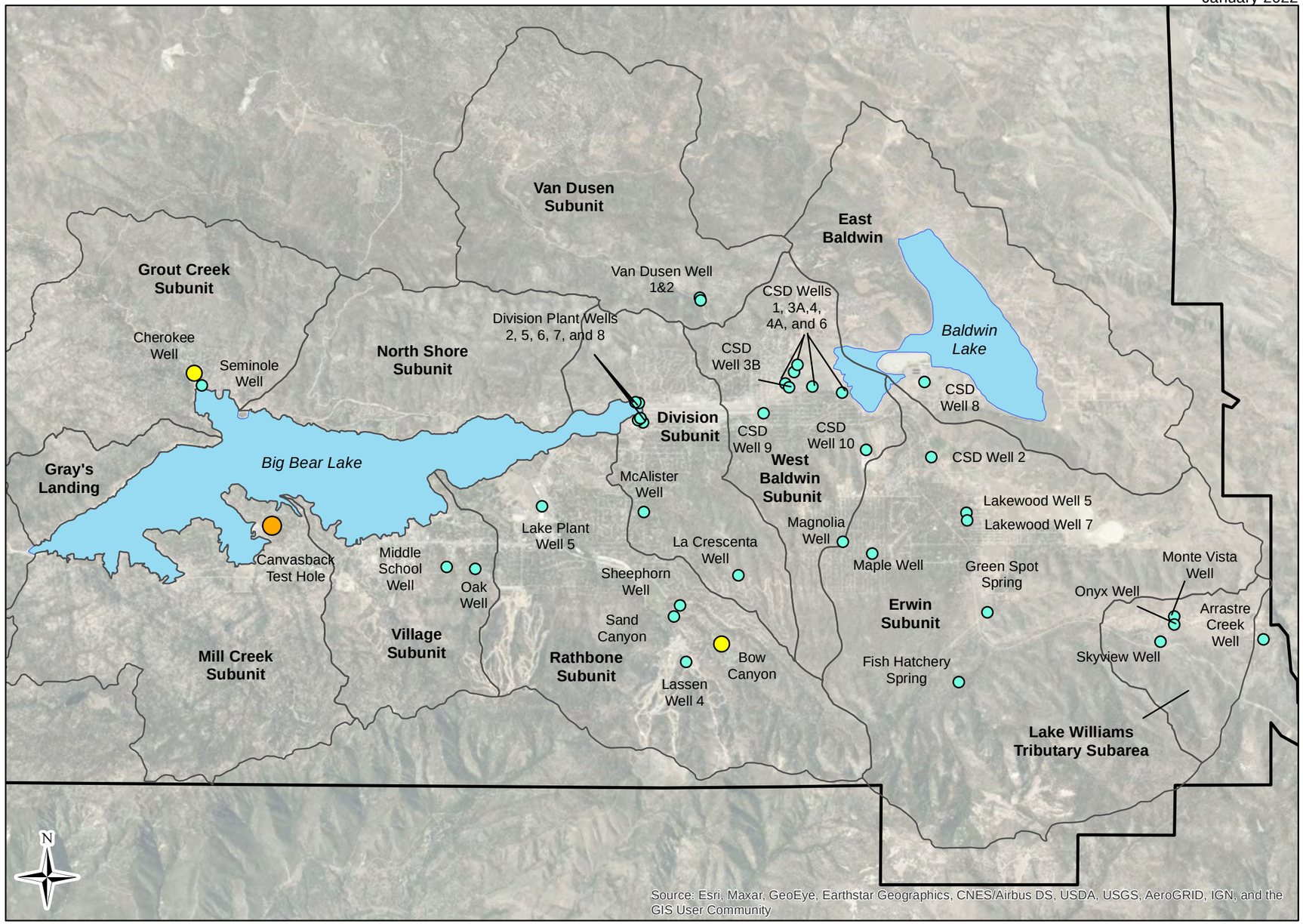
NAD 83 State Plane Zone 4

Groundwater Quality - Fluoride

Figure 2-10

Bear Valley Basin Groundwater Sustainability Plan

January 2022



Map Features

Arsenic (µg/L) - 2017

- 0
- 7 - 8
- 88
- Hydrologic Subunit
- Bear Valley Basin Groundwater Sustainability Agency

Note:

Arsenic MCL = 10 µg/L

Source:
California Water Boards: State Water Resources Water Quality Analyses Data Library

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0 1 2 4 Miles

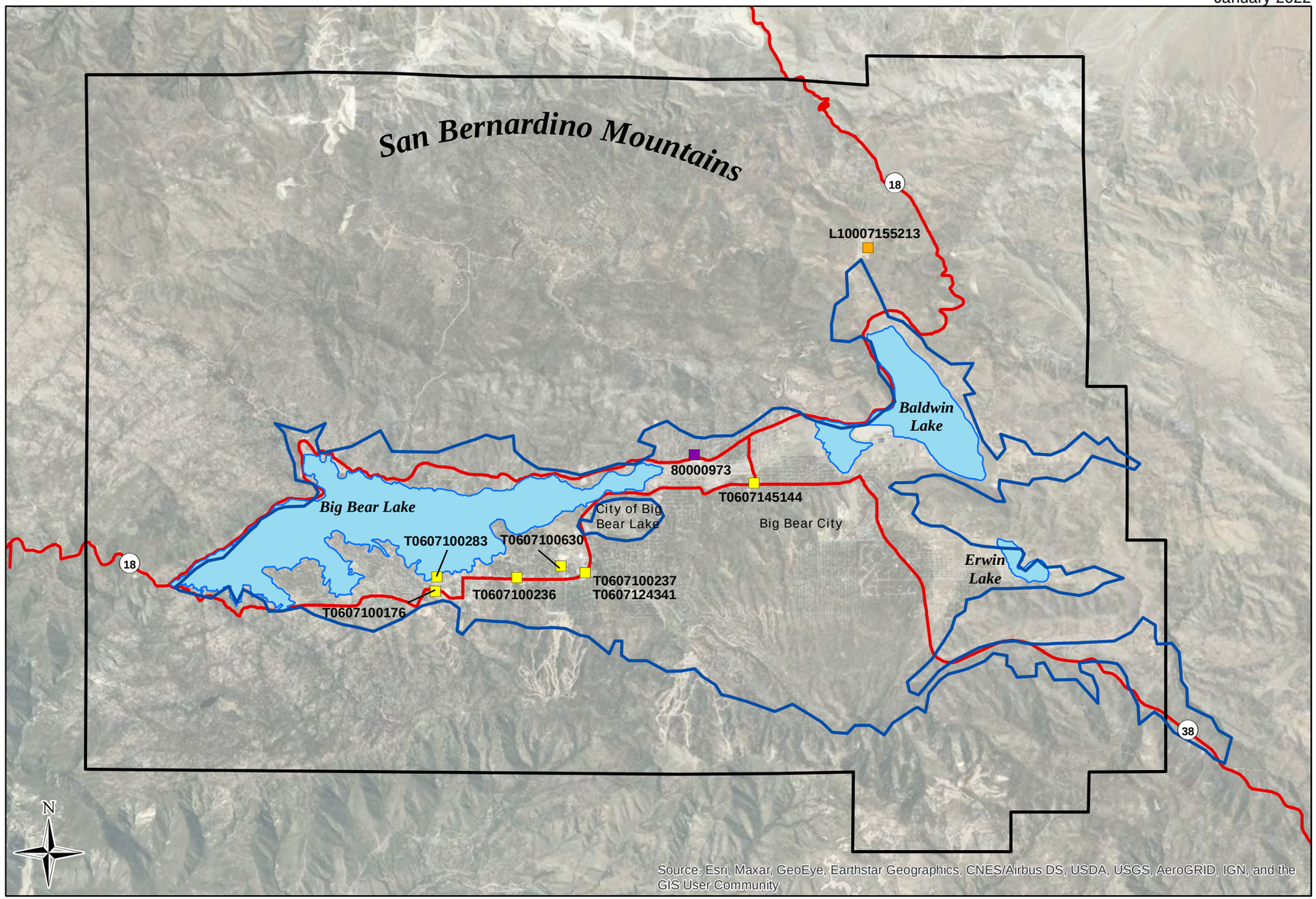
NAD 83 State Plane Zone 4

Groundwater Quality - Arsenic

Figure 2-11

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Active Cleanup Site

- DTSC Cleanup Site
- Land Disposal Site
- LUST Cleanup Site

Bear Valley Basin Groundwater Sustainability Agency Boundary

Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)

Highway

Source: https://geotracker.waterboards.ca.gov

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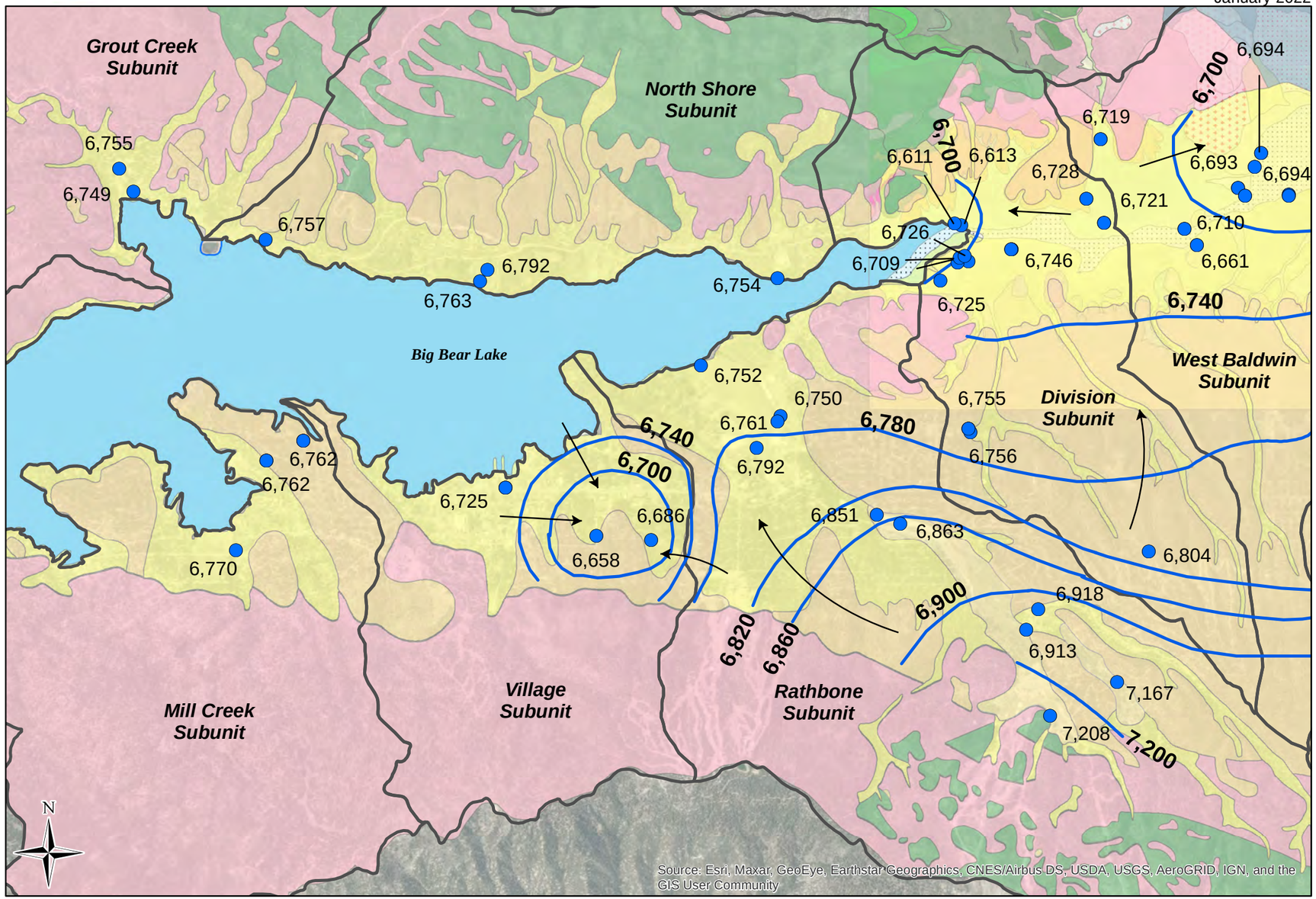
Active Clean Up Sites within the Bear Valley Basin

Figure 2-12

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Groundwater Elevation (ft amsl)
- 6,700 Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- Hydrologic Subunit

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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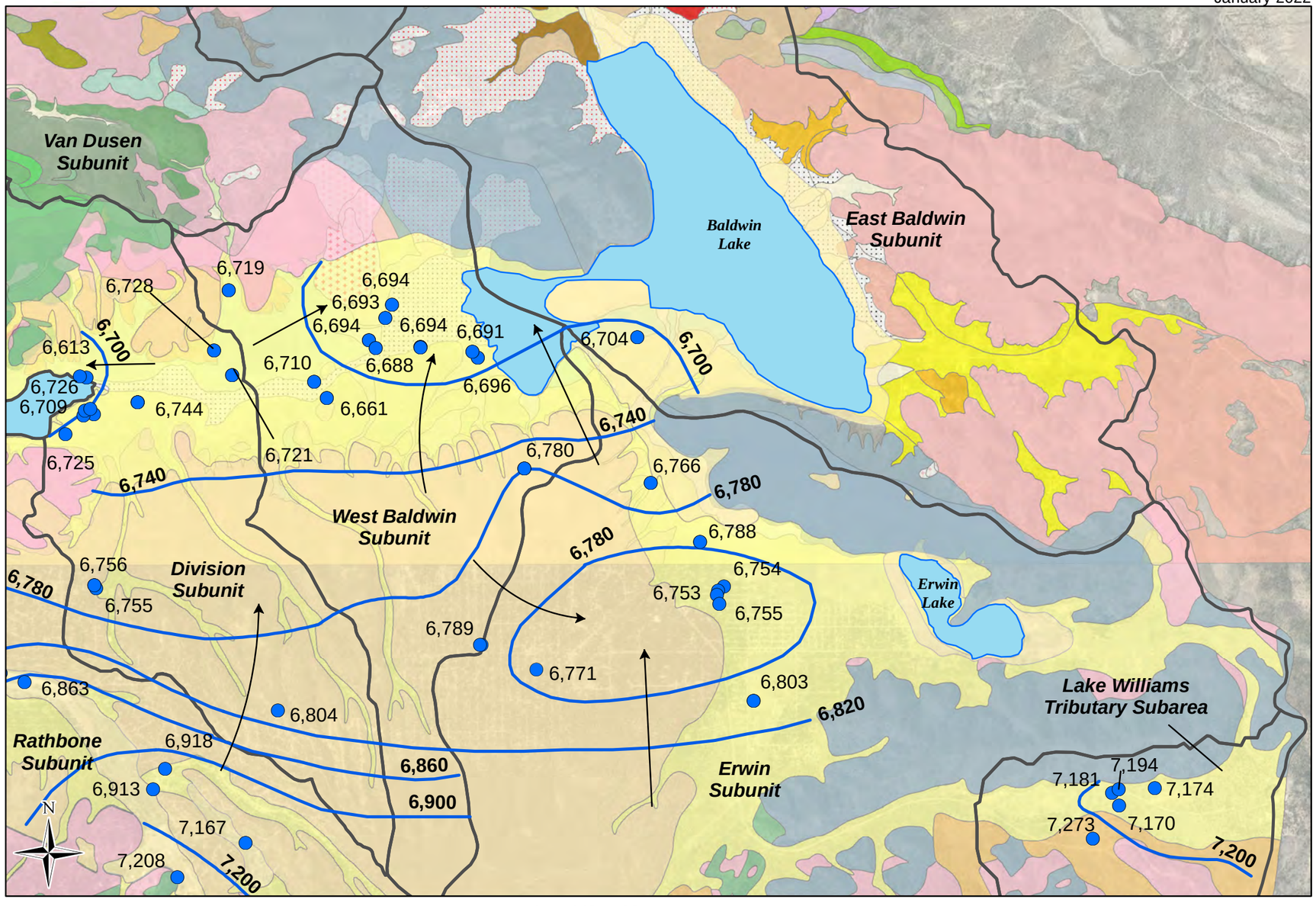
Bear Valley Basin West
Spring 2019 Groundwater Elevation Contour Map

Figure 2-13

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



NAD 83 UTM Zone 11

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Map Features

- Well with Groundwater Elevation (ft amsl)
- 6,700 Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- Hydrologic Subunit

Bear Valley Basin East Spring 2019 Groundwater Elevation Contour Map

Figure 2-14

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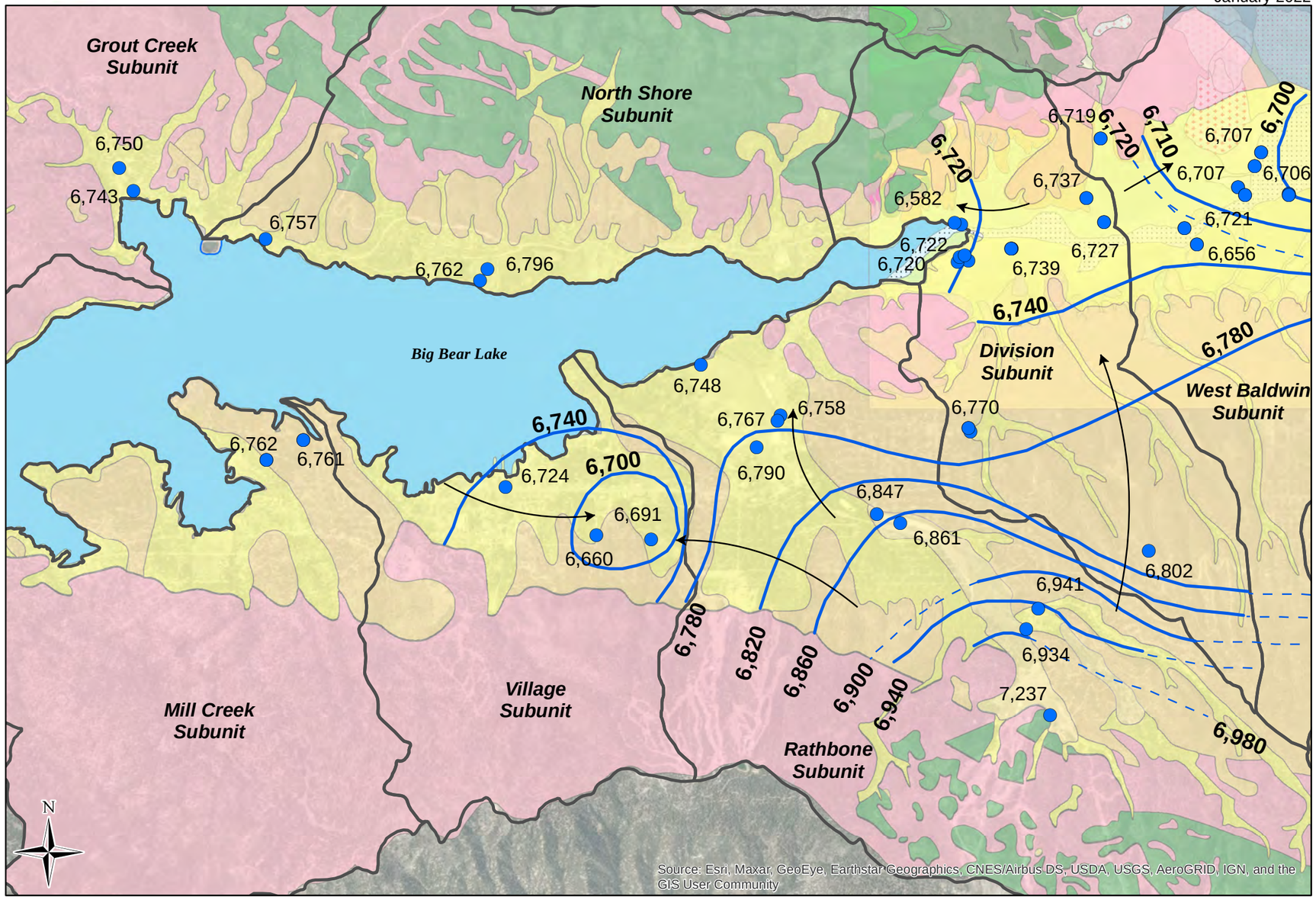
Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

Map Features

- Well with Groundwater Elevation (ft amsl)
- 6,700 Groundwater Elevation Contour (Dashed where approximate)
- Groundwater Flow Direction
- Hydrologic Subunit

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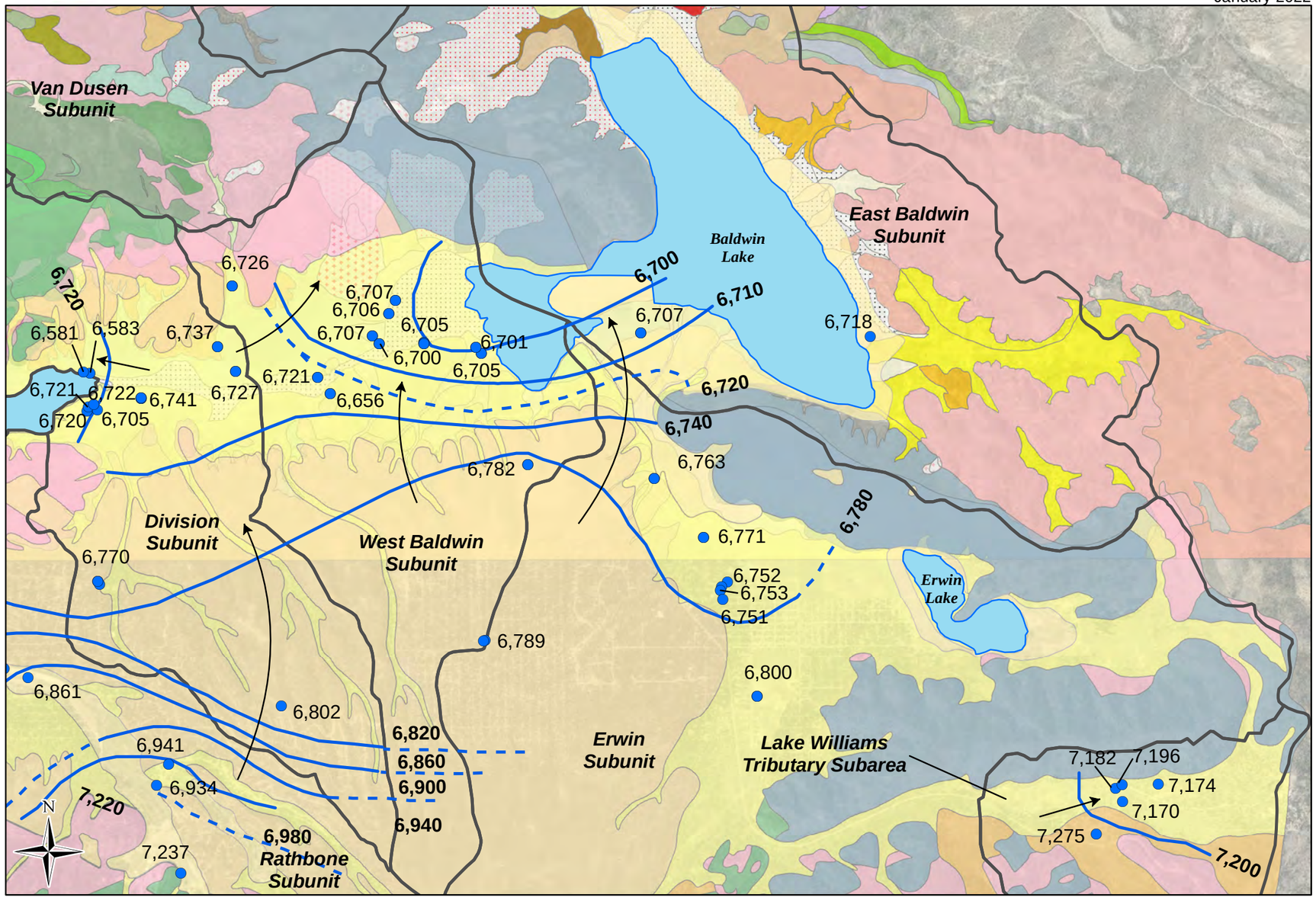
Bear Valley Basin West Fall 2019 Groundwater Elevation Contour Map

Figure 2-15

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Groundwater Elevation (ft amsl)
- 6,700 Groundwater Elevation Contour (Dashed where approximate)
- Groundwater Flow Direction
- Hydrologic Subunit

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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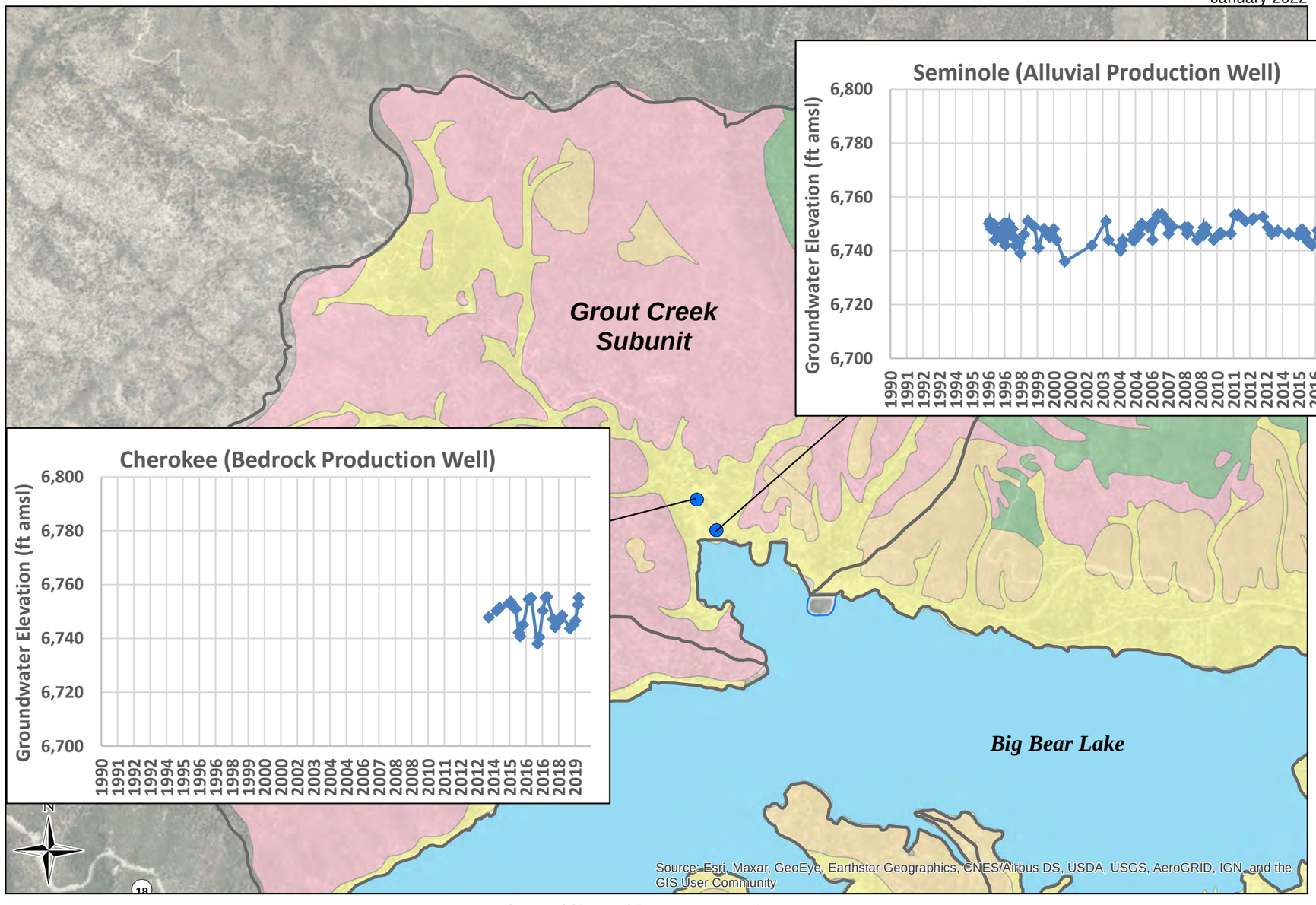
Bear Valley Basin East Fall 2019 Groundwater Elevation Contour Map

Figure 2-16

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Hydrograph
- Hydrologic Subunit

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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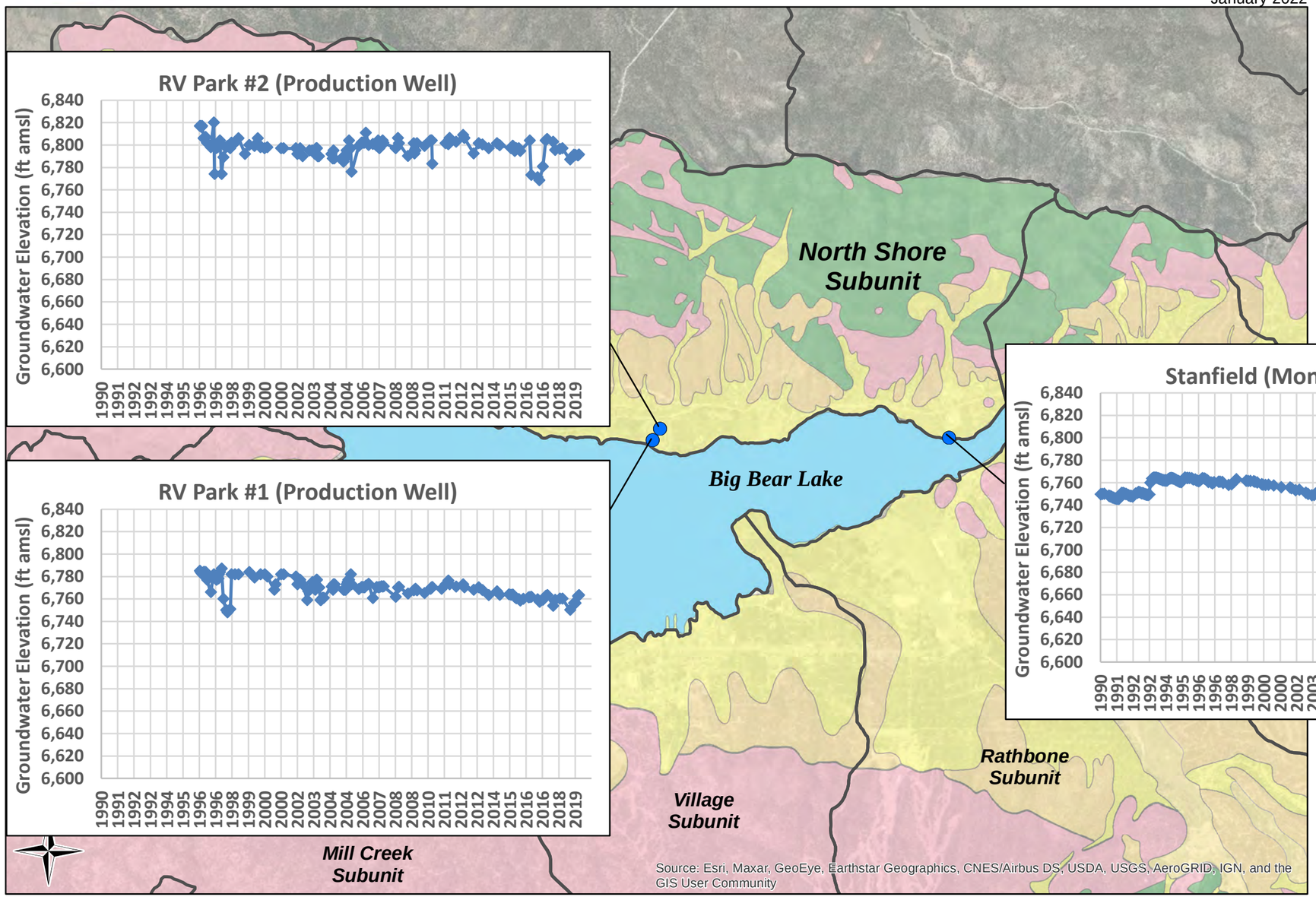
Groundwater Level Hydrographs
Grout Creek Subunit

Figure 2-17

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Hydrograph
- Hydrologic Subunit

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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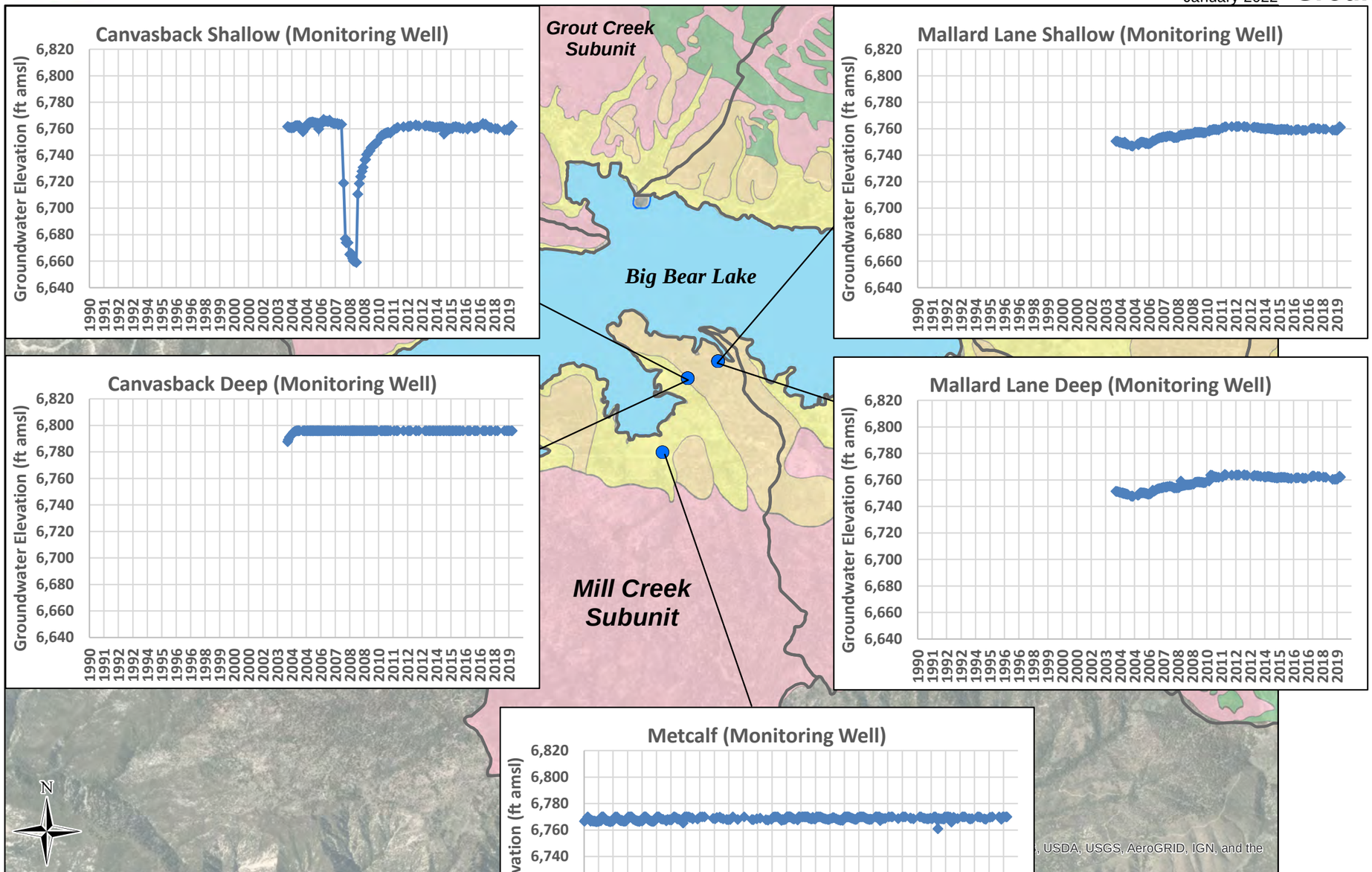
Groundwater Level Hydrographs
North Shore Subunit

Figure 2-18

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Hydrograph
- Hydrologic Subunit Boundary

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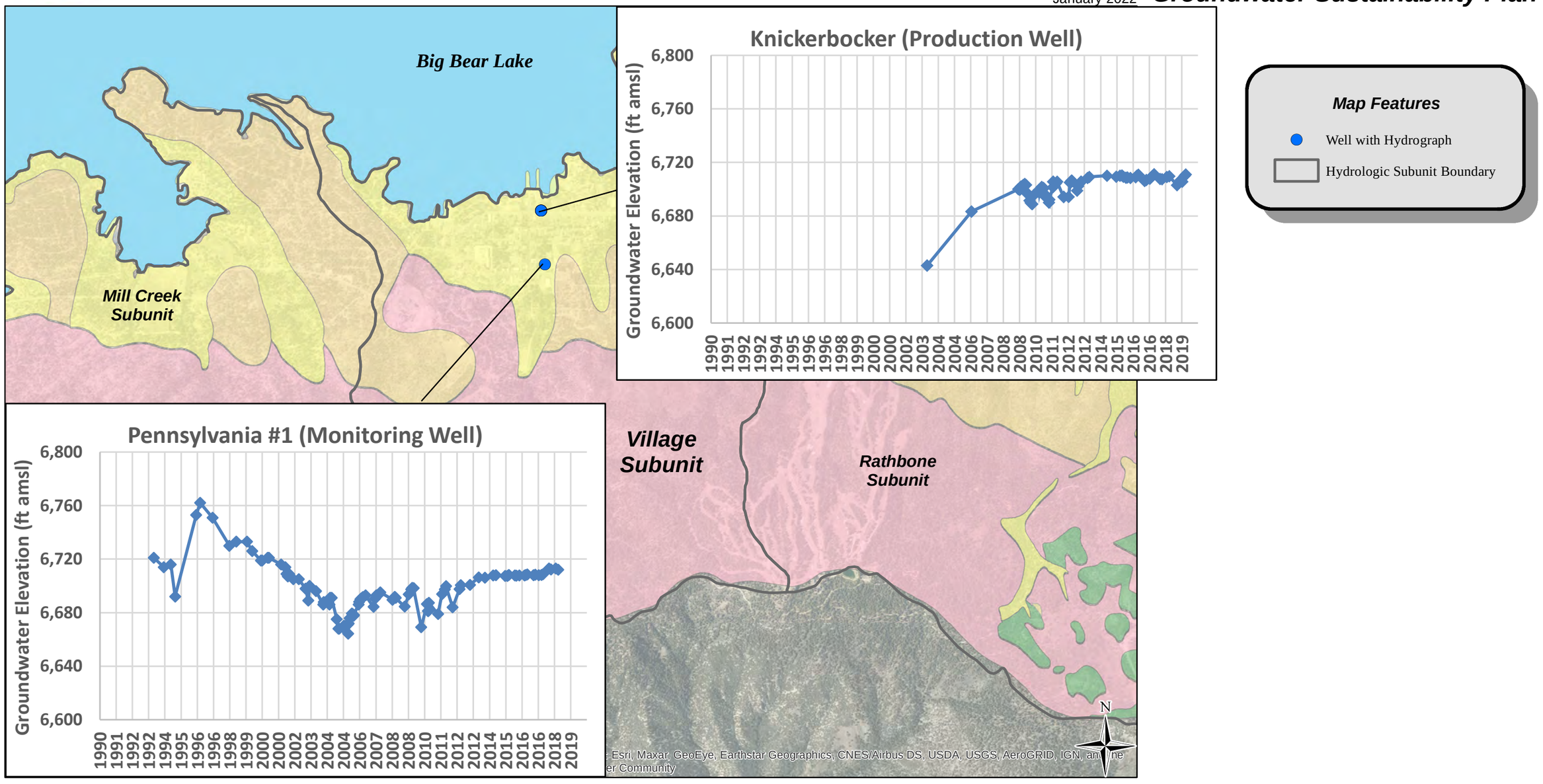
Groundwater Level Hydrographs Mill Creek Subunit

Figure 2-19

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



NAD 83 UTM Zone 11

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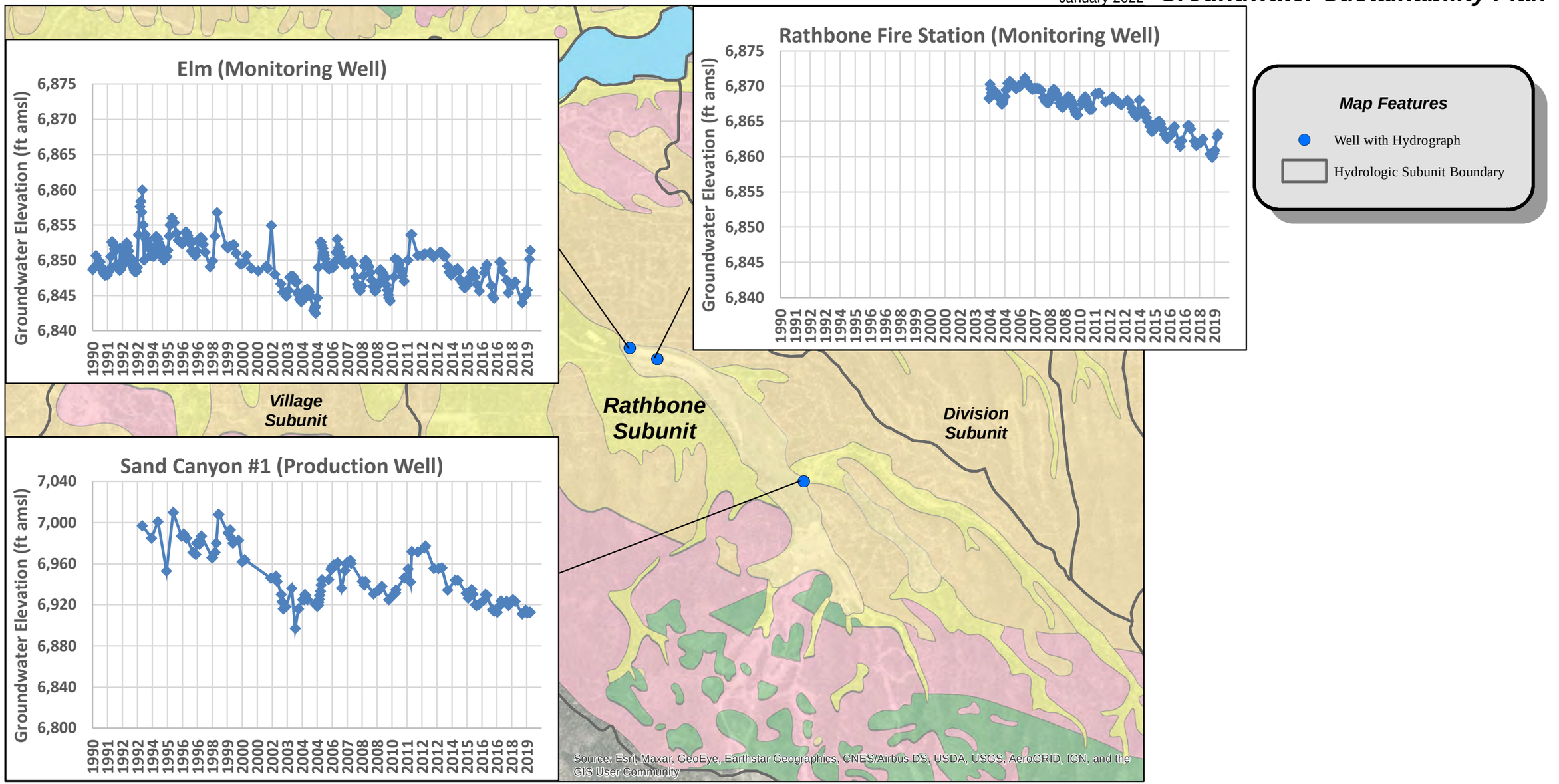
Groundwater Level Hydrographs - Village Subunit

Figure 2-20

Bear Valley Basin Groundwater Sustainability Plan

January 2022



Map Features

- Well with Hydrograph
- Hydrologic Subunit Boundary

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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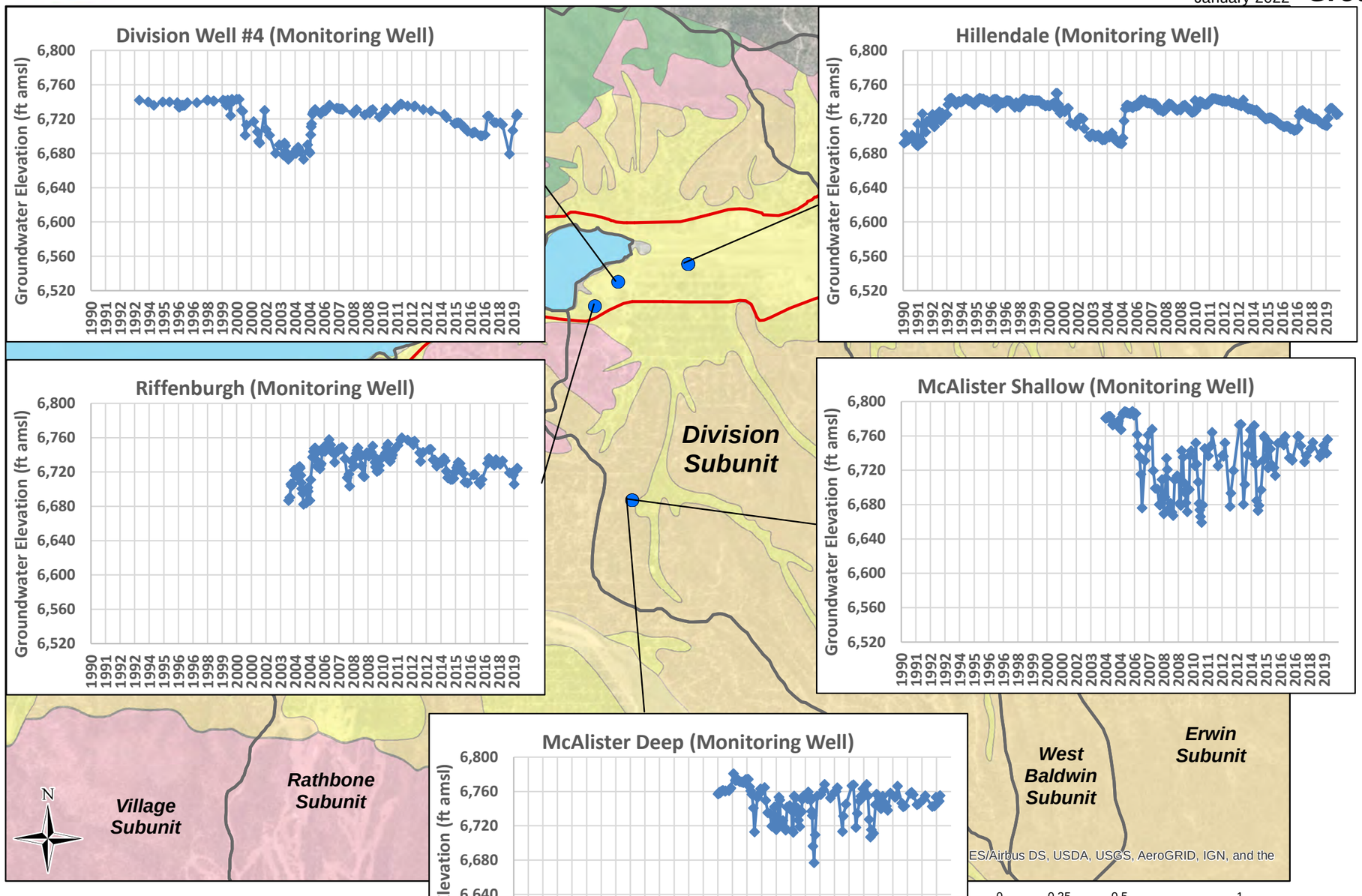
Groundwater Consulting

Groundwater Level Hydrographs Rathbone Subunit

Figure 2-21

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



Map Features

- Well with Hydrograph
- Hydrologic Subunit Boundary
- Highway

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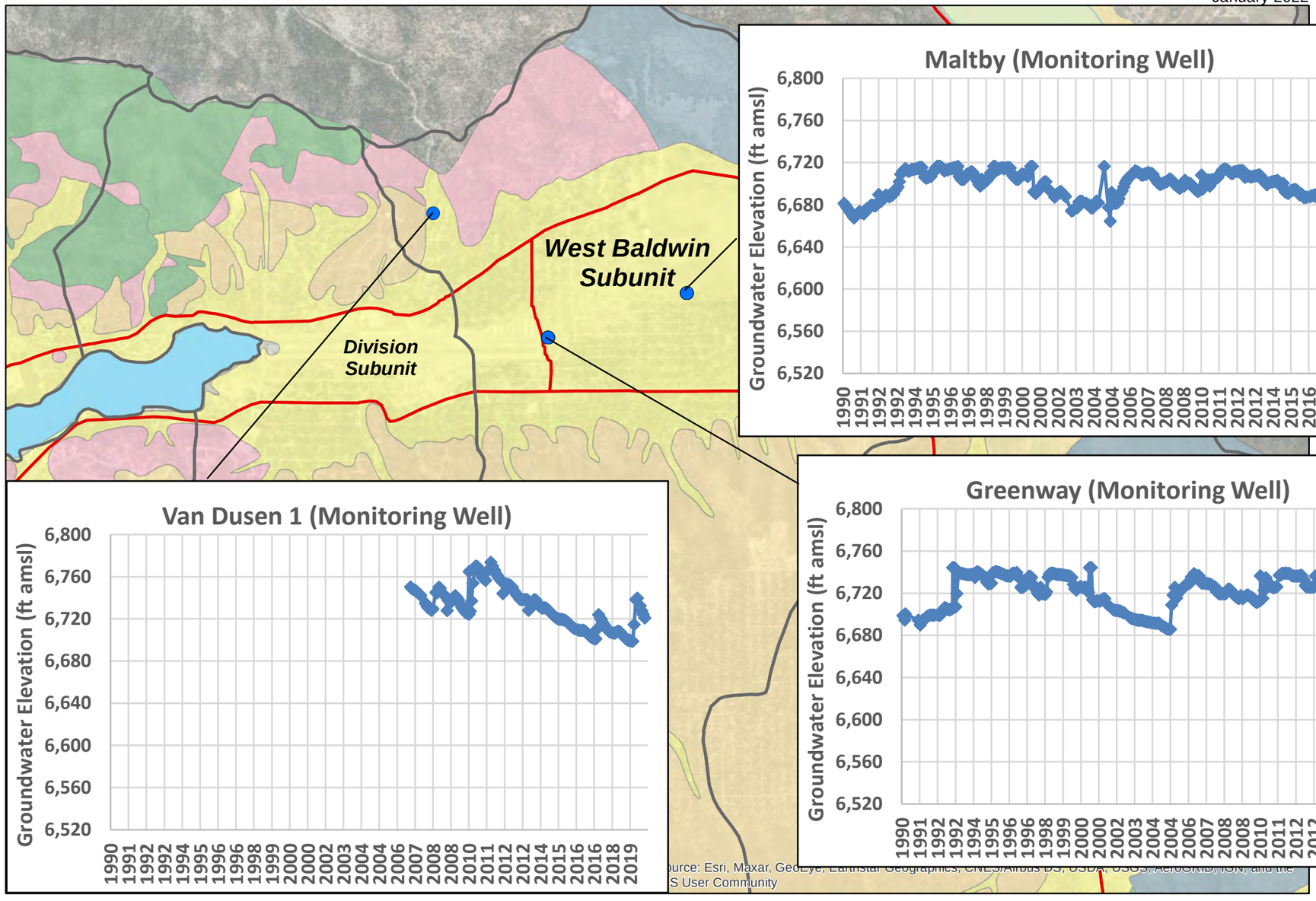
Groundwater Consulting

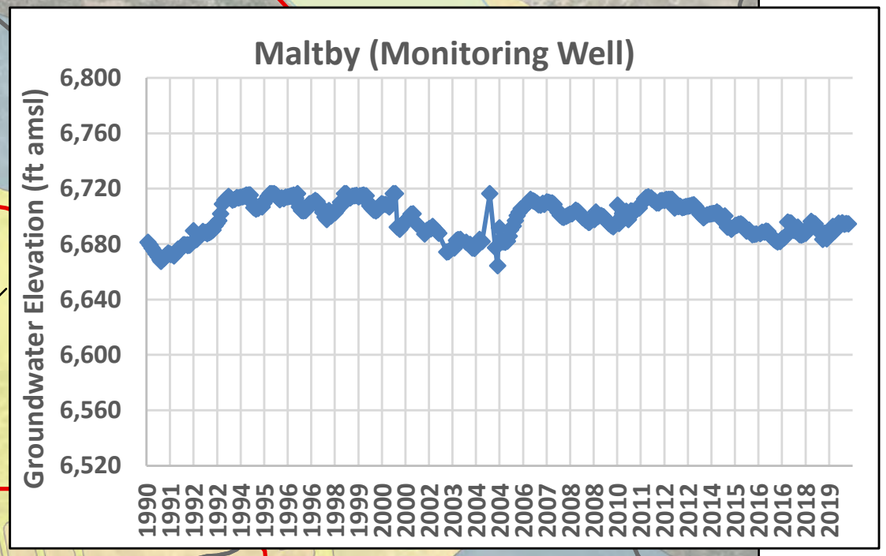
Groundwater Level Hydrographs - Division Subunit

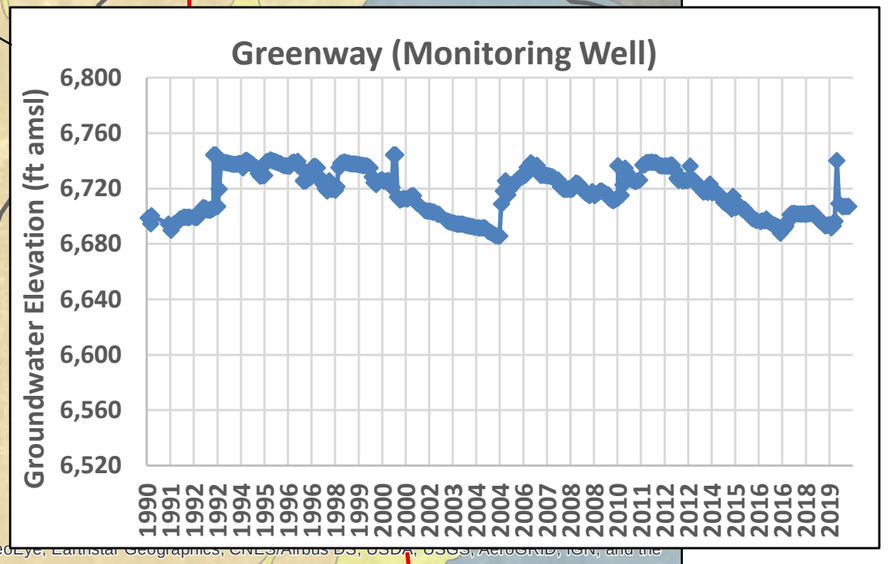
Figure 2-22

Bear Valley Basin
Groundwater Sustainability Plan

January 2022







Map Features

- Well with Hydrograph
- Hydrologic Subunit Boundary
- Highway

urce: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
S User Community

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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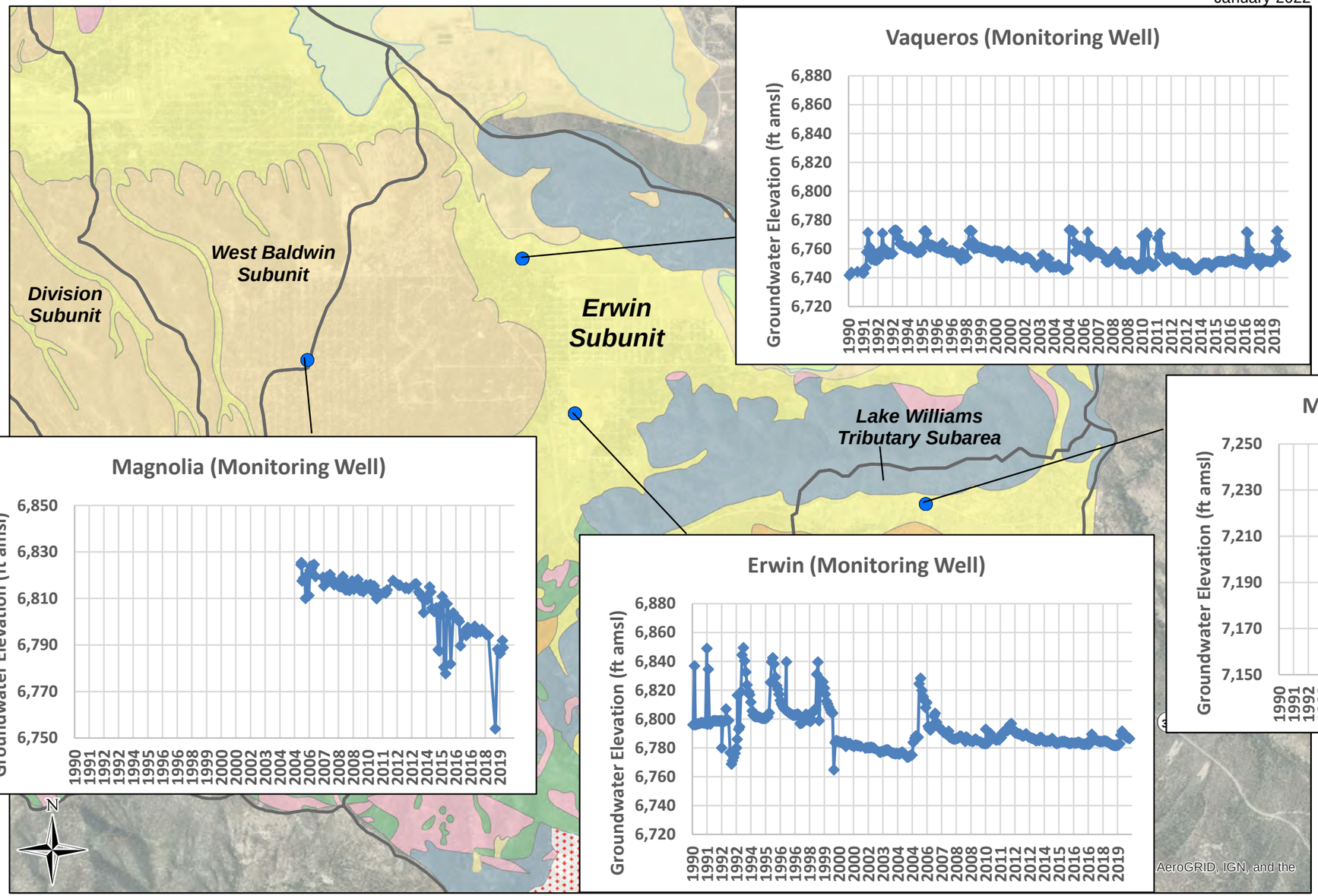
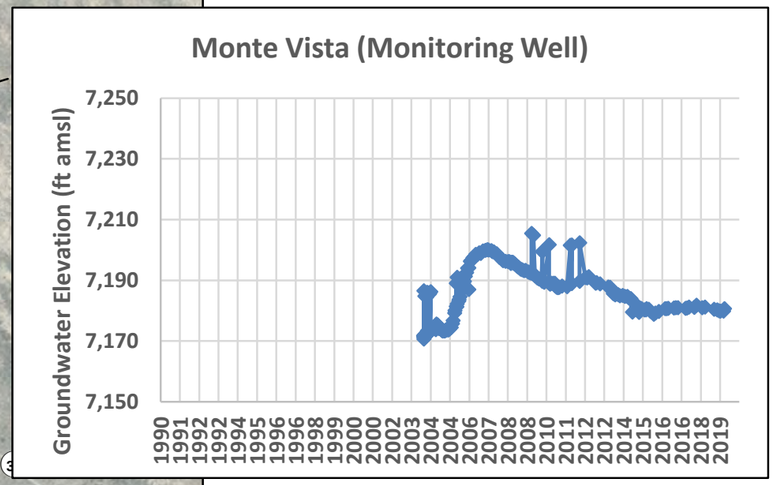
Groundwater Level Hydrographs West Baldwin Subunit

Figure 2-23

Bear Valley Basin
Groundwater Sustainability Plan

January 2022





Map Features

- Well with Hydrograph
- Hydrologic Subunit Boundary

0 0.25 0.5 1 Miles

NAD 83 UTM Zone 11

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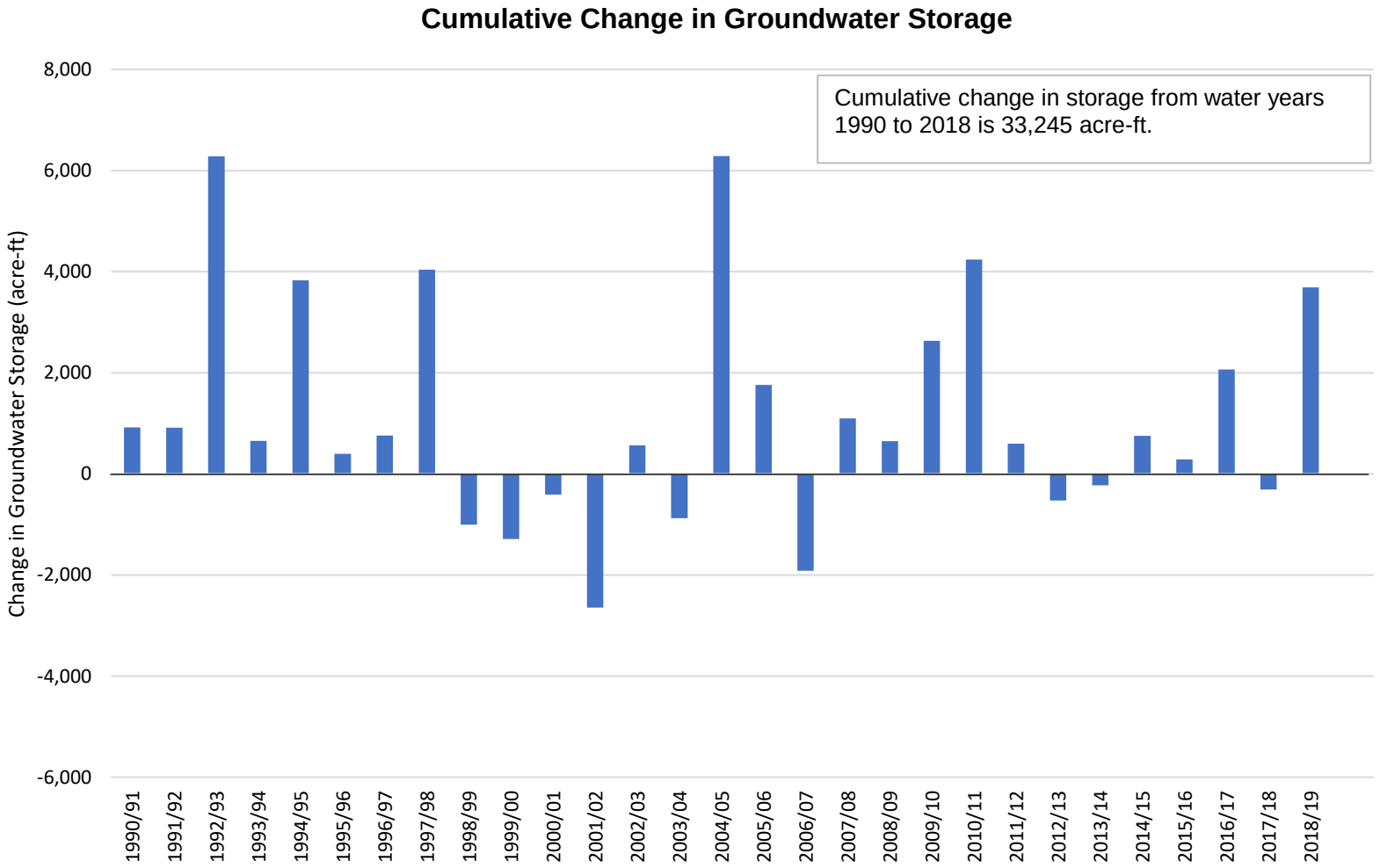
Groundwater Level Hydrographs - Erwin Subunit

Figure 2-24

Figure 2-25



Note: Data in water years (October 1 to September 30).

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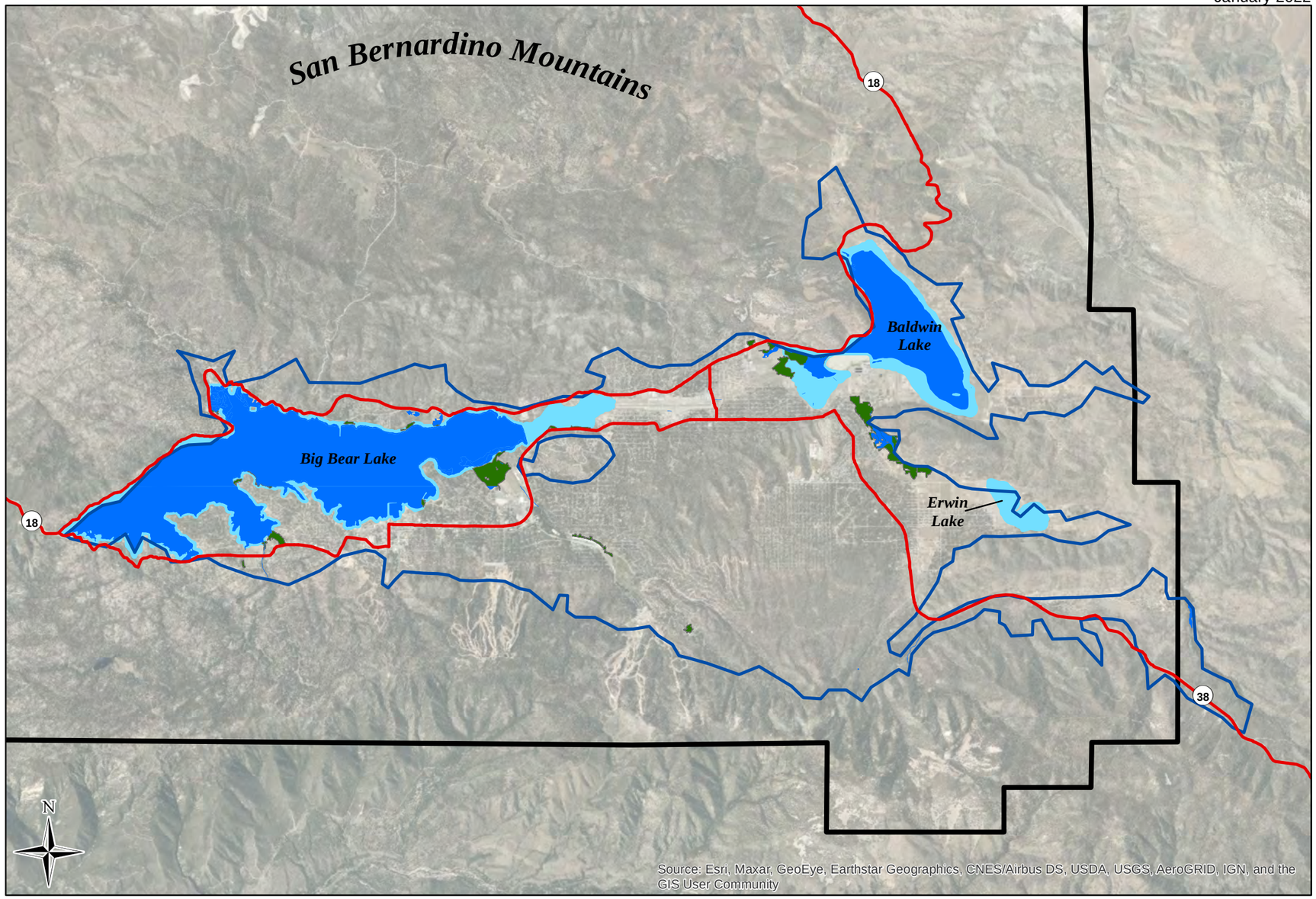
Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)
- Bear Valley Basin Groundwater Sustainability Agency Boundary
- Groundwater Sourced Wetlands
- Groundwater Dependent Vegetation (Phreatophytes)
- Highway

Groundwater Dependent Ecosystem Data Source:

Natural Communities Commonly Associated with Groundwater Dataset - DWR

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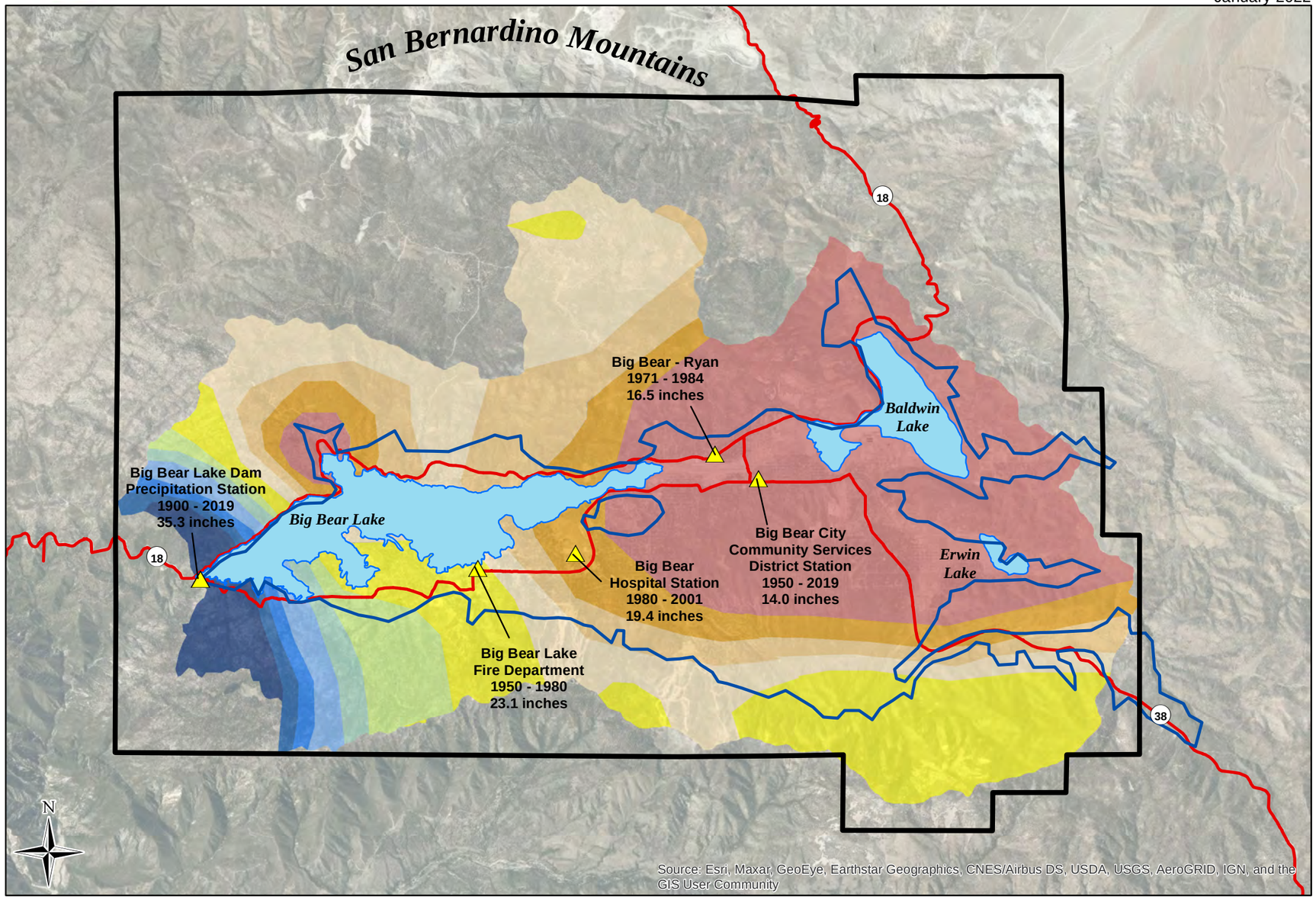
Bear Valley Basin Groundwater Dependent Ecosystems

Figure 2-26

Bear Valley Basin
Groundwater Sustainability Plan

January 2022



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

Average Annual Precipitation (inches)

- 31 - 34
- 30 - 31
- 29 - 30
- 28 - 29
- 27 - 28
- 23 - 26
- 22 - 23
- 21 -2 2
- 20 - 21
- 19 - 20
- 10 - 19

△ Precipitation Station, Period of Record, Average Annual Precipitation (Inches per Water Year)

Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)

Bear Valley Basin Groundwater Sustainability Agency Boundary

Highway

Notes: Precipitation station data from Big Bear Municipal Water District, San Bernardino County Department of Public Works - Flood Control District, and California Irrigation Management Information System.

Average Annual Precipitation Zones modified from the INFIL v3 model USGS 2012 Geohydrology of Big Bear Valley, California, Scientific Investigation Report 2012-5100.

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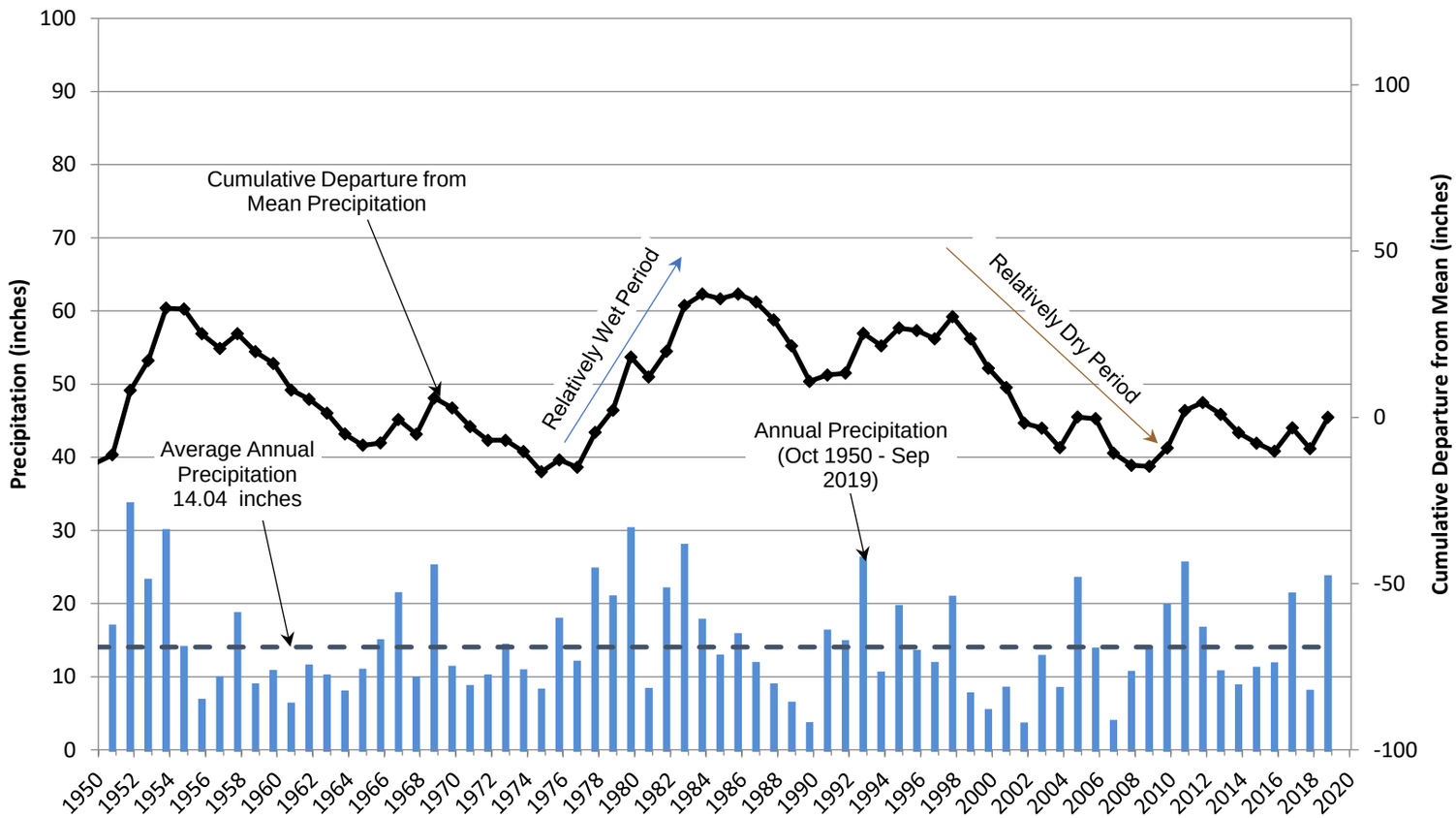
Isohyetal Map

Figure 2-27

Figure 2-28

Big Bear City Community Services District Station
Historical Annual Precipitation 1950 to 2019



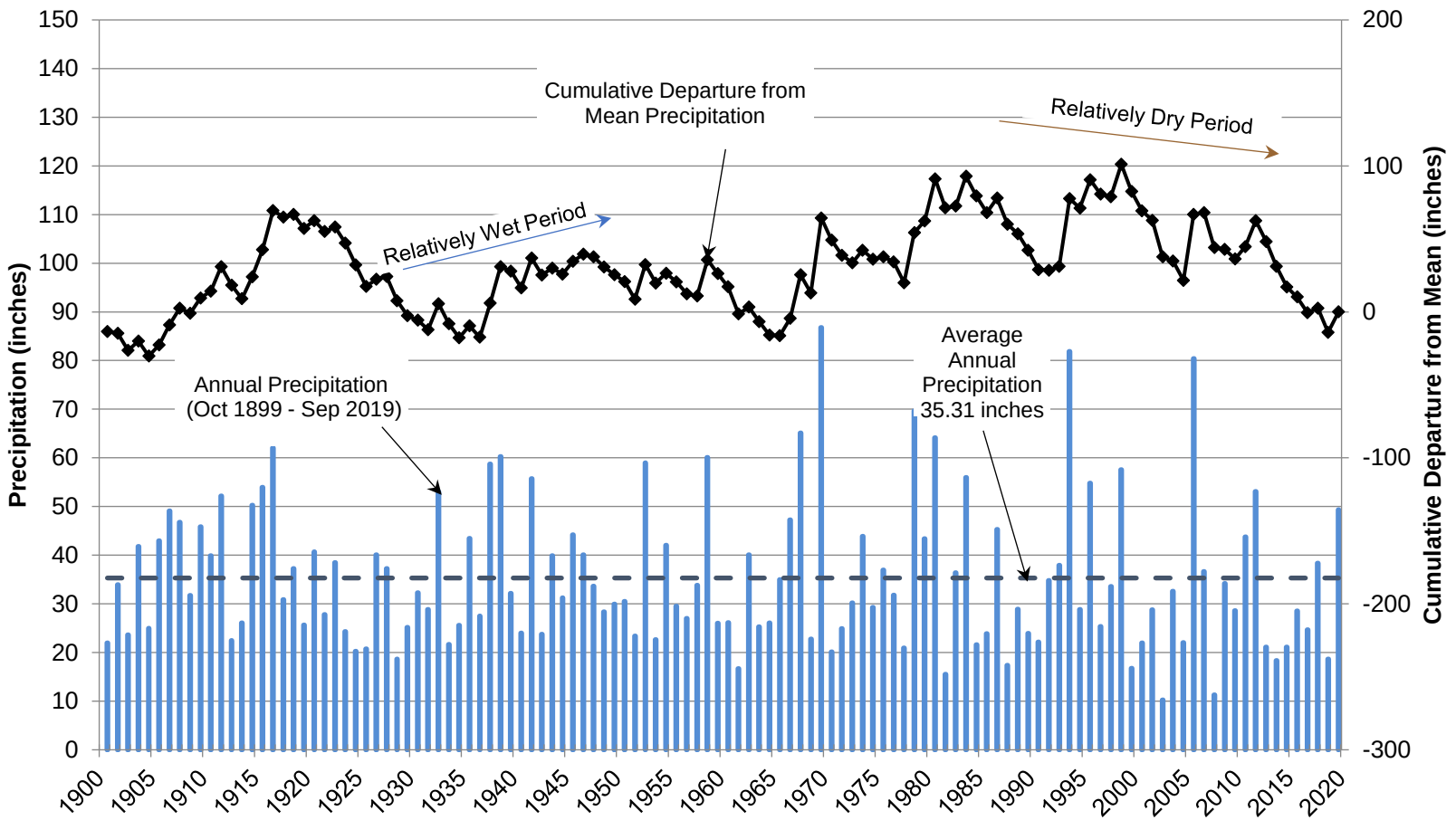
Data from San Bernardino County Department of Public Works.

* Data updated as of September 2019.

* Annual data for water years, October 1 through September 30.

Figure 2-29

Big Bear Lake Dam Station
Historical Annual Precipitation 1900 to 2019

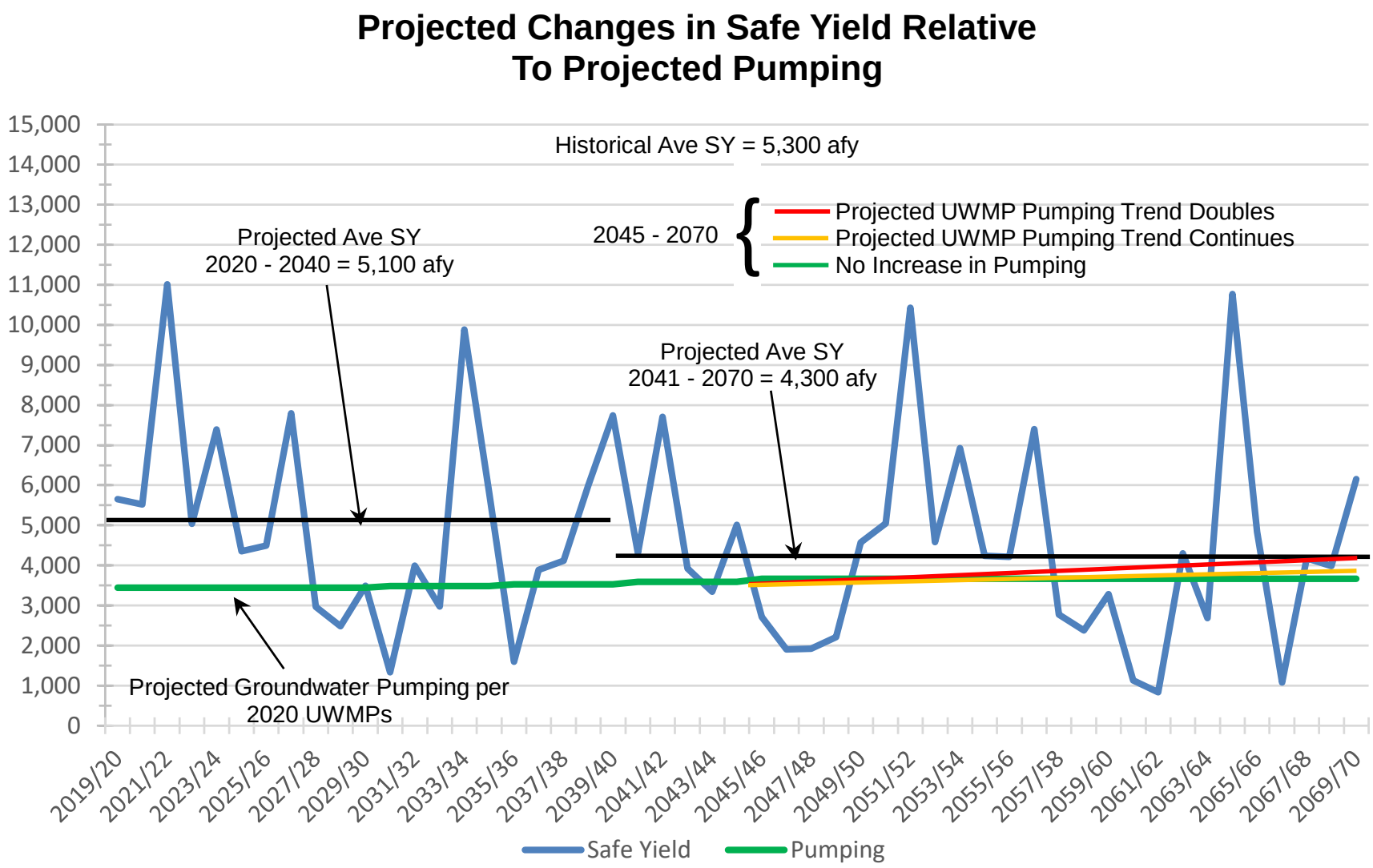


Data from Big Bear Municipal Water District, Accessed May 2020. (https://www.bbmwd.com/historical-lake-levelprecip)

* Data updated as of September 2019.

* Annual data for water years, October 1 through September 30.

Figure 2-30



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Bear Valley Basin
Groundwater Sustainability Plan

January 2022

Map Features

- Monitoring Well
  - BBCCSD
  - BBLDWP
  - RMS Well
- Management Areas
- Bear Valley Groundwater Basin (DWR Bulletin 118, Rev. 2018)

0 0.5 1 2 Miles

NAD 83 UTM Zone 11

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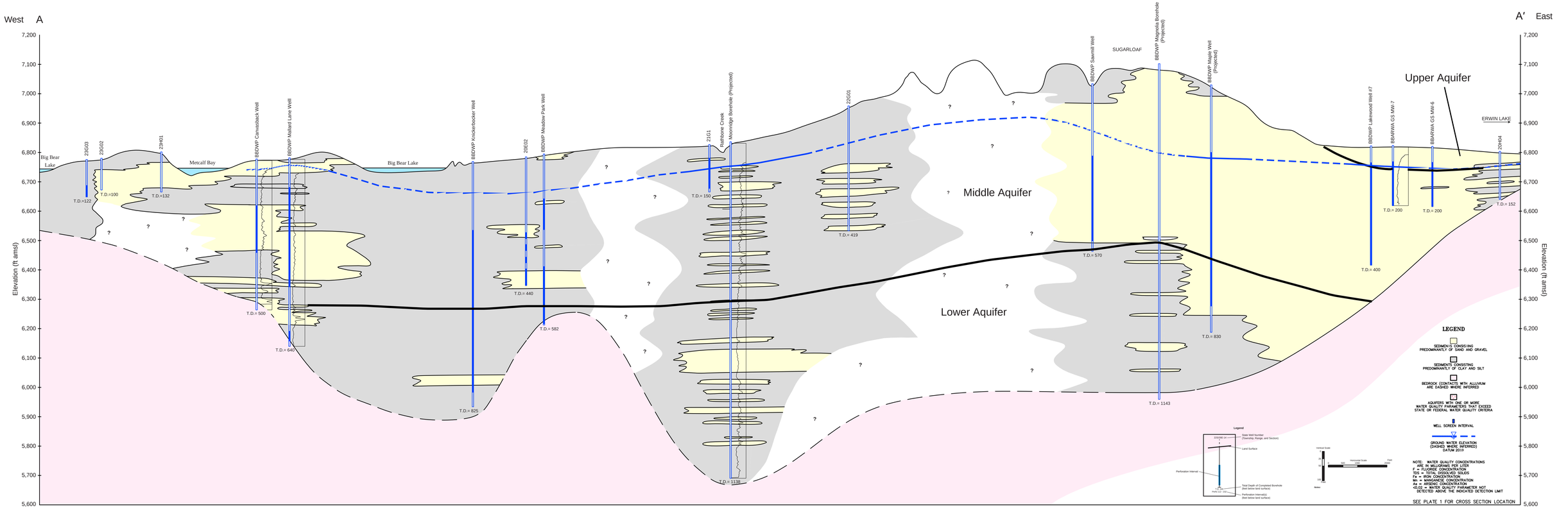
Bear Valley Basin Monitoring Network

Figure 2-31

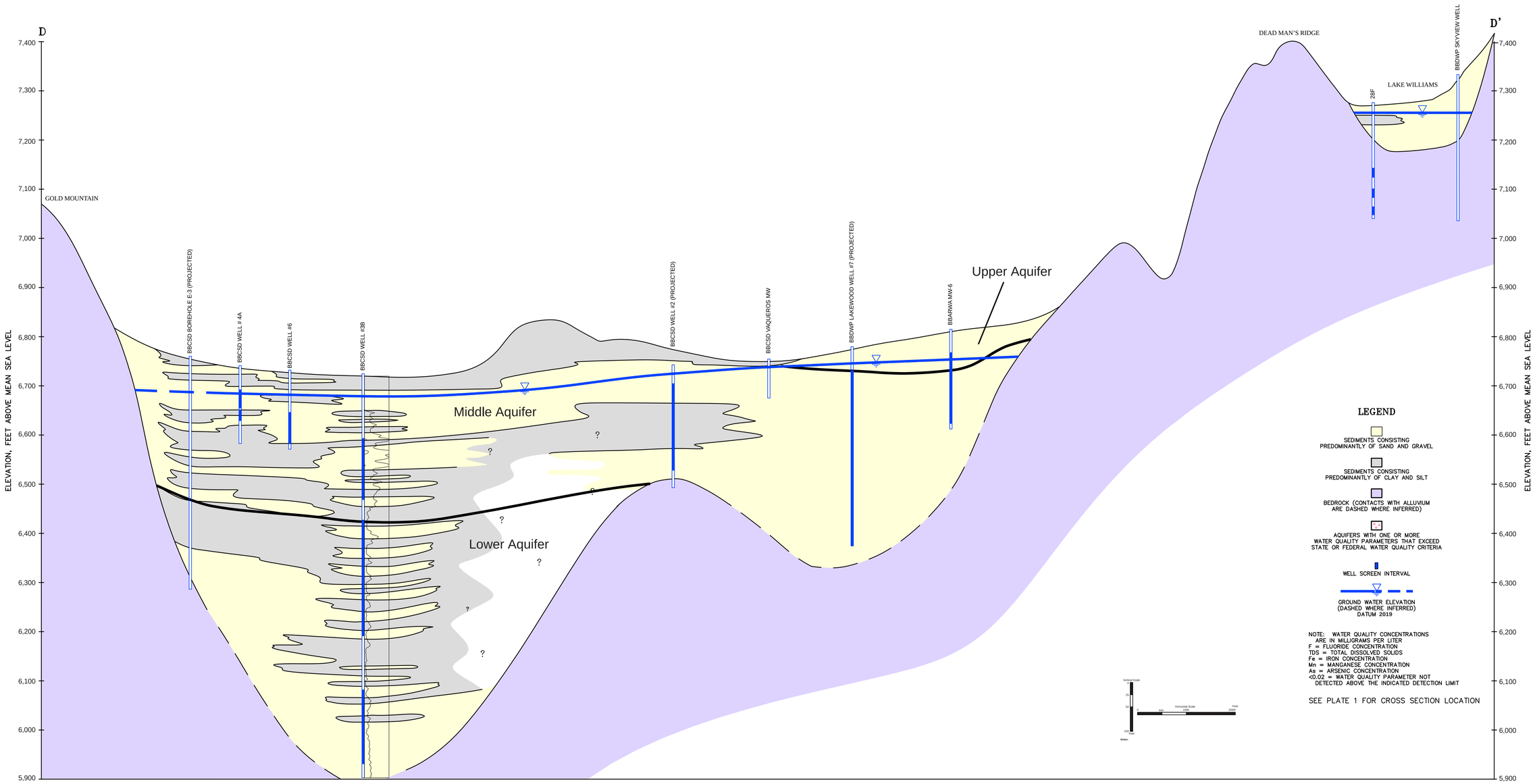
Bear Valley Basin
Basin Setting



Hydrogeologic Cross Section A-A'

Plate 1
January 2022

Bear Valley Basin
Basin Setting



Hydrogeologic Cross Section B-B'

Plate 2
January 2022

3. Sustainable Management Criteria

3.1 Introduction

This section describes the conditions that constitute sustainable groundwater management for the Bear Valley Basin. Sustainable groundwater management will be evaluated in the context of the sustainability goal for the basin and the absence of undesirable results. Undesirable results are evaluated for each of the sustainability indicators specified in SGMA:[2]

- Chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon;
- Reduction of groundwater storage;
- Seawater intrusion;
- Degraded water quality, including the migration of contaminant plumes that impair water supplies;
- Land subsidence that substantially interferes with surface land uses; and
- Depletions of interconnected surface water that have adverse impacts on beneficial uses.

When impacts associated with any one of the sustainability indicators become significant and unreasonable across the basin, it is considered an undesirable result.

It is noted that the Bear Valley Basin is isolated in the San Bernardino Mountains and not in hydrologic connection with any neighboring basins. As such, the sustainable management criteria identified herein will not result in groundwater impacts to other designated groundwater basins identified in CDWR Bulletin 118.

3.2 Sustainability Goal

The sustainability goal of the Bear Valley Basin (BVB) is the absence of undesirable results associated with groundwater pumping through a collaborative, basin-wide program of groundwater management. In adopting this GSP, it is the express goal of the BVBGSA to balance the needs of all groundwater users in the Bear Valley Basin within the sustainable limits of the basin's resources, while maintaining the unique cultural, community, and business aspects of the Bear Valley Basin.

3.3 Process for Establishing Sustainable Management Criteria

The Sustainable Management Criteria (SMC) discussed and established in this Section were developed in consultation with BVBGSA's member agencies, local stakeholders, technical leads,

[2] California Water Code, Division 6, Section 10721; Definitions x. Undesirable Result

and other interested parties. The general process leading up to the development and establishment of these SMC included:

- Reviewing existing hydrogeologic data assembled in the Bear Valley Basin Setting (Section 2).
- Corresponding with BVBGSA members and their staff to identify groundwater levels that would present undesirable results for the Bear Valley Basin and its individual management areas;
- Holding public workshops outlining the process for GSP development, discussing SMC, and providing data and context related to local groundwater-related issues; and
- Soliciting public feedback through public comment, stakeholder surveys, and written correspondence, to gather information on local values, locally relevant groundwater issues, and how local stakeholders might define groundwater conditions that they consider to be undesirable.

3.4 Sustainable Management Criteria

3.4.1 Chronic Lowering of Groundwater Levels

While groundwater levels in the Bear Valley Basin fluctuate seasonally and with prolonged wet and dry hydrologic periods, sustained lowering of groundwater levels below the minimum thresholds in any given management area is considered an undesirable result (see Section 3.4.1.5).

3.4.1.1 Information Used to Establish Measurable Objectives and Minimum Thresholds

Information and data used to establish measurable objectives and minimum thresholds related to groundwater levels included:

- Historical groundwater elevation data measured in wells monitored by BVBGSA managers.
- Information on the constructed depths and perforated intervals of production wells.
- Input from basin managers and stakeholders regarding preferred current and future operational groundwater elevations as well as groundwater levels that potentially could result in significant and unreasonable conditions.

3.4.1.2 Locally Defined Significant and Unreasonable Conditions

Significant and unreasonable groundwater levels in the Basin are those that:

- Reduce the pumping capacity of existing municipal wells to the point that they are no longer adequate to meet water demands.
- Cause significant financial burden to those who rely on the groundwater basin.
- Trigger other SGMA sustainability indicators (e.g. water quality, land subsidence, etc.).

3.4.1.3 Measurable Objectives

In the Bear Valley Basin, groundwater levels in most management areas are currently sustainable with conservation measures and support the water demands of both private and public stakeholders. As such, groundwater level Measurable Objectives have been selected at each Representative Monitoring Site (RMS) at the average 2019 groundwater level at that site. Representative Monitoring Sites are shown on Figure 2-31. Measurable Objectives for each RMS well are shown on Figures 3-1 through 3-10. Sustainable Management Criteria for each RMS well by management area are summarized in Table 3-1.

Groundwater pumping within the Basin, as a whole, has historically been within the Sustainable Yield resulting in relatively stable long-term groundwater levels. While there have periodically been localized groundwater level declines, pumping sustainability has been maintained through changes in pumping distribution between management areas and implementation of conservation measures. The BVBGSA plans to maintain pumping sustainability through continued managed pumping and conservation while allowing for strategic growth of the valley.

3.4.1.4 Interim Milestones

As the recent groundwater conditions are the same as the measurable objective, the interim milestones and measurable objectives are the same at most of the RMS wells (see Figures 3-1 through 3-10). At RMS wells in the Rathbone (Sand Canyon Well), Erwin (Maple Well), and North Shore (RV Park Well No.1), allowance is made for slightly lower interim milestones to allow for some fluctuation in groundwater levels during the sustainability transition period between 2022 and 2042.

3.4.1.5 Minimum Thresholds

As defined in Section §354.28(c)(1) of the SGMA regulations, "*The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results.*" In general, the groundwater level minimum threshold was set, for any given RMS, at the depth/elevation at which it would become difficult for the local water supply municipality to produce groundwater in amounts historically necessary to meet municipal supplies. Minimum Thresholds for each RMS well are shown on Figures 3-1 through 3-10.

Minimum Thresholds are locally defined, in the sense that localized geological, hydrogeological, and hydrological conditions affected their selection. For example, in the Grout Creek Management Area, the Cherokee Well RMS is approximately 600 feet deep and perforated in granitic bedrock. The Seminole Well RMS, on the other hand, is only 65 feet deep and perforated in the alluvial aquifer. Even though these RMS wells are only 550 feet apart, their Minimum Threshold groundwater elevations are significantly different due to differences in well construction and source aquifers (it is noted that the Cherokee Well is the only RMS in the Bear Valley GSP that is constructed in bedrock).

Each management area is relatively distinct hydrologically and, in most cases, hydrogeologically. Accordingly, Minimum Threshold exceedances in one area are not anticipated to contribute to Minimum Threshold exceedances in neighboring management areas. In those cases where groundwater level impacts are determined to extend across multiple management areas, groundwater pumping distribution can be adjusted to mitigate the impacts.

3.4.1.6 Relationship of Groundwater Level Sustainable Management Criteria to Other Sustainability Indicators

Groundwater elevation SMC can influence the other sustainability indicators.

Change in groundwater storage. Changes in groundwater elevations result in changes in the amount of groundwater in storage. Pumping at or less than the Sustainable Yield will maintain average groundwater elevations in the basin. The goal of the BVBGSA is to maintain average groundwater elevations near the measurable objectives but above the minimum thresholds through the SGMA 50-year planning horizon, consistent with the practice of pumping at or less than the sustainable yield. As groundwater elevations provide an indication of groundwater in storage, maintenance of these levels will not result in a long term significant or unreasonable depletion of groundwater in storage.

Seawater intrusion. Given the Bear Valley Basin's isolated nature in the San Bernardino Mountains and its physical distance from the ocean, seawater intrusion cannot occur in this area. Accordingly, this sustainability indicator is not applicable to this basin.

Degraded water quality. Maintaining groundwater levels protects against degradation of water quality or exceeding regulatory limits for constituents of concern in supply wells. Fluoride concentrations in the discharge from some wells in the eastern portion of the Bear Valley Basin tend to increase when groundwater levels drop as the contribution of water to the wells comes increasingly from the deeper aquifers where the fluoride concentrations are higher. As such, the groundwater level minimum thresholds that have been selected

for wells in the Bear Valley Basin are protective of high fluoride concentrations in the produced groundwater.

Land Subsidence. A significant and unreasonable condition for subsidence is permanent pumping induced subsidence that substantially interferes with surface land use. Subsidence is caused by dewatering and compaction of clay-rich sediments in response to lowering groundwater levels. Very small amounts of recoverable land surface elevation fluctuations have been reported across the Bear Valley Basin. The groundwater elevation minimum thresholds are set below existing groundwater elevations, which are protective of nonrecoverable land subsidence. Should new subsidence be observed due to lower groundwater elevations, the groundwater elevation minimum thresholds will be raised to avoid this subsidence.

Depletion of interconnected surface water. While there is evidence for a connection between groundwater and some surface water bodies in the Bear Valley Basin under high groundwater conditions, the direct impact of low groundwater levels on the beneficial uses of each water body has not been established. In general, the measurable objectives developed for groundwater levels in the vicinity of surface water bodies in Bear Valley Basin have not resulted in significant and unreasonable conditions in the past. Accordingly, the groundwater level SMC used herein serve as a proxy for this sustainability indicator.

3.4.1.7 Undesirable Results

A lowering of groundwater levels below the Minimum Threshold in any one RMS well within any two management areas (not including the Lake Williams management area) for three consecutive months in any two consecutive years constitutes an undesirable result. Lowering of groundwater levels below the Minimum Threshold in the Lake Williams RMS well will require investigation and increased monitoring to determine the relative impact of the exceedance on the BBDWP's ability to meet municipal water supply demands.

3.4.2 Reductions of Groundwater in Storage

3.4.2.1 Information Used to Establish Measurable Objectives and Minimum Thresholds

Information and data used to establish measurable objectives and minimum thresholds related to groundwater storage included:

- Historical groundwater elevation data measured in wells monitored by BVBGSA managers.

- Information on the constructed depths and perforated intervals of production wells.
- Input from basin managers and stakeholders regarding preferred current and future operational groundwater elevations as well as groundwater levels that potentially could result in significant and unreasonable conditions.

3.4.2.2 Locally Defined Significant and Unreasonable Conditions

A significant and unreasonable reduction in groundwater storage in the basin occurs when:

- The pumping capacity of existing municipal wells is reduced to the point that they are no longer adequate to meet water demands.
- It causes significant financial burden to those who rely on the groundwater basin.
- It triggers other SGMA sustainability indicators (e.g. water quality, land subsidence, etc.).

3.4.2.3 Measurable Objectives

As the groundwater storage of the Basin is directly related to groundwater level conditions, the measurable objectives used for chronic lowering of groundwater levels (see Section 3.4.1.3 herein) are applicable to reduction in groundwater storage. The measurable objective, using the groundwater level proxy, is stable average groundwater levels at 2019 conditions.

3.4.2.4 Interim Milestones

As the groundwater storage of the Basin is directly related to groundwater level conditions, the interim milestones used for chronic lowering of groundwater levels (see Section 3.4.1.4 herein) are applicable to reduction in groundwater storage.

3.4.2.5 Minimum Thresholds

Section §354.28(c)(2) of the SGMA regulations states that "*The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.*"

It has been observed that groundwater levels decline in the Basin during dry years when natural recharge is limited and groundwater production exceeds recharge for that year (see Section 2.2.1 of this GSP). The Bear Valley Basin has successfully sustained groundwater production during many historical dry climatic cycles, each consisting of multiple below normal precipitation years. Although the groundwater storage capacity of the Bear Valley Basin is thought to be relatively small compared to other basins in southern California, as indicated by significant fluctuations in

groundwater levels during wet and dry periods, its exact storage capacity is unknown. A preliminary minimum threshold is established as a depletion of 9,000 acre-ft of groundwater in storage in any two-year period, which is a depletion of approximately the sustainable yield each year over two consecutive years. However, as more data are collected, this minimum threshold may be revised.

3.4.2.6 Undesirable Results

A depletion of storage by more than 9,000 acre-ft in any consecutive two-year period is anticipated to be an undesirable result, as groundwater levels would likely drop below the minimum thresholds in many RMS wells, potentially triggering the impacts described in Section 3.4.1.5, herein.

3.4.3 Seawater Intrusion

Seawater intrusion cannot occur in the Bear Valley Basin due to its location with respect to the Pacific Ocean. The Bear Valley Basin is an isolated mountain groundwater basin located approximately 70 miles inland of the Pacific Ocean (see Figure 2-1). This mountain aquifer system is separated hydraulically from the coastal aquifers that are susceptible to seawater intrusion. Thus, no sustainable management criteria need be established.

3.4.4 Degraded Groundwater Quality

3.4.4.1 Information Used to Establish Measurable Objectives and Minimum Thresholds

Information and data used to establish measurable objectives and minimum thresholds related to groundwater quality included:

- Historical groundwater quality data measured in wells monitored by BVBGSA managers.
- Input from basin managers and stakeholders regarding meeting future water quality standards and addressing portions of the groundwater basin that are currently unusable due to naturally occurring groundwater quality issues.

3.4.4.2 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were assessed based on federal and state mandated drinking water and groundwater quality regulations, public workshops, and discussions with BVBGSA managers. A significant and unreasonable groundwater quality condition occurs when the water produced from one or more municipal supply wells cannot be used for municipal supply because constituents of concern (COCs) exceed drinking water standards that cannot be mitigated through treatment or blending.

3.4.4.3 Measurable Objectives

The quality of the groundwater in Bear Valley Basin is excellent and, except for isolated areas with naturally occurring COCs, meets regulatory requirements for municipal supply. In those areas where naturally occurring COCs occur, local agencies have been able to beneficially use the water through treatment or blending. The measurable objective for groundwater quality in the Bear Valley Basin is to maintain the existing quality and address high concentrations of naturally occurring water COCs through treatment and/or blending.

3.4.4.4 Minimum Thresholds

Section §354.28(c)(2) of the SGMA regulations states that "*The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin*."

The primary beneficial use of the groundwater produced from the Bear Valley Basin is municipal supply. The inability to produce groundwater suitable for municipal supply due to groundwater quality is considered an undesirable result. In keeping with State of California and Federal drinking water regulations, the established maximum contaminant levels (MCLs) for the naturally occurring COCs found in the groundwater basin, as described in Section 2.2.4 of this GSP (i.e. fluoride, arsenic, uranium, and manganese) are also the minimum thresholds, given that the groundwater produced from wells cannot be used for municipal supply if any of COC concentrations exceed their respective MCLs.

Historically, the agencies within the Bear Valley Basin have been able to address COC concentrations by perforating new wells to avoid the constituents, treating the water through wellhead treatment, or blending. Fluoride concentrations in the discharge from some wells in the eastern portion of the Basin tend to go up when groundwater levels drop as the contribution of water to the wells comes increasingly from the deeper aquifers where the fluoride concentrations are higher. As such, the groundwater level minimum thresholds that have been selected for wells in the Basin are protective of high fluoride concentrations in the produced groundwater.

Movement of existing point source contaminant plumes resulting from groundwater production management is not anticipated to occur in the Bear Valley Basin. As groundwater levels are not predicted to change significantly into the future, neither are groundwater flow paths that might change the direction of contaminant plume migration.

3.4.4.5 Undesirable Results

Undesirable results for the water quality of the Bear Valley Basin include the following:

- Any reduction in the existing water quality of the Basin resulting from anthropogenic activity including projects and management actions associated with this GSP,
- An exceedance of the MCL for any COC in the discharge of one or more wells such that the groundwater from that well(s) cannot be treated or blended for municipal supply.

On average during any one year, no groundwater quality minimum threshold shall be exceeded as a direct result of projects or management actions taken as part of GSP implementation.

3.4.5 Land Subsidence

3.4.5.1 Information Used to Establish Measurable Objectives and Minimum Thresholds

Historical InSAR data has not detected permanent, non-recoverable land subsidence in the Bear Valley Basin (see Section 2.2.5 of this GSP). Land subsidence is a gradual settling of the land surface caused by compaction of fine-grained subsurface sediments in areas where the groundwater level has been lowered from groundwater pumping. If groundwater levels are kept low enough for a long enough period of time, the ensuing land subsidence can become permanent (i.e. non-recoverable). The primary sources of information to inform sustainable management criteria for land subsidence in the Bear Valley Basin are Flint and Martin (2012) and the California DWR online InSAR dataset.

3.4.5.2 Locally Defined Significant and Unreasonable Conditions

Land subsidence would become significant and unreasonable within the Bear Valley Basin if it was non-recoverable and caused damage to surface land uses such as roads, buildings or other infrastructure. The most vulnerable areas to future land subsidence are the area of the airport and the Big Bear Village, which are areas where there is thick layers of fine-grained clay sediments underground. However, non-recoverable land subsidence has not been observed in these areas and maintenance of groundwater levels above their respective minimum thresholds will be protective of land subsidence in the future.

3.4.5.3 Measurable Objective

Existing ground surface elevation data do not suggest the occurrence of permanent land subsidence in the Basin. Therefore, the measurable objective for subsidence is maintenance of current ground surface elevations.

3.4.5.4 Minimum Threshold

The minimum threshold for land subsidence in the Bear Valley Basin will be no more than 0.1 foot in any single year and a cumulative of 0.5 foot in any five-year period, as measured between June of one year and June of the subsequent year using InSAR.

3.4.5.5 Undesirable Results

Any pumping induced, non-recoverable land subsidence that causes damage to surface infrastructure or other surface land uses is considered an undesirable result.

3.4.6 Depletion of Interconnected Surface Water

3.4.6.1 Information Used to Establish Measurable Objectives and Minimum Thresholds

The potential for interconnection between surface water and groundwater in the Basin occurs in three different areas:

1. Beneath and at the margins of Big Bear Lake
2. Shay Pond in the Erwin Subunit
3. Natural springs fed by bedrock aquifers in the watershed surrounding the Basin

Studies of the relationship between surface water and groundwater at Big Bear Lake and Shay Pond have been conducted and described in Section 2.2.6 of this GSP. Detailed information regarding the historical flow rate of natural springs has been obtained from BBLDWP and BBCCSD. These data and studies were used to inform the sustainable management criteria for the depletion of interconnected surface water in the Basin.

3.4.6.2 Locally Defined Significant and Unreasonable Conditions

Regarding the connection between groundwater levels and surface water in Big Bear Lake and Shay Pond, while there is evidence for a connection between the two under high groundwater conditions, the direct impact of low groundwater levels on the beneficial uses of each water body has not been established. In general, the measurable objectives developed for groundwater levels in the vicinity of Big Bear Lake and Shay Pond have not resulted in significant and unreasonable conditions in the past. Groundwater and surface water monitoring will be required into the future to determine if groundwater levels approaching the minimum thresholds in these areas has an adverse impact on the surface water bodies.

As the spring flow fed by bedrock aquifers at the margins of the Basin is entirely dependent on precipitation, groundwater pumping does not have an impact on this surface water source.

3.4.6.3 Measurable Objectives

Measurable objectives applicable to depletion of interconnected surface water were not developed for the GSP. If in the future, data from the monitoring program allow for development of a relationship between lowered groundwater levels and their impact on surface water bodies, then measurable objectives specific to this sustainability indicator will be developed. In the meantime, groundwater level measurable objectives will serve as a proxy.

3.4.6.4 Minimum Thresholds

Minimum thresholds applicable to depletion of interconnected surface water were not developed for the GSP. If in the future, data from the monitoring program allow for development of a relationship between lowered groundwater levels and their impact on surface water bodies, then minimum thresholds specific to this sustainability indicator will be developed. In the meantime, groundwater level minimum thresholds will serve as a proxy.

3.4.6.5 Undesirable Results

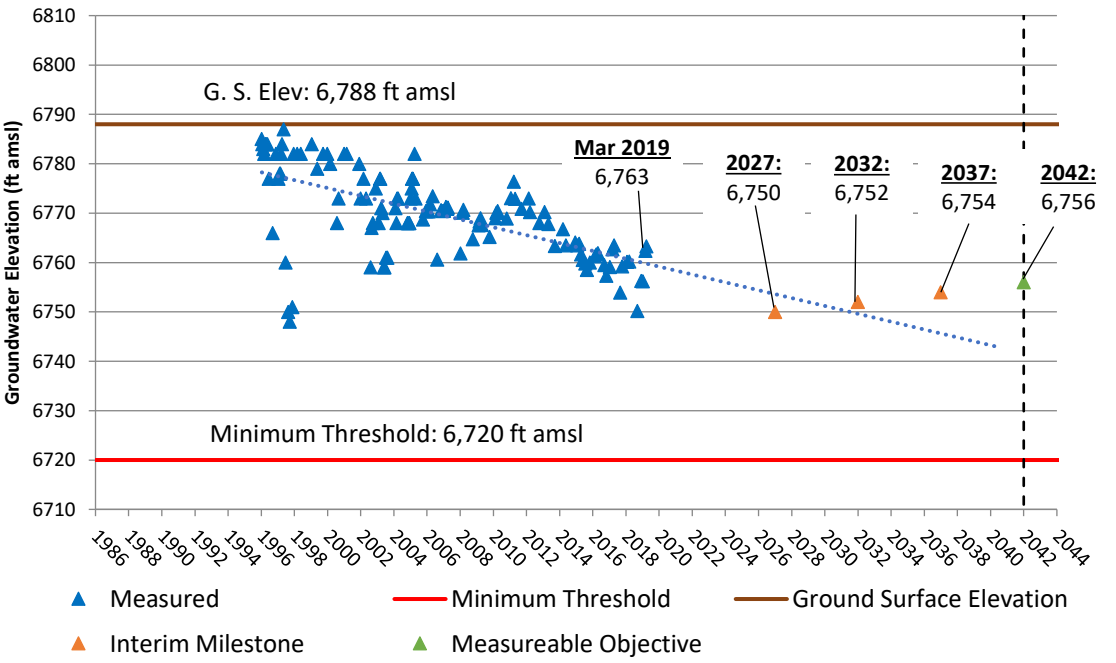
In general, if lowering of groundwater levels in the vicinity of Big Bear Lake and Shay Pond below their historical levels was shown to have a negative impact on the beneficial uses of these water bodies, then that would be considered an undesirable result. Future data collection and monitoring will help quantify the relationship between groundwater levels and surface water levels in these water bodies.

Sustainable Management Criteria at each RMS Well

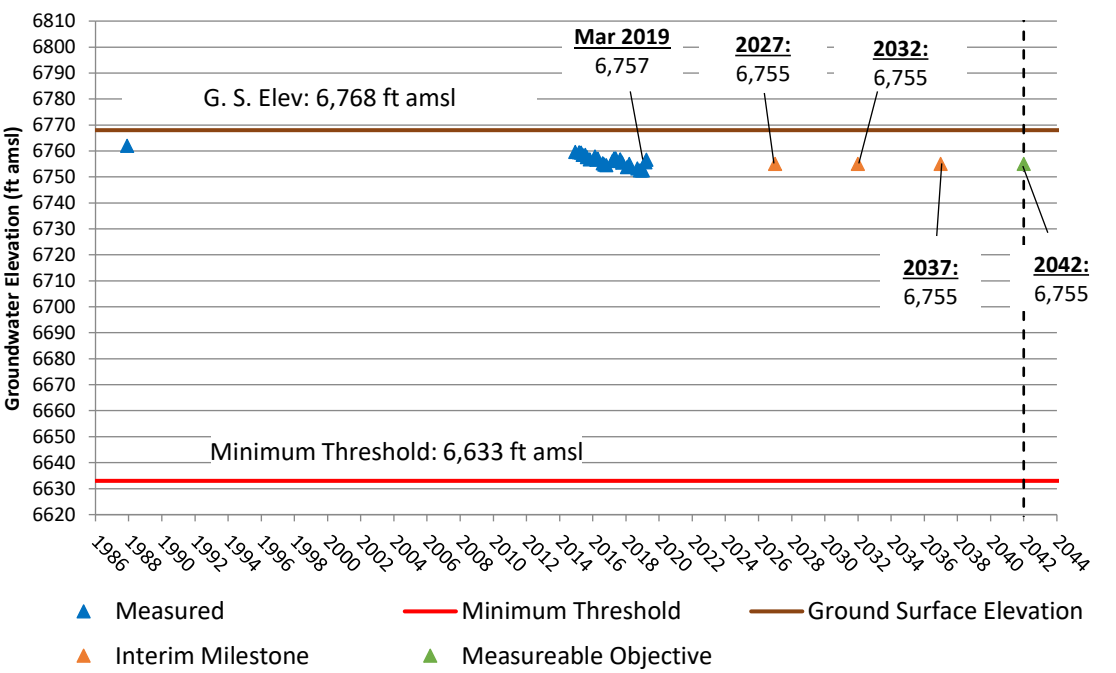
Watershed	Management Area	RMS Well	Aquifer Monitored	Interim Milestone (GWE (ft amsl))			Measurable Objective (GWE (ft amsl))	Minimum Threshold
				2027	2032	2037	2042	
Big Bear Lake	North Shore	RV Park #1	Middle	6,750	6,752	6,754	6,756	6,756
Big Bear Lake	North Shore	FP-2	Middle	6,755	6,755	6,755	6,755	6,755
Big Bear Lake	Grout Creek	Cherokee Well	Middle	6,745	6,745	6,745	6,745	6,745
Big Bear Lake	Grout Creek	Seminole	Middle	6,745	6,745	6,745	6,745	6,745
Big Bear Lake	Mill Creek	Canvasback Shallow Monitoring Well	Middle	6,730	6,730	6,730	6,730	6,730
Big Bear Lake	Village	Oak Well	N/A	6,690	6,690	6,690	6,690	6,690
Big Bear Lake	Rathbone	Rathbun Well (DWP Yard)	N/A	6,780	6,780	6,780	6,780	6,780
Big Bear Lake	Rathbone	Sand Canyon #1	N/A	6,900	6,905	6,910	6,915	6,915
Big Bear Lake	Division	McAlister Shallow Monitoring Well	Middle	6,730	6,730	6,730	6,730	6,730
Big Bear Lake	Division	Division Well #4	Middle	6,700	6,700	6,700	6,700	6,700
Big Bear Lake	Division	Hillendale Monitoring Well	Middle	6,710	6,710	6,710	6,710	6,710
Baldwin Lake	West Baldwin	Maltby Monitoring Well	Middle	6,694	6,694	6,694	6,694	6,694
Baldwin Lake	West Baldwin	Greenway Monitoring Well	Middle	6,710	6,710	6,710	6,710	6,710
Baldwin Lake	East Baldwin	CSD Well #8	Middle	6,680	6,680	6,680	6,680	6,680
Baldwin Lake	Erwin	Vaqueros Monitoring Well	Middle	6,755	6,755	6,755	6,755	6,755
Baldwin Lake	Erwin	Maple Well	N/A	6,760	6,750	6,750	6,760	6,760
Baldwin Lake	Lake Williams	Monte Vista Monitoring Well	Middle	7,175	7,175	7,175	7,175	7,175

RMS Groundwater Elevation Hydrographs, North Shore

RV Park Well #1



FP-2



RMS Groundwater Elevation Hydrographs, Grout Creek

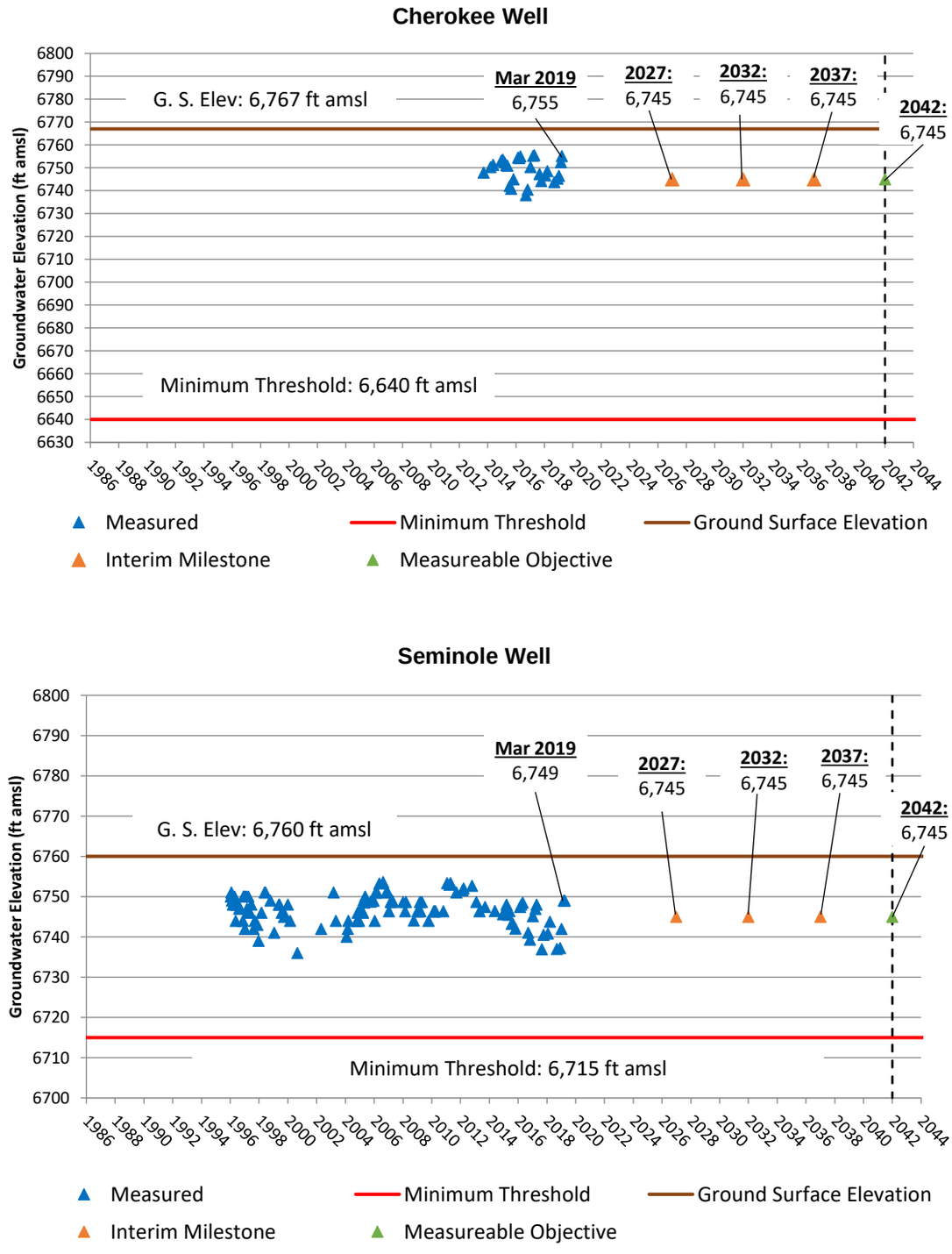
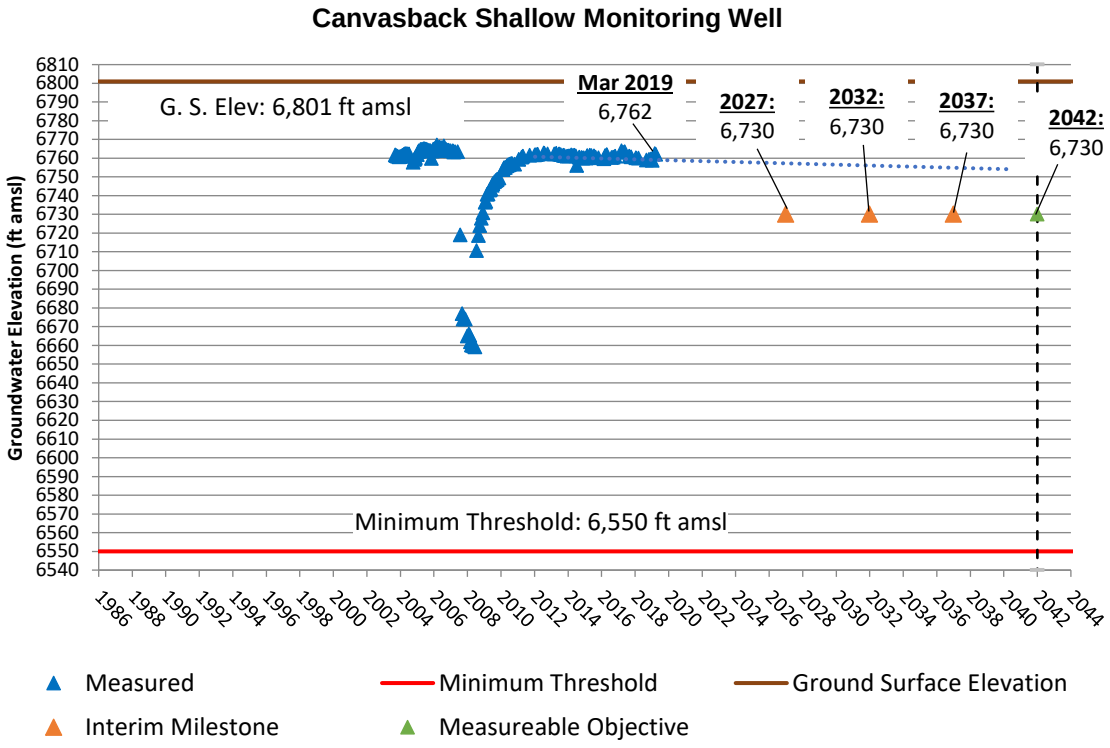
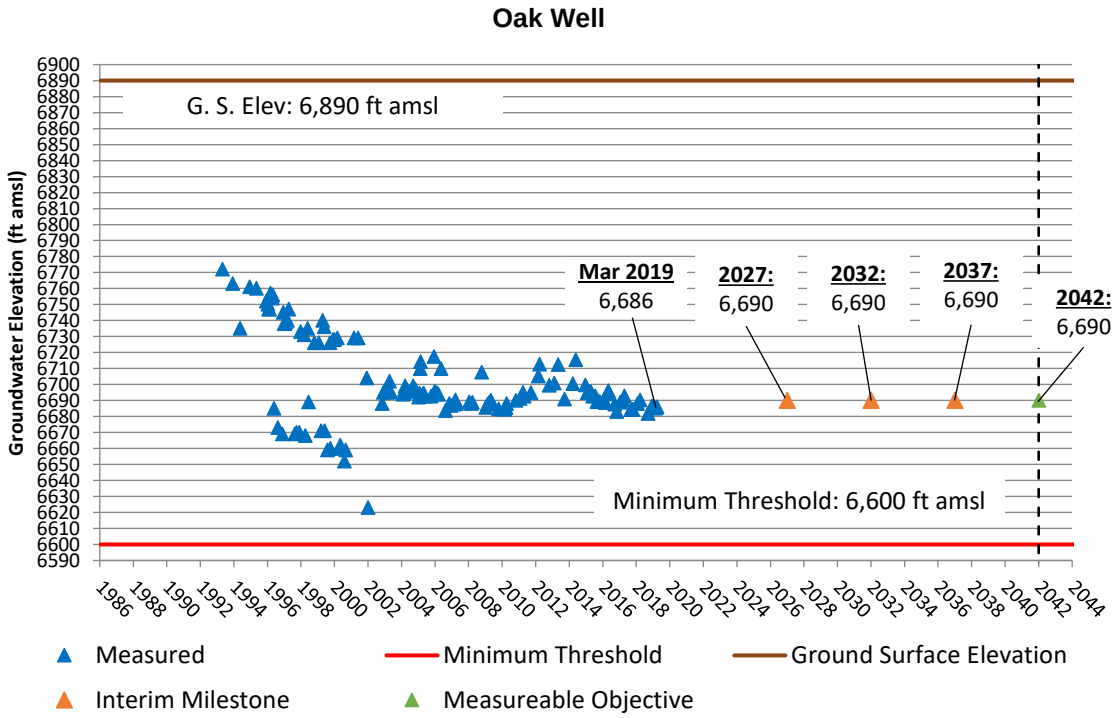


Figure 3-3

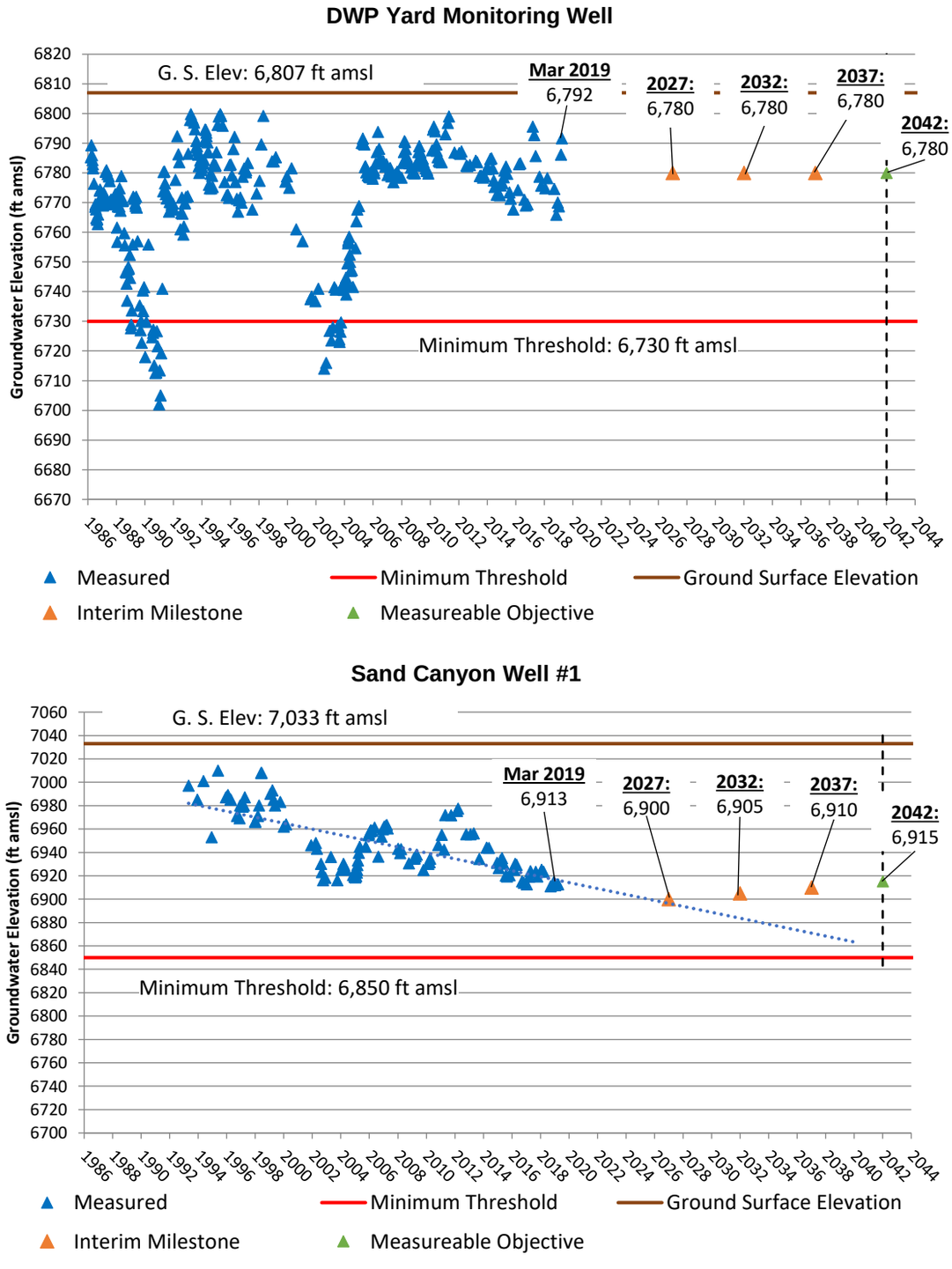
RMS Groundwater Elevation Hydrographs, Mill Creek



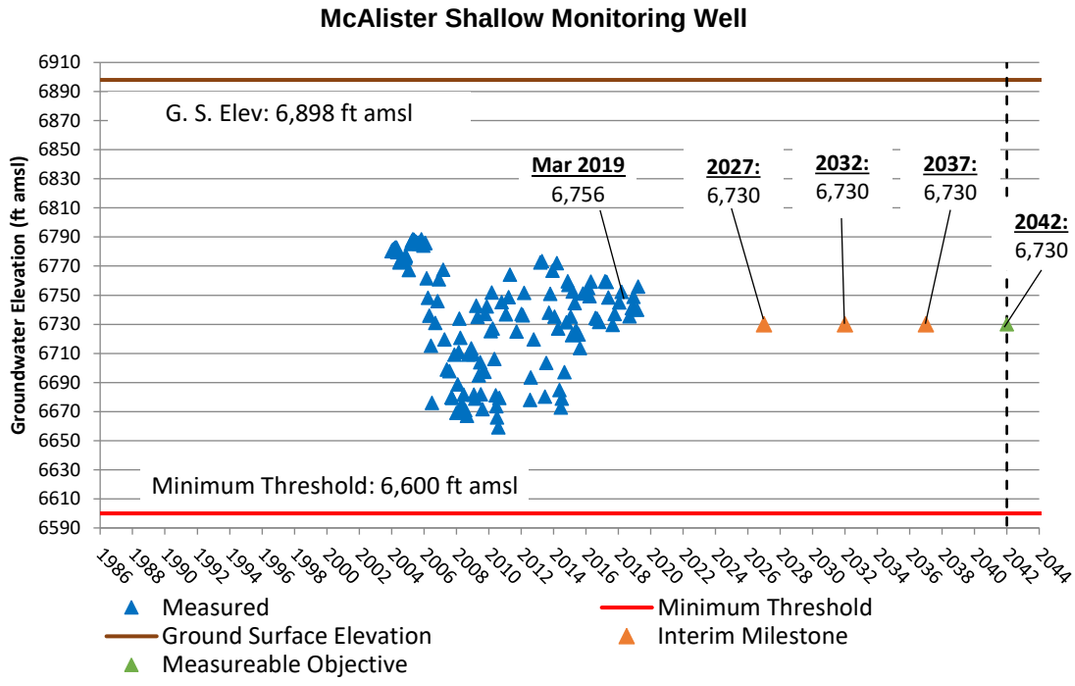
RMS Groundwater Elevation Hydrographs, Village

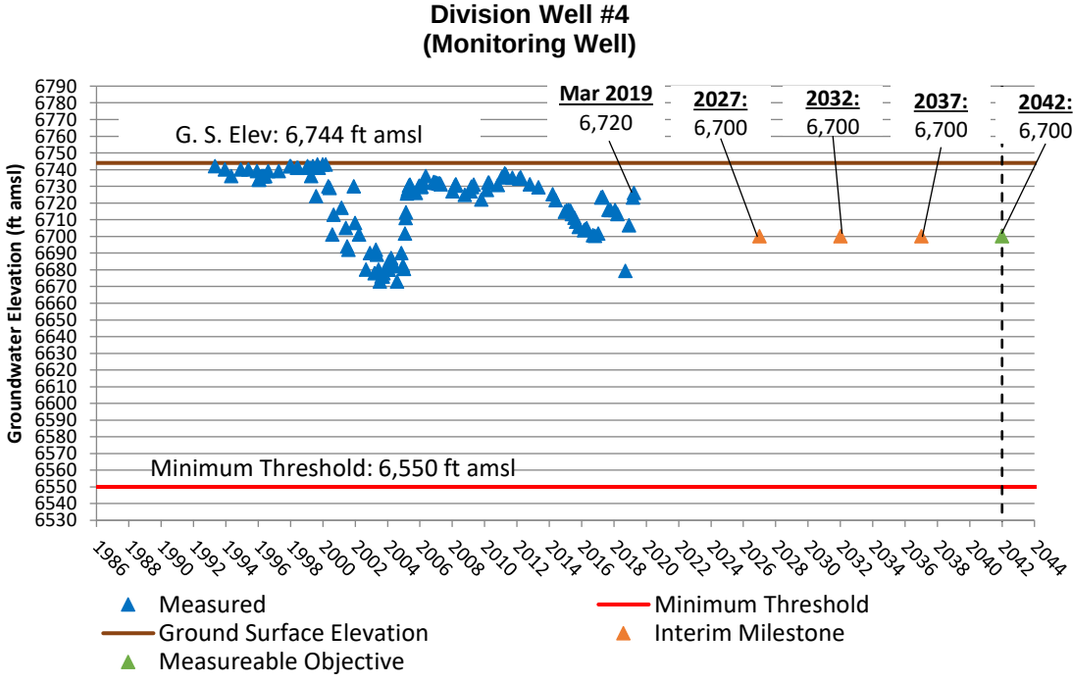


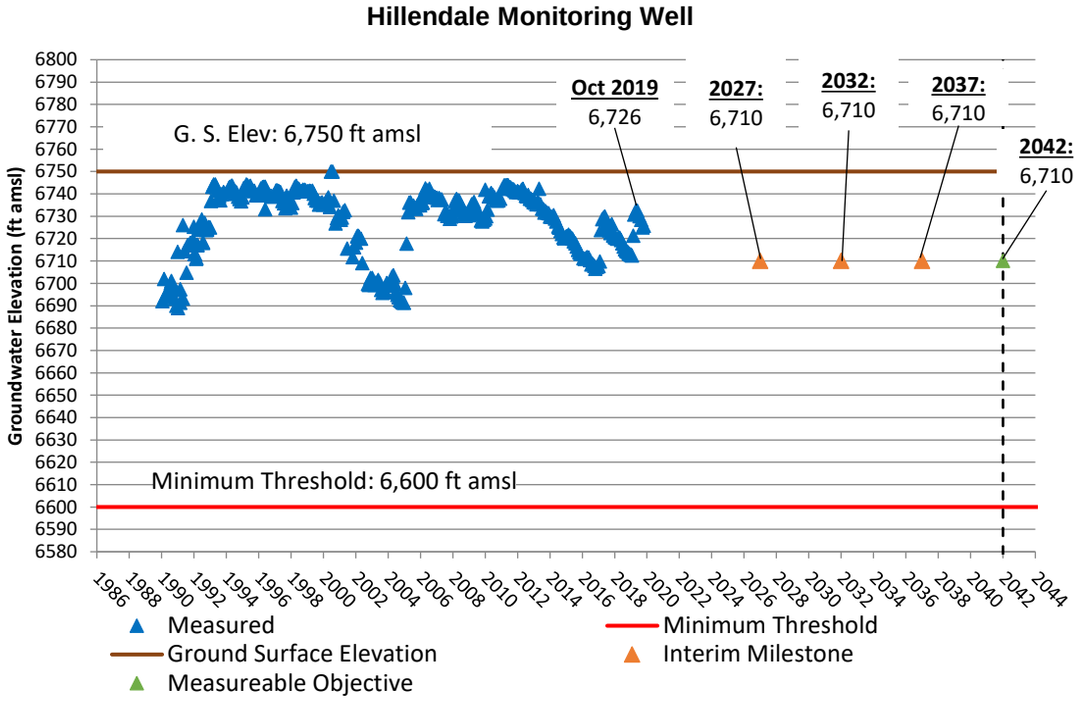
RMS Groundwater Elevation Hydrographs, Rathbone



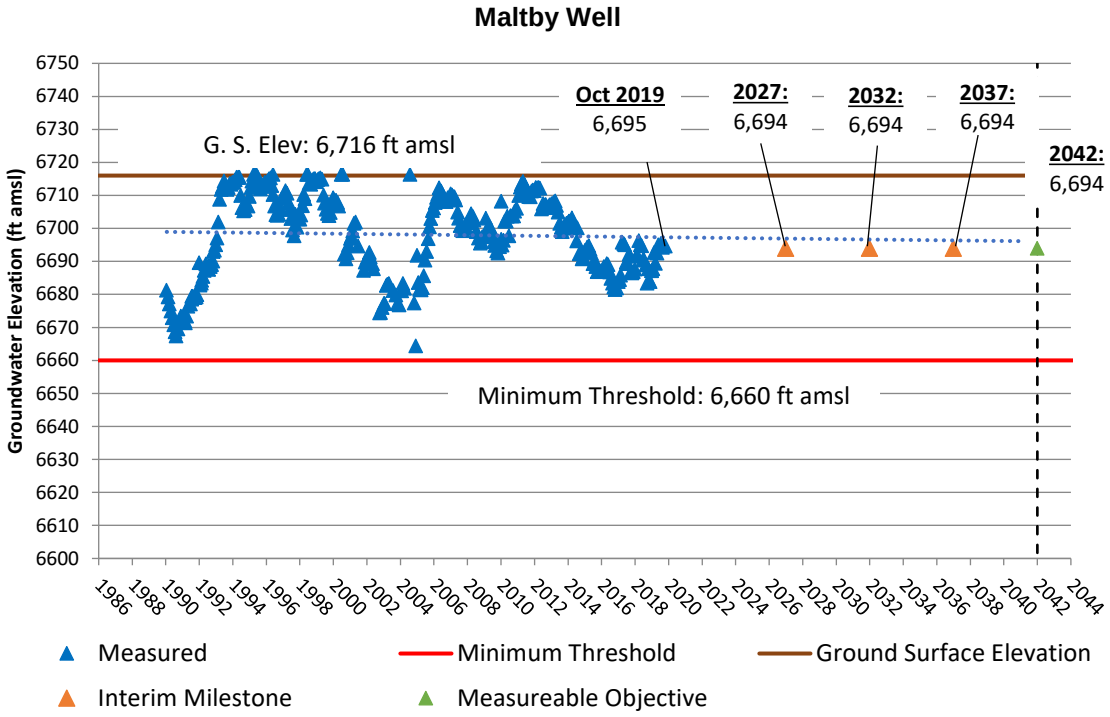
RMS Groundwater Elevation Hydrographs, Division






Hillendale Monitoring Well
Groundwater Elevation (ft amsl)
6800
6790
6780
6770
6760
6750
6740
6730
6720
6710
6700
6690
6680
6670
6660
6650
6640
6630
6620
6610
6600
6590
6580
G. S. Elev: 6,750 ft amsl
Minimum Threshold: 6,600 ft amsl
Oct 2019
6,726
2027:
6,710
2032:
6,710
2037:
6,710
2042:
6,710
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038
2040
2042
2044
Measured
Minimum Threshold
Ground Surface Elevation
Interim Milestone
Measureable Objective

RMS Groundwater Elevation Hydrographs, West Baldwin



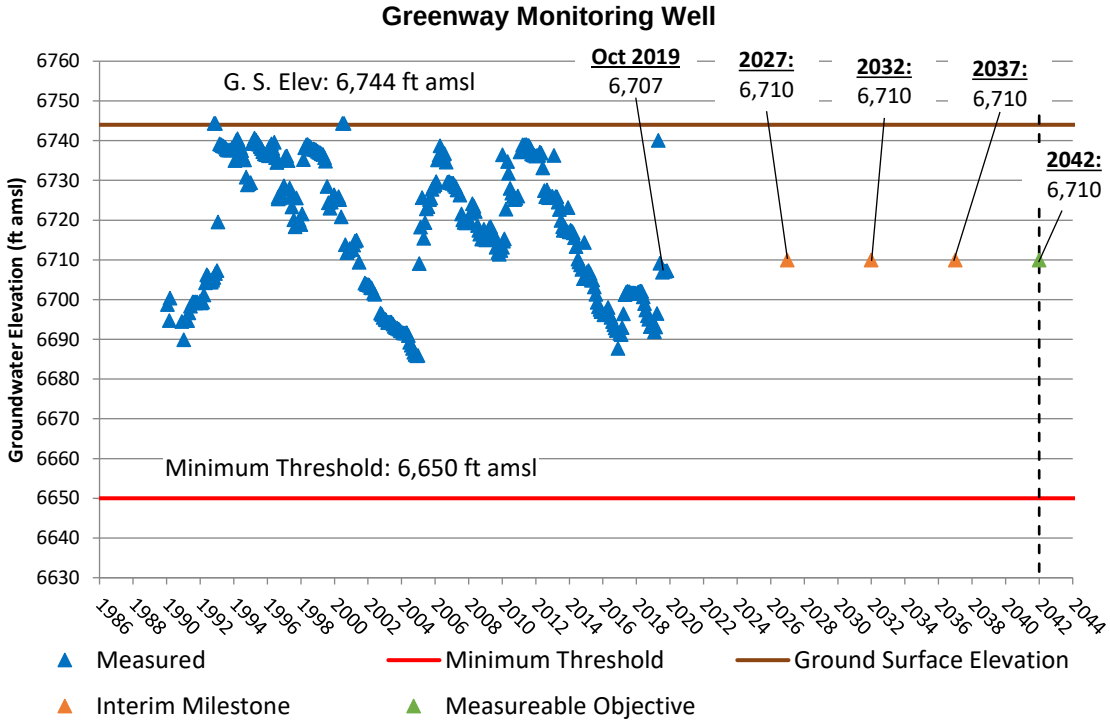
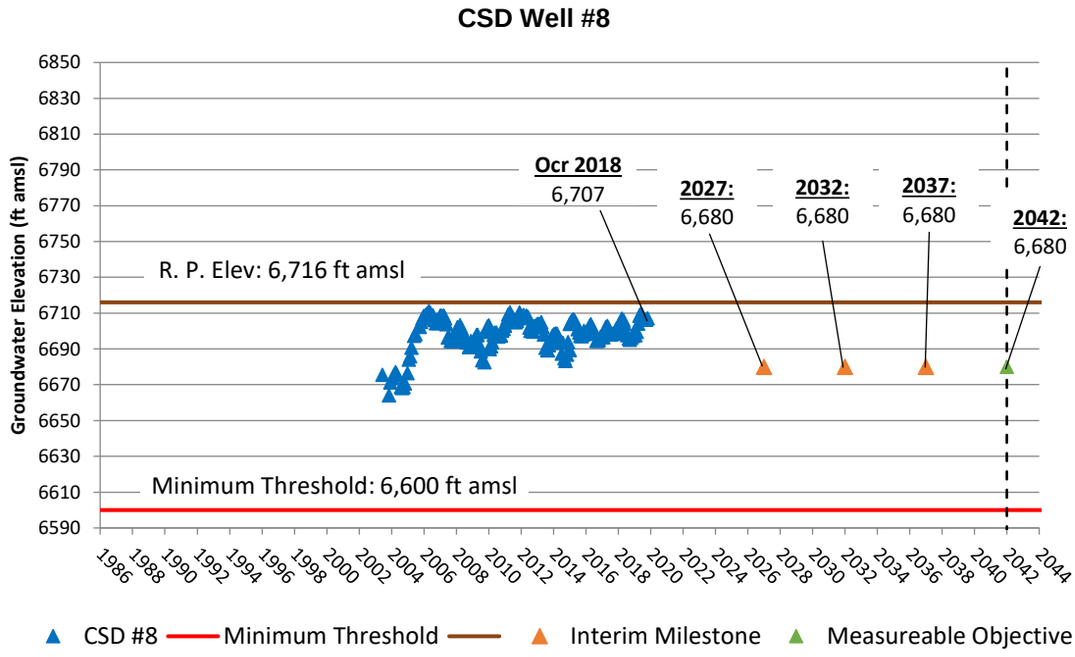
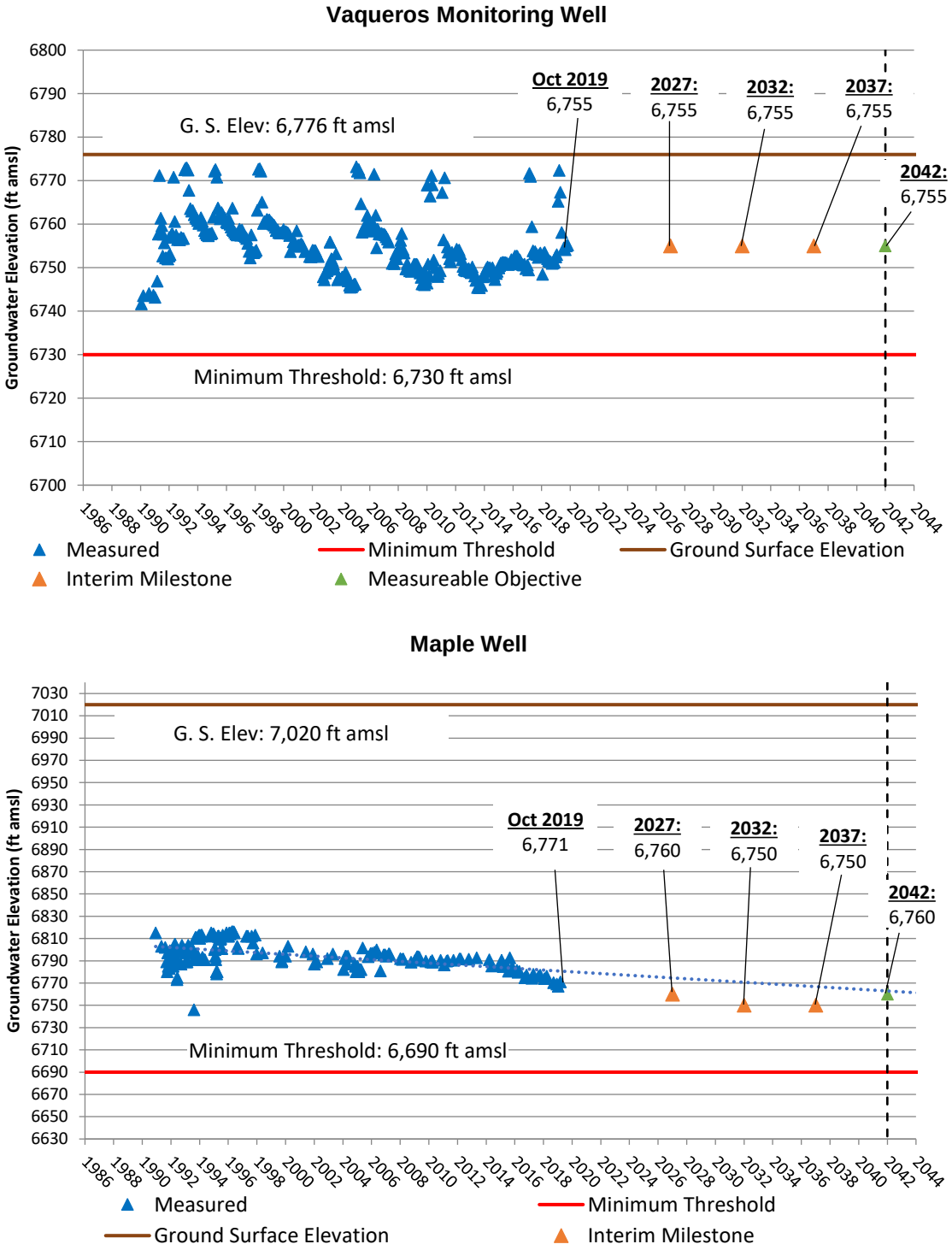


Figure 3-8

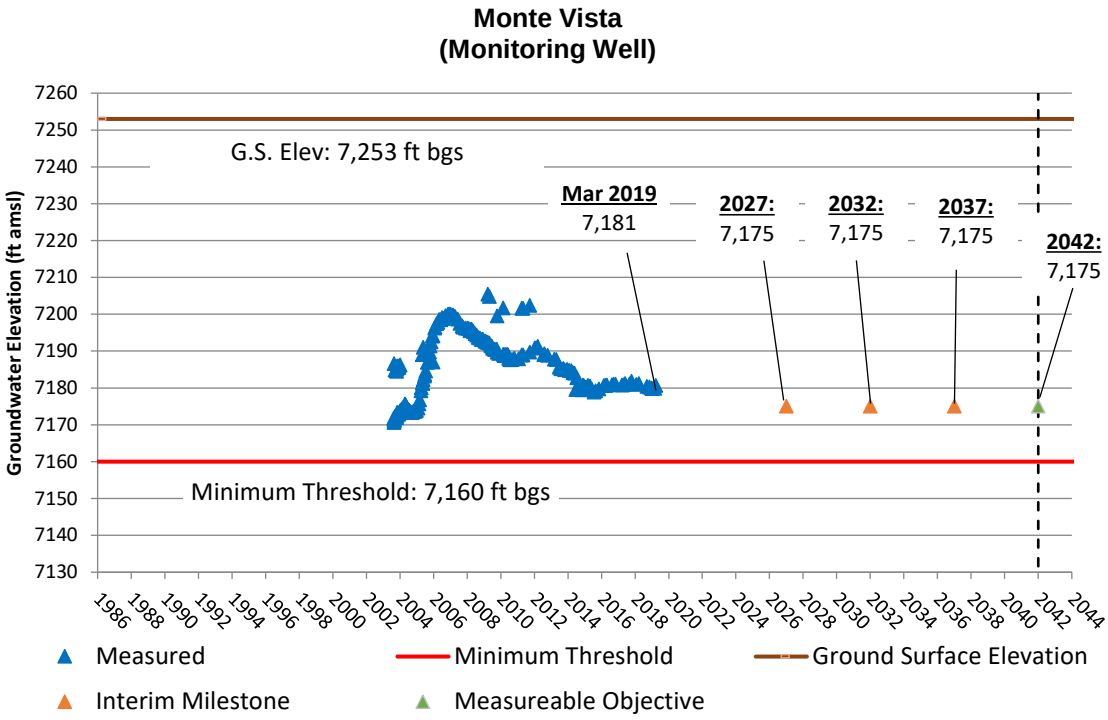
RMS Groundwater Elevation Hydrographs, East Baldwin



RMS Groundwater Elevation Hydrographs, Erwin



RMS Groundwater Elevation Hydrographs, Lake Willams



4. Monitoring Network

4.1 Introduction

The groundwater monitoring network presented herein is to be relied on by the BVBGSA to collect the data necessary to prepare its annual reports and assess progress with regard to achieving sustainability goals. Data to be collected from the monitoring network will include groundwater levels, groundwater quality and land elevation data. Groundwater levels and quality data will be collected from a network of monitoring wells spaced throughout the Bear Valley Basin. The monitoring well network includes existing monitoring wells and production wells. Changes in land elevation, in the form of InSAR satellite data, will be obtained from the CDWR website.

4.1.1 Monitoring Objectives

The monitoring network has been selected to meet the following Basin wide objectives:

- To ensure that the data collected within the basin are in sufficient quantities, areal distribution, frequency and accuracy to provide meaningful results for demonstrating progress toward achieving measurable objectives of each GSA and the sustainability goal of the subbasin as a whole.
- To monitor impacts to the beneficial uses and users of groundwater.
- To monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
- Enable the quantification of annual changes in water budget components.
- To identify data gaps and monitoring features to address the data gaps.
- To provide a standard methodology for the collection of groundwater and land surface subsidence data within the Basin.
- To provide for a central, secure monitoring database available to the BVBGSA for their use.

The monitoring network and associated monitoring plan is both flexible and iterative, allowing for the addition or subtraction of monitoring features, as necessary, and to accommodate changes in monitoring frequency and alternative methodologies, as appropriate.

4.1.2 Monitoring Plan Organization

The monitoring network enables the collection of the following types of data:

- Groundwater Level Data
- Groundwater Quality Data

- Land Subsidence Data

Each data type will be addressed in its own section that includes a description of the monitoring features for collecting data, the data collection protocols, and the monitoring frequency.

The final section of this section describes the data management system that includes a description of the database management platform, criteria for data QA/QC, file storage, security and access, and database maintenance.

4.2 Chronic Lowering of Groundwater Levels

Monitoring wells to be used to collect groundwater level data are shown on Figure 2-31. This groundwater level monitoring network consists of 37 existing wells located throughout the Basin. At least one monitoring well has been selected for each Management Area except Grays Landing. No groundwater production occurs in the Grays Landing Management Area and, as such, no groundwater level monitoring is conducted. A table of monitoring wells included in the Bear Valley Basin monitoring network is summarized in Table 2-7.

4.2.1 Monitoring Procedure

Groundwater level measurements shall be collected from each well using either a calibrated well sounder or a pressure transducer. Measurement devices will be calibrated to the nearest 0.01 ft. All equipment must be in good working condition. No damaged or refurbished electrical sounding tape shall be used.

Groundwater level measurements must be representative of static (i.e. non-pumping) groundwater level conditions. To ensure measurement of static groundwater levels in active pumping wells, the field technician collecting the data must verify that the pump has been off for at least 24 hours prior to collecting the data.

4.2.1.1 Manual Groundwater Level Measurements

The following monitoring procedure shall be used to obtain manual groundwater level measurements in the field:

- Upon arrival at each site, the field technician shall note the well name, time of day, and date on the standard groundwater level data form (see Appendix A).
- All monitoring equipment shall be cleaned prior to lowering it into the well(s) using the following decontamination procedure:
    - Wash equipment with an Alconox solution which is followed by a deionized water rinse.

  - Triple rinse equipment with deionized water.
  - Place equipment on clean surface such as teflon or polyethylene sheet to air dry.
- To measure the depth to groundwater with an electrical sounder or meter, slowly lower the steel tape or water level electrical tape into the designated sounding port for production wells and into the main well for monitoring wells. Electrical tapes are lowered to the water surface, as determined by the audio signal, meter, or technician. Depths to groundwater are measured relative to the dedicated reference point at the top of the casing or sounding tube. Depth to groundwater shall be immediately recorded on the standard groundwater level data form (see Appendix A). Depths to groundwater shall be compared to previous measurements in the field and re-measured if significantly different.
- When finished sounding the groundwater level, all downhole equipment shall be removed, and where existing, the well cap shall be replaced, and the riser locked.
- Prior to leaving the monitoring well site, the field representative shall note any physical changes in the concrete well pad and riser pipe, such as erosion, cracks or damage. All changes shall be recorded on the standard field forms provided in Appendix A.

4.2.1.2 Automatic Groundwater Level Measurements Using Transducers

Transducers may be installed in monitoring wells identified as representative monitoring sites. Transducers shall be installed below the groundwater level with enough submergence to accommodate anticipated groundwater level fluctuations.

4.2.2 Frequency of Measurement

Groundwater level measurements from the monitoring wells shown on Figure 2-31 will be collected monthly. For those monitoring wells equipped with pressure transducers, the transducer will be programmed to record one groundwater level measurement per day. Pressure transducers will be downloaded on a semi-annual basis. During each download session, the field technician will also obtain a manual groundwater level measurement to verify transducer readings and ensure that the instruments are working properly.

4.3 Reduction in Groundwater Storage

Groundwater level data to be relied on for the change in groundwater storage estimates will be collected as described in Section 4.2 of this GSP. The change in groundwater storage will be estimated using the following equation:

$$V_w = S_y A \, \Delta h$$

Where:

V_w	=	the volume of groundwater storage change (acre-ft).
S_y	=	specific yield of aquifer sediments (unitless).
A	=	the surface area of the aquifer within the Tule Subbasin/GSA (acres).
Δh	=	the change in hydraulic head (i.e. groundwater level) (feet).

The change in storage estimate is specific to the shallow aquifer as the groundwater level in the deep aquifer will not likely drop below the top of the aquifer. The calculations will be made using a Geographic Information System (GIS) map of the Bear Valley Basin that will be discretized into 300-foot by 300-foot grids to allow for spatial representation of specific yield and groundwater level change.

The distribution of specific yield for the shallow aquifer will be based on values obtained from pumping tests conducted on wells in the basin.

For the areal distribution of change in hydraulic head within the Tule Subbasin/GSA, groundwater contours for the spring of the previous year will be digitized and overlain on the grid map of the Bear Valley Basin in GIS. Groundwater levels will then be assigned to each grid. A contour map with groundwater elevation contours from spring of the next year will also be digitized and overlain on the grid map. Change in hydraulic head (groundwater level) at each grid will be calculated as the difference in groundwater level between the two years.

The complete GIS files of specific yield and groundwater levels will be exported into a spreadsheet program for the final analysis of groundwater storage change. The change in groundwater storage will be calculated for each grid cell by multiplying the change in groundwater level by the specific yield and then by the area of the cell.

The data from the analysis can be used to develop change in storage maps for incorporation into the annual reports.

4.4 Seawater Intrusion

Seawater intrusion cannot occur in the Bear Valley Basin due to its location with respect to the Pacific Ocean. The Bear Valley Basin is an isolated mountain groundwater basin located approximately 70 miles inland of the Pacific Ocean (see Figure 2-1). This mountain aquifer system is separated hydraulically from the coastal aquifers that are susceptible to seawater intrusion. As such, monitoring for seawater intrusion is not necessary and is not included in this monitoring plan.

4.5 Degraded Water Quality

The groundwater quality monitoring plan specified in this section is designed to address the primary water quality undesirable result described in the Sustainable Management Criteria (Section 3 of this GSP), which is the inability to produce groundwater suitable for municipal supply. Accordingly, groundwater samples will be collected from agency production wells and analyzed in accordance with their required sampling and analysis schedule specified by the California Division of Drinking Water (DDW).

The groundwater sampling protocols described herein will ensure that:

- Groundwater quality data are collected from the correct location
- Groundwater quality data are accurate and reproducible
- Groundwater quality data represent conditions that inform appropriate basin management decisions
- All salient information is recorded to normalize, if necessary, and compare data
- Data are handled in a way that ensures data integrity

4.5.1 Groundwater Quality Constituents to be Analyzed

Groundwater quality constituents to be analyzed as part of this GSP are the same as are currently being analyzed to comply with California DDW requirements for drinking water. A complete list of the constituents that are currently being analyzed and which are proposed to be analyzed into the future is summarized in Table 4-1. In general, these constituents include general mineral and physical properties (including nitrate), volatile organic compounds (VOCs), methyl tert butyl ether (MTBE), ethylene dibromide (EDB), dibromochloropropane (DBCP), and gross alpha.

4.5.2 Sample Collection Protocol

All samples shall be collected from the discharge point near the well head and placed in laboratory-prepared sample containers. Groundwater samples will be collected during normal operation of the well to ensure that the samples are reflective of groundwater quality and not stagnant water in the well. The technician collecting the sample shall wear new latex or neoprene gloves while collecting the sample. Sample containers shall be labeled before or immediately after sampling with self-adhesive tags having the following information written in waterproof ink:

- Well I.D.
- Sample I.D. number
- Date and time sample was collected
- Initials of sample collector

4.5.3 Handling, Storage and Transportation of Samples

Upon collection and labeling, all samples shall be placed immediately into a clean chest/cooler with ice to keep samples cool. Exposure to dust, direct sunlight, high temperature, adverse weather conditions, and possible contamination shall be avoided.

All samples will be transported to a State-certified analytical laboratory within 24 hours of collection. Samples shall be transported under chain-of-custody procedures, which document the transfer of custody of samples from the field to the laboratory. Each sample sent to the laboratory for analysis shall be recorded on a Chain-of-Custody Record, which includes instructions to the laboratory for analytical services.

Information contained on the triplicate Chain-of-Custody Record shall include:

- Well No.
- Signature of sampler(s)
- Date and time sampled
- Number of sample containers
- Sample matrix (water)
- Analyses required
- Remarks, including preservatives, special conditions, or specific quality control measures
- Turnaround time and person to receive laboratory report
- Method of shipment to the laboratory
- Release signature of sampler(s), and signatures of all people assuming custody
- Condition of samples when received by laboratory

Blank spaces on the Chain-of-Custody Record will be crossed out between the last sample listed and the signatures at the bottom of the sheet.

The field sampler shall sign the Chain-of-Custody Record and record the time and date at the time of transfer to the laboratory or to an intermediate person. A set of signatures is required for each relinquished/reserved transfer, including intermediate transfers. The original imprint of the Chain-of-Custody Record will accompany the sample containers. A duplicate copy shall be placed in the project file.

If the samples are to be shipped to the laboratory, the original Chain-of-Custody will be sealed inside a plastic bag within the ice chest, and the chest shall be sealed with custody tape which has been signed and dated by the last person listed on the Chain-of-Custody. U. S. Department of Transportation shipping requirements shall be followed and the sample shipping receipt retained in the project file as part of the permanent chain-of-custody document. The shipping company

(e.g. Federal Express, UPS, DHL) will not sign the chain-of-custody forms as a receiver, instead the laboratory shall sign as a receiver when the samples are received.

4.5.4 Quality Control Samples

Quality control samples shall consist of duplicates and blanks. At least one duplicate sample shall be collected during each day of sampling. The duplicate sample shall be collected from the same well as the original and immediately after the original sample. At least one blank sample shall be included with each batch of samples delivered to the laboratory. Blank samples shall consist of laboratory prepared deionized water that is containerized at the laboratory and delivered with the sample containers.

4.5.5 Frequency of Measurement

Groundwater quality samples will be collected from agency wells in the Bear Valley Basin and analyzed according to the schedule shown in Table 4-2. The analysis schedule is specified by the DDW.

4.6 Land Subsidence

Monitoring of changes in land surface elevation related to groundwater withdrawal will be conducted through evaluation of satellite data.

4.6.1 Monitoring Features

Changes in land surface elevation over time can be observed on a regional scale using satellite data. The data is generated using interferometric synthetic aperture radar (InSAR). Monthly InSAR datasets will be published on a quarterly basis by the DWR. Additional information on the DWR's InSAR subsidence data is available at https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence.

4.6.2 Monitoring Procedure

InSAR data will be downloaded from https://gis.water.ca.gov/arcgisimg/rest/services/SAR to develop maps showing regional land surface changes.

4.6.3 Frequency of Measurement

InSAR data will be downloaded from the DWR website and analyzed on an annual basis for evaluation and incorporation into the annual reports.

4.7 Depletions of Interconnected Surface Water

The measurable objectives developed for groundwater levels in the vicinity of Big Bear Lake and Shay Pond have not resulted in significant and unreasonable surface water conditions in the past. Although a lowering of groundwater levels to the minimum thresholds is not anticipated, ongoing monitoring of the impact of groundwater on surface water and vice versa will be conducted into the future to determine if groundwater levels approaching the minimum thresholds in these areas has an adverse impact on the beneficial uses of the surface water bodies.

4.7.1 Monitoring Features

Monitoring wells used to measure groundwater levels in areas where there is potential for direct groundwater and surface water interaction will be the primary monitoring features from which data is obtained to assess groundwater and surface water interaction. Surface water levels for Big Bear Lake will be obtained from the Big Bear Municipal Water District. Surface water level conditions in Shay Pond will be obtained from the BBCCSD.

4.7.2 Monitoring Procedure

Groundwater levels will be monitored using the procedures described in Section 4.2.1.

4.7.3 Frequency of Measurement

Groundwater level measurement frequency for depletions of interconnected surface water will be monthly, as described in Section 4.2.2.

Surface water stage level data will be compiled annually.

4.8 Representative Monitoring

4.8.1 Groundwater Levels

A subset of groundwater level monitoring features in the monitoring network have been identified as representative monitoring sites to be relied on for the purpose of assessing progress with respect to groundwater level sustainability in the Bear Valley Basin. The representative groundwater level monitoring sites are shown on Figure 2-31. At least one representative groundwater level monitoring site has been identified within each management area.

4.8.2 Reduction of Groundwater Storage

Changes in groundwater storage within the Bear Valley Basin will be estimated using the method described in Section 4.3 of this GSP. Groundwater level data to be relied on for the change in groundwater storage estimates will be collected as described in Section 4.2 of this GSP from the monitoring network shown on Figure 2-31 and summarized in Table 2-7. As such, there are no single representative monitoring sites for evaluating progress with respect to groundwater sustainability as it relates to changes in groundwater storage in the Bear Valley Basin.

4.8.3 Seawater Intrusion

Seawater intrusion cannot occur in the Bear Valley Basin due to its location with respect to the Pacific Ocean (see Section 3.4.3 herein). As such, representative monitoring sites for evaluating progress with respect to groundwater sustainability as it relates to seawater intrusion are not needed.

4.8.4 Degraded Groundwater Quality

Groundwater quality degradation in the Bear Valley Basin is being monitored and regulated in accordance with California DDW drinking water requirements. Groundwater produced from any municipal well in the basin that does not meet regulatory requirements for potable supply is considered an undesirable result. As such, all municipal production wells in the Bear Valley Basin serve as representative monitoring sites for groundwater quality.

4.8.5 Land Subsidence

Changes in land surface elevation across the Bear Valley Basin will be monitored using satellite data as described in Section 4.6 of this GSP. As such, there are no single representative monitoring sites for evaluating changes with respect to land subsidence in the Bear Valley Basin.

4.8.6 Interconnected Surface Water

The groundwater level data collected from the groundwater level monitoring network will serve as a proxy for monitoring changes with respect to interconnected surface water in the Bear Valley Basin. As such, the representative monitoring sites identified for evaluating groundwater sustainability as it relates to groundwater levels will also serve as the representative monitoring sites for evaluating interconnected surface water.

4.9 Data Management System

As per SGMA Regulations § 352.6, a data management system (DMS) has been developed for data filing, storage, and security during the implementation of the Bear Valley Basin GSP. Certain types of data necessary to implement the GSP and prepare annual reports will be stored in a relational computer database (Microsoft Access) that will enable the efficient communication and display of data, when needed. The general types of data to be stored in the database will include:

- Information on wells, including name, location, and construction
- Groundwater production
- Groundwater levels

Other types of data may be added to the database, as deemed necessary by the BVBGSA.

The database will be maintained by the BVBGSA or its technical representative. Data will be compiled and stored in the database, at a minimum, annually. The updated database will be made available to the BVBGSA managers and/or their technical representative(s) by December 1 of each year to provide the information necessary to prepare annual reports.

The BVBGSA and/or their technical representative will implement measures to prevent accidental loss of data and tampering with the database. All data entered in the database will be saved during each work session. The database will be backed up on a separate external drive or offsite (i.e. "cloud") server following each session. Access to the working database files will be limited to the BVBGSA managers, staff, and their assigned technical representatives.

For purposes of this plan, quality assurance (QA) is defined as the integrated program designed to assure reliability of monitoring and measurement data. Quality control (QC) is defined as the routine application of specified procedures to obtain prescribed standards of performance in the monitoring and measurement process (ASTM D-18). BBDWP and their assigned technical experts are responsible for assuring that the precision, accuracy, and completeness of data collected during as part of this GSP are known and documented. Accordingly, all field instruments will be operated in strict accordance with manufacturers specifications. All data and data collection procedures will be checked by a California Certified Hydrogeologist.

Laboratory Water Quality Suite

Constituent	Units	Detection Limit	Method
General Physical Properties			
Color	Color Unit	3.0	SM-2120B
Odor	Odor Unit	1.0	SM-2150B
Turbidity*	NTU	0.2	SM-2130B
General Minerals			
Ammonia as N	mg/L	0.1	EPA-350.1
Ortho Phosphate as P	mg/L	0.1	EPA-365.1
Total Phosphate	mg/L	0.2	EPA-365.4
Total Phosphorous as P	mg/L	0.1	EPA-365.4
Total Hardness	mg/L	3.1	SM 2340B/EPA
Calcium	mg/L	1.0	EPA-200.7
Magnesium	mg/L	1.0	EPA-200.7
Sodium	mg/L	1.0	EPA-200.7
Potassium	mg/L	1.0	EPA-200.7
Total Alkalinity, as $CaCO_3$	mg/L	3.0	SM 2320B
Hydroxide	mg/L	3.0	SM-2320B
Carbonate	mg/L	3.0	SM-2320B
Bicarbonate	mg/L	3.0	SM-2320B
Sulfate	mg/L	0.5	EPA-300.0
Chloride	mg/L	1.0	EPA-300.0
Nitrate, as N	mg/L	0.2	EPA-300.0
Fluoride	mg/L	0.1	EPA-300.0
pH*	pH unit	1.0	EPA-150.1
Temperature*	Degree C		
Electrical Conductance*	µmhos/cm	1.0	SM-2510B
Total Dissolved Solids (TDS)	mg/L	20.0	SM-2540C
Hydrogen Sulfide (H_2S)	µg/L	2.0	SM 4500 S2 H
Metals			
Arsenic	µg/L	2.0	EPA-200.8
Barium	µg/L	20.0	EPA-200.7
Cadmium	µg/L	1.0	EPA-200.8
Chromium	µg/L	1.0	EPA-200.8
Lead	µg/L	5.0	EPA-200.8
Mercury	µg/L	1.0	EPA-200.8
Selenium	µg/L	5.0	EPA-200.8
Aluminum	µg/L	50.0	EPA-200.7
Antimony	µg/L	6.0	EPA-200.8
Beryllium	µg/L	1.0	EPA-200.8
Nickel	µg/L	10.0	EPA-200.7
Thallium	µg/L	1.0	EPA-200.8
Manganese	µg/L	20.0	EPA-200.7
Iron	µg/L	100.0	EPA-200.7
Boron	µg/L	100.0	EPA-200.7

Laboratory Water Quality Suite

Constituent	Units	Detection Limit	Method
Copper	µg/L	50.0	EPA-200.7
Silver	µg/L	10.0	EPA-200.8
Hexavalent Chromium	µg/L	0.2	EPA-218.6
Vanadium	µg/L	2.0	EPA-200.8
Zinc	µg/L	50.0	EPA-200.7
Additional Analyses			
Perchlorate	µg/L	4.0	EPA-314.0
Gross Alpha	pCi/L	1.0	EPA-900.1
Gross Beta	pCi/L	1.0	EPA-900.1
Uranium	pCi/L	1.0	EPA-200.8
Cyanide	µg/L	100	SM 4500CN E
Volatile Organic Compounds (VOCs)			
1,1,1,2-Tetrachloroethane	µg/L	0.5	EPA-524.2
1,1,1-Trichloroethane	µg/L	0.5	EPA-524.2
1,1,2,2-Tetrachloroethane	µg/L	0.5	EPA-524.2
1,1,2-Trichloroethane	µg/L	0.5	EPA-524.2
1,1-Dichloroethane	µg/L	0.5	EPA-524.2
1,1-Dichloroethene	µg/L	0.5	EPA-524.2
1,1-Dichloropropene	µg/L	0.5	EPA-524.2
1,2,3-Trichlorobenzene	µg/L	0.5	EPA-524.2
1,2,4-Trichlorobenzene	µg/L	0.5	EPA-524.2
1,2,4-Trimethylbenzene	µg/L	0.5	EPA-524.2
1,2-Dichlorobenzene	µg/L	0.5	EPA-524.2
1,2-Dichloroethane	µg/L	0.5	EPA-524.2
1,2-Dichloropropane	µg/L	0.5	EPA-524.2
1,3-Dichlorobenzene	µg/L	0.5	EPA-524.2
1,3-Dichloropropane	µg/L	0.5	EPA-524.2
1,3-Dichloropropene	µg/L	0.5	EPA-524.2
1,3,5-Trimethylbenzene	µg/L	0.5	EPA-524.2
1,4-Dichlorobenzene	µg/L	0.5	EPA-524.2
2,2-Dichloropropane	µg/L	0.5	EPA-524.2
2-Butanone(MEK)	µg/L	5	EPA-524.2
2-Chlorotoluene	µg/L	0.5	EPA-524.2
4-Chlorotoluene	µg/L	0.5	EPA-524.2
4-Methyl-2-Pentanone(MIBK)	µg/L	5	EPA-524.2
Benzene	µg/L	0.5	EPA-524.2
Bis(2-chloroethyl)ether'''	µg/L	0.5	EPA-524.2
Bromobenzene	µg/L	0.5	EPA-524.2
Bromochloromethane	µg/L	0.5	EPA-524.2
Bromodichloromethane	µg/L	0.5	EPA-524.2

Laboratory Water Quality Suite

Constituent	Units	Detection Limit	Method
Bromoform	µg/L	0.5	EPA-524.2
Bromomethane	µg/L	0.5	EPA-524.2
Carbon Tetrachloride	µg/L	0.5	EPA-524.2
Chlorobenzene	µg/L	0.5	EPA-524.2
Chloroethane	µg/L	0.5	EPA-524.2
Chloroform	µg/L	0.5	EPA-524.2
Chloromethane	µg/L	0.5	EPA-524.2
cis-1,2-Dichloroethene	µg/L	0.5	EPA-524.2
cis-1,3-Dichloropropene	µg/L	0.5	EPA-524.2
Dibromochloromethane	µg/L	0.5	EPA-524.2
Dibromomethane	µg/L	0.5	EPA-524.2
Dichlorodifluoromethane	µg/L	0.5	EPA-524.2
Ethylbenzene	µg/L	0.5	EPA-524.2
Hexachlorobutadiene	µg/L	0.5	EPA-524.2
Isopropylbenzene	µg/L	0.5	EPA-524.2
Methyl tert butyl Ether (MTBE)	µg/L	0.5	EPA-524.2
Methylene Chloride	µg/L	0.5	EPA-524.2
n-Butylbenzene	µg/L	0.5	EPA-524.2
n-Propylbenzene	µg/L	0.5	EPA-524.2
Naphthalene	µg/L	0.5	EPA-524.2
p-Isopropyltoluene	µg/L	0.5	EPA-524.2
sec-Butylbenzene	µg/L	0.5	EPA-524.2
Styrene	µg/L	0.5	EPA-524.2
tert-Butylbenzene	µg/L	0.5	EPA-524.2
Tetrachloroethene (PCE)	µg/L	0.5	EPA-524.2
Toluene	µg/L	0.5	EPA-524.2
trans-1,2-Dichloroethene	µg/L	0.5	EPA-524.2
trans-1,3-Dichloropropene	µg/L	0.5	EPA-524.2
Trichloroethene (TCE)	µg/L	0.5	EPA-524.2
Trichlorofluoromethane	µg/L	0.5	EPA-524.2
Trichlorotrifluoroethane	µg/L	0.5	EPA-524.2
Vinyl Chloride	µg/L	0.3	EPA-524.2
Xylenes (m+p)	µg/L	0.5	EPA-524.2
Xylenes (ortho)	µg/L	0.5	EPA-524.2
Xylenes (Total)	µg/L	0.5	EPA-524.2

Laboratory Water Quality Suite

Constituent	Units	Detection Limit	Method
Per- and Polyfluoalkyl Substances (PFAS)			
Hexafluoropropylene oxide dimer acid	ng/L	0.2	EPA-537.1
N-ethyl perfluorooctanesulfonamidoacetic acid	ng/L	0.2	EPA-537.1
N-methyl perfluorooctanesulfonamidoacetic acid	ng/L	0.2	EPA-537.1
Perfluorobutanesulfonic acid	ng/L	0.2	EPA-537.1
Perfluorodecanoic acid	ng/L	0.2	EPA-537.1
Perfluorododecanoic acid	ng/L	0.2	EPA-537.1
Perfluoroheptanoic acid	ng/L	0.2	EPA-537.1
Perfluorohexanesulfonic acid	ng/L	0.2	EPA-537.1
Perfluorohexanoic acid	ng/L	0.2	EPA-537.1
Perfluorononanoic acid	ng/L	0.2	EPA-537.1
Perfluorooctanesulfonic acid (PFOS)	ng/L	0.2	EPA-537.1
Perfluorooctanoic acid (PFOA)	ng/L	0.2	EPA-537.1
Perfluorotetradecanoic acid	ng/L	0.2	EPA-537.1
Perfluorotridecanoic acid	ng/L	0.2	EPA-537.1
Perfluoroundecanoic acid	ng/L	0.2	EPA-537.1
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	ng/L	0.2	EPA-537.1
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	ng/L	0.2	EPA-537.1
4,8-dioxa-3H-perfluorononanoic acid	ng/L	0.2	EPA-537.1

Explanation of Units
NTU - nephelometric turbidity units
mg/L - milligrams per liter
µmhos/cm - micromhos per centimeter
µg/L - micrograms per liter
pCi/L - picocuries per liter
ng/L - nanograms per liter

*Temperature, pH, electrical conductivity and turbidity will also be measured in the field.

Groundwater Sampling Occurrence Recommendations

Management Area	Nitrate	General Mineral and Physical Inorganic[1]	MTBE[2]	EDB / DBCP[3]	Volatile Organic Compounds[1]	Gross Alpha Radiological
North Shore	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 3 Years
Grout Creek	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Gray's Landing	N/A	N/A	N/A	N/A	N/A	N/A
Mill Creek	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Village	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Rathbone	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Division	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Van Dusen	N/A	N/A	N/A	N/A	N/A	N/A
West Baldwin	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
East Baldwin	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Erwin	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 9 Years
Lake Williams	Annual	Every 3 Years	Every 3 Years	Every 3 Years	Every 6 Years	Every 3 Years

Note:

[1] See Table 4-1 for Constituent List and Analytical Methods

[2] MTBE: Methyl tert-Butyl Ether

[3] EDB: 1,2-Dibromomethane / DBCP: 1,2-Dibromo-3-Chloropropane

5. Project and Management Actions

This chapter describes the Projects, Management Actions, and Adaptive Management information that satisfies Sections 354.42 and 354.44 of the Sustainable Groundwater Management Act (SGMA) regulations. These projects, actions, and their benefits are intended to help achieve the sustainable management goals in the Basin.

Groundwater pumping within the Bear Valley Basin, as a whole, has historically been within the Sustainable Yield resulting in relatively stable long-term groundwater levels. While there have periodically been localized groundwater level declines, pumping sustainability has been maintained through adaptive management of pumping distribution between management areas and implementation of conservation measures. To maintain pumping sustainability into the future, the BVBGSA plans to continue these effective management actions on a routine basis and implement projects as needed that support sustainable management. These projects and management actions are described in detail in the following sections.

5.1 Introduction

Per Section 354.44 of the SGMA regulations, the GSP is to include the following:

a) Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.

b) Each Plan shall include a description of the projects and management actions that include the following:

1. *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:*
    - A. *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*
    - B. *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions*

is being considered or has been implemented, including a description of the actions to be taken.

2. *If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.*
3. *A summary of the permitting and regulatory process required for each project and management action.*
4. *The status of each project and management action, including a timetable for expected initiation and completion, and the accrual of expected benefits.*
5. *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*
6. *An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*
7. *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*
8. *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*
9. *A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.*

c) *Projects and management actions shall be supported by best available information and best available science.*

d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

5.2 Projects

Based on discussion with the BVBGSA stakeholders, two projects or types of projects have been identified for inclusion in the GSP because they support efforts to maintain long term groundwater sustainability:

- Replenish Big Bear
- Any projects that provide new or maintain existing groundwater pumping facilities

These projects are described in detail in the following sections.

5.2.1 Replenish Big Bear Project

Replenish Big Bear is a multi-benefit recycled water project that will utilize a water resource currently discharged outside of the Bear Valley Basin to secure a new drought proof local water supply that will support continued groundwater sustainability, among other benefits.

Replenish Big Bear includes permitting, design, and construction of treatment facility upgrades at the existing BBARWA Wastewater Treatment Plant (WWTP) to produce high quality recycled water, approximately 7 miles of pipeline for recycled water conveyance, three pump stations, a groundwater recharge facility, monitoring wells, and brine minimization and disposal facilities.

The project will produce approximately 1,950 acre-feet per year (AFY) of high-quality recycled water for various uses. Approximately 1,900 AFY will be discharged to Stanfield Marsh, which subsequently flows into Big Bear Lake (Lake). Pending confirmation of its suitability for use to sustain habitat for the endangered unarmored threespine stickleback fish, approximately 50 AFY of the treated water may be discharged on a continuous basis to Shay Pond in the Erwin Lake area, which is currently sustained with groundwater pumped from BBCCSD wells.

Of the water discharged to the Lake, some of it can be extracted and conveyed to Sand Canyon for groundwater recharge. The recharge potential at Sand Canyon is approximately 380 AF over a 6-month dry weather period (April – October) (TH&Co, 2017b). Groundwater recharge at Sand Canyon may require construction of monitoring wells to monitor water quality in the area, subject to regulatory permit conditions.

Water can also be extracted from the Lake to irrigate Bear Mountain Golf Course, which currently uses approximately 120 AFY from private groundwater wells for irrigation. The additional surface water available as a result of Replenish Big Bear would provide irrigation water in lieu of groundwater pumping, thus reducing the demand on the aquifer system in an area where groundwater levels have been declining.

While some of the 1,900 AFY of recycled water discharged to the Lake will later be extracted and used to supplement groundwater supplies, most of that water will remain in the Lake to help stabilize Lake levels and provide recreational and habitat benefits. As summarized in Table 5-1, up to 550 AFY of the water produced will benefit groundwater in the Bear Valley Basin.

An overview map of the project is shown on Figure 5-1.

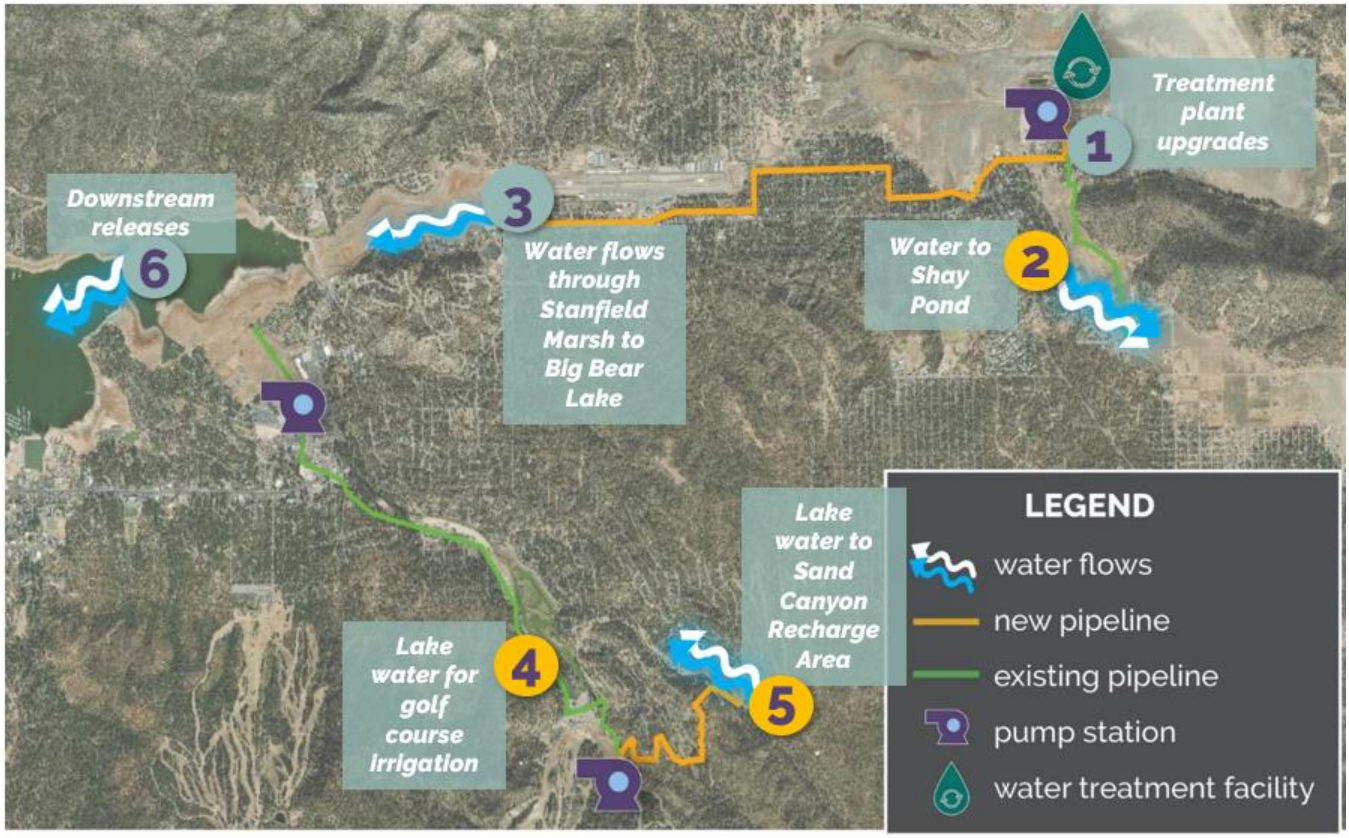


Figure 5-1. Replenish Big Bear Project Overview

5.2.1.1 Planned Treatment Plant Upgrades

Upgrades will be necessary to BBARWA's existing WWTP to meet the water quality objectives (WQOs) identified for the Lake in the Santa Ana Basin Plan (Basin Plan), the total phosphorus target identified in the Big Bear Lake Nutrient Total Maximum Daily Load for the Dry Hydrologic Conditions (TMDL) and regulatory requirements for groundwater recharge. To meet the WQOs and TMDL targets for the Lake, total dissolved solids (TDS), inorganic nitrogen and phosphorus concentrations must be reduced through multiple in-series treatment processes to meet the anticipated discharge limits – 175 mg/l, 0.15 mg/L and 0.035 mg/L, respectively. To achieve these expected strict effluent limits, BBARWA is planning to implement a series of advanced treatment upgrades to existing unit processes and integrate new unit processes, specifically:

- Upgrade the extended aeration process through retrofit of the existing oxidation ditches to optimize biological nitrification-denitrification (NDN).
- Nutrient-laden liquid sidestreams, which are produced during solids handling processes, may require treatment to mitigate reduced treatment capacity impacts from returning high nutrient loads to liquid stream processes.

- Addition of a denitrification filter to reduce nitrate-nitrogen concentrations and provide chemical phosphorus removal.
- Low-pressure filtration, such as ultrafiltration (UF), to reduce flocculated or colloidal solids upstream of the reverse osmosis (RO) process.
- RO to reduce TDS and nutrient concentrations.
- Pellet reactor brine minimization system to minimize brine stream from RO process.
- Addition of ultraviolet (UV) disinfection to deactivate any bacteria, viruses, and other microorganisms.

It is anticipated that 100% of the water discharged to the Lake and Shay Pond will be treated with RO and UV disinfection to meet the strict WQO. The permitting process with the Regional Water Quality Control Board (RWQCB) and DDW is ongoing, so the specifics of the treatment processes have yet to be finalized. Additional coordination with the California Department of Fish and Wildlife (CDFW) and United States Fish and Wildlife Serve (USFWS) is anticipated to occur once the Lake discharge requirements are better defined. However, the final treatment process intends to comply with all regulatory permitting requirements for discharge to the Lake and Shay Pond.

Incorporation of RO into the treatment process will require a brine management system. The preliminary RO brine management option for Replenish Big Bear is a brine minimization pellet reactor to minimize brine from the RO brine stream, followed by solar evaporation ponds located at a site near BBARWA. Using an RO recovery of 90% for the treated flow and RO influent of 2.2 million gallons per day (MGD) would result in 0.22 MGD of RO brine to be minimized through the pellet reactor, and approximately 0.022 MGD of brine to be conveyed to the evaporation pond. A total evaporation pond area of 23 acres is needed for the RO brine flows, which will be conveyed to evaporation ponds in Big Bear adjacent to the BBARWA WWTP. Alternative RO brine management strategies will be evaluated further as the Project enters the design phase.

5.2.1.2 Advanced Treated Water Quality

The water produced by the BBARWA WWTP, after the upgrades described in Section 5.2.1.1 are implemented, will be of high quality and is anticipated to satisfy WQOs and permitting requirements for discharge into the Lake and Shay Pond.

As part of the discharge permit for the project, it will be necessary to conduct a pilot test of the treatment process to demonstrate that the final treated water complies with regulatory requirements. As part of the project development process, a study of the treated product water will be conducted to confirm that the physical and chemical characteristics of the advanced treated product water are suitable for sustaining the unarmored threespine stickleback fish habitat in Shay Pond. Coordination with the CDFW and USFWS is anticipated to prepare the scope of work for

the fish survivability study and to interpret the results. The BBARWA will not discharge treated Project water to Shay Pond until it is determined that the quality of the water will not adversely impact the fish habitat.

5.2.1.3 Project Benefits

The various components of Replenish Big Bear provide multiple benefits to the Valley, including enhanced groundwater sustainability, increased Lake levels, and associated recreation, ecosystem and economic benefits. This section focuses on the groundwater benefits that support the sustainable management goals of the GSP. More information on the full components and benefits of Replenish Big Bear can be found on the project website at ReplenishBigBear.com.

The groundwater benefits associated with each project component and the Sustainable Management Criteria addressed are detailed in Table 5-1.

Table 5-1. Replenish Big Bear Groundwater Benefits

Component	Estimated Supply	Groundwater Benefit	Sustainable Management Criteria Addressed
WWTP Upgrades	Included below	Produces a new, high-quality drought proof source of supply that provides numerous benefits to the Valley, including supporting groundwater sustainability.	CHRONIC LOWERING OF GROUNDWATER LEVELS REDUCTION OF GROUNDWATER STORAGE
Shay Pond Discharge	50 AFY	Provides a new source of water for potential discharge to Shay Pond to sustain endangered species habitat. Groundwater from BBCCSD wells currently used for this purpose can be stored in the basin instead, helping to sustain groundwater levels and storage. Helps maintain the Measurable Objective of groundwater level for the Erwin Management Area.	
Sand Canyon Groundwater Recharge	380 AFY	Provides a new source of water to supplement natural recharge in Sand Canyon, which will increase groundwater levels and storage. Increases adaptive management opportunities by providing additional water that can be pumped out by BBLDWP and transferred to BBBCCSD using exisitng interconnections. Helps achieve the Measurable Objective of groundwater level for various Management Areas. Effectively increases Sustainable Yield by approximately 380 AFY.	
Bear Mountain Golf Resort Irrigation	120 AFY	Provides a new source of water for irrigation of the golf course. Groundwater from private wells currently used for this purpose can be stored in the basin instead, helping to sustain groundwater levels and storage. Helps achieve the Measurable Objective of groundwater level for various Management Areas.	

5.2.1.4 Supply Reliability

As previously mentioned, groundwater is the only potable water supply in the Bear Valley Basin. Efforts by the water agencies and community have been successful in reducing demand; and total potable consumption has been maintained below the Sustainable Yield of the groundwater basin. BBLDWP and BBCCSD have implemented a series of ongoing conservation, education and outreach programs to help reduce water usage in the service area. In the past decade, BBLDWP and BBCCSD have maintained a decreasing trend in per capita demands through conservation efforts. However, while past conservation efforts have been very effective, the agencies expect that additional demand reduction will become slower and more difficult or costly to achieve in the future. As more and more customers take advantage of water efficient fixture upgrades, low water use landscaping and adopt more efficient water use behaviors, additional opportunities for customers to further reduce water demand will become more limited.

In addition, climate change is anticipated to have an impact on the timing and intensity of precipitation, which will impact how much natural runoff can percolate into the groundwater basin. Climate change models indicate that these changes will result in a reduction of Sustainable Yield in the Bear Valley Basin over time, as discussed in Section 2.3.9 of this GSP.

If Sustainable Yield declines over time, growth in the Valley continues and water users have limited ability for further conservation, additional supply will likely be needed in the future to maintain supply reliability. The drought proof supply provided by Replenish Big Bear will become more critical to maintain water reliability in times of extended drought and provide insurance against climate change uncertainty.

5.2.1.4.1 Groundwater Depletion

The Project would provide substantial benefits to help mitigate localized imbalances in the Bear Valley Basin. While the Bear Valley Basin as a whole is sustainable, there are localized areas that show persistent groundwater level declines, which may exceed established sustainability criteria if allowed to continue. One such area is in the vicinity of the Sand Canyon Golf Course. The greens for the course are irrigated, in part, from private wells located on or near the property. As shown on Figure 5-1, groundwater levels in the monitoring well Sand Canyon No. 1, which were evaluated for the GSP, have shown an overall decline since 1992, despite periodic recovery during wet years. Without a change in groundwater management in the area, groundwater levels in this well could drop below the minimum threshold by 2042 (see Figure 5-1)

The Project will include the future option to pump 380 AF of blended recycled water and Lake water from the Lake to Sand Canyon, thus providing an alternative source of water for the Sand Canyon Golf Course. As the golf course is the primary groundwater pumper in the area, in-lieu

water supply from the Project is anticipated to have the beneficial effect of stabilizing groundwater levels and avoiding undesirable results.

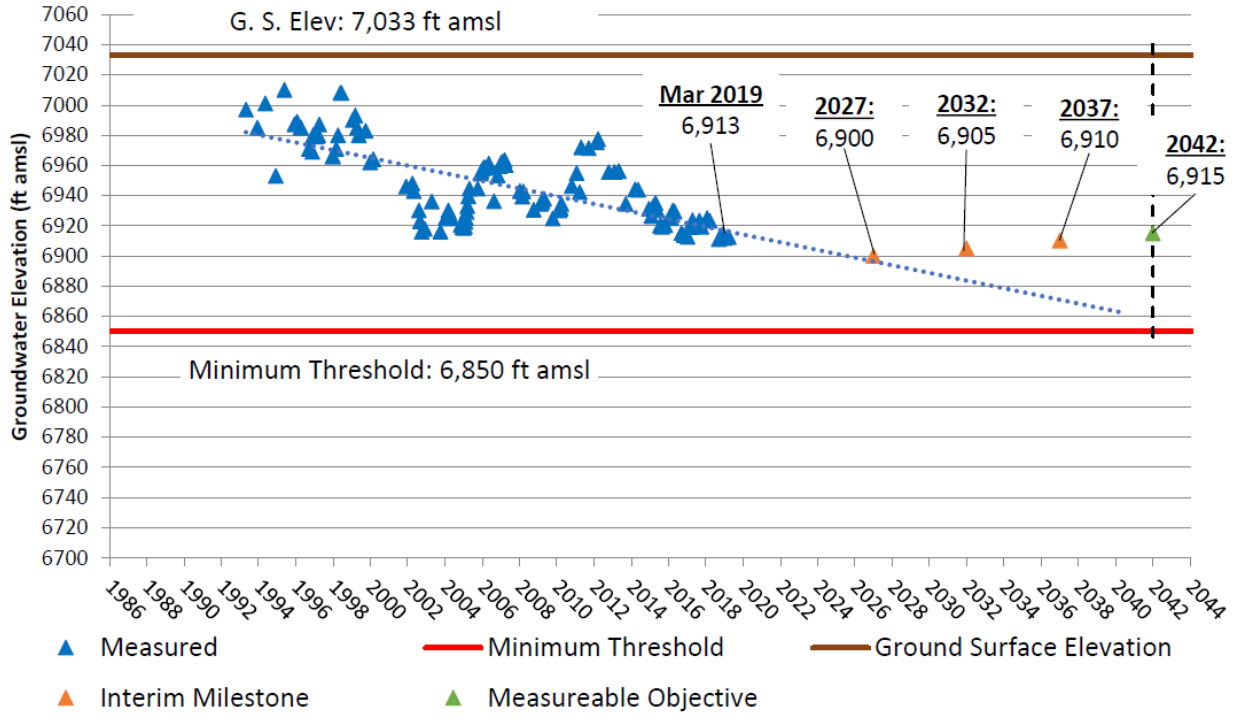


Figure 5-1. Groundwater Elevation Hydrograph, Sand Canyon Well #1

5.2.1.4.2 Availability of Alternative Supplies

The water agencies in the Bear Valley Basin rely solely on groundwater to supply municipal potable water demand. Absent Replenish Big Bear, surface water in Big Bear Lake is not available for municipal water supply in Big Bear as the lake is adjudicated and the natural inflows are reserved for other uses. Imported water, such as from the State Water Project (SWP), is not financially feasible due to the lack of infrastructure to the Valley's high elevation and isolated location. Also, there is a concern that the reliability of SWP imported supplies will continue to decrease due to multiple factors including increased demands for environmental uses and municipal demand increases with growing populations. Replenish Big Bear will provide a local, drought-resistant water supply with up to 550 AFY used to sustain groundwater levels and storage in the Basin.

5.2.1.5 Project Costs

The estimated Replenish Big Bear capital cost is approximately $55,717,000 with an annual O&M of $2,438,000. This includes the cost of the treatment upgrades at the BBARWA WWTP, as described in Section 5.2.1.1 herein, to produce the high-quality recycled water and the cost of pipelines and pump stations to convey the water to the various use locations.

To date, Replenish Big Bear has been awarded approximately $6.7 million in grant funding toward capital costs. The project team is continuously identifying and applying for new funding sources and anticipates receiving additional grant funding. Project costs not paid for by grant funding will likely be paid for through a combination of local funding sources and funding from project partners associated with the project benefits provided. The project team is currently in the process of identifying funding sources.

5.2.1.6 Project Implementation

The BVBGSA will continue to monitor projected Sustainable Yield and projected pumping to estimate when additional supply may be needed. However, due to the extended drought in recent years and the availability of grant funding to support drought resilience projects, the BVBGSA members are working to implement Replenish Big Bear in the near term to proactively address the threat of drought and begin accumulating local storage to reduce the impact of future droughts on groundwater sustainability.

The Replenish Big Bear Team, which consists of all of the member agencies of the BVBGSA, is working to obtain the necessary permitting to continue the project implementations. The current schedule anticipates completing the project by November 2025. However, the regulatory process is on the critical path and may cause the project schedule to be extended for reasons outside the agencies' control.

Once it is demonstrated that the treated Project water will be suitable for use in Shay Pond, the Replenish Big Bear Team will work with the CDFW and USFWS to develop a monitoring plan to monitor any adverse effects on the fish from changing the source of water to the pond. The existing well currently providing water to the pond will be kept on standby to provide a backup source of water should adverse impacts be observed.

5.2.1.7 Basin Uncertainty (§ 354.44.9d)

While Replenish Big Bear will help mitigate localized groundwater level and storage imbalances in the near-term, its greatest benefit will be providing insurance against uncertainty in future long-term climate change projections that affect groundwater supply in the Bear Valley Basin. Based on the current climate change projections provided by the CDWR, the average Sustainable Yield

of the basin is projected to decrease from approximately 5,300 acre-ft/yr in 2020 to approximately 4,300 acre-ft/yr by 2070 (see Figure 2-30). If current groundwater pumping projections are accurate, it is possible that pumping can be maintained below the climate-adjusted Sustainable Yield in the 50-year SGMA planning horizon. However, there is uncertainty in both the climate change projections and the pumping projections. If climate change has a bigger impact on water supply than projected, it is possible that pumping could exceed the long-term average Sustainable Yield within the 50-year SGMA planning horizon, which would result in long-term overdraft. Pumping demand in excess of that projected could also result in pumping exceeding Sustainable Yield. This uncertainty is directly addressed by the aspects of Replenish Big Bear that result in groundwater recharge and reduced groundwater pumping demand, both of which work to stabilize groundwater levels, increase groundwater in storage, and increase the Sustainable Yield of the Bear Valley Basin.

5.2.1.8 Legal Authority

California Water Code (CWC) §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The BBARWA has the legal authority to sell the recycled water to BBCCSD and BBLDWP to recharge the Basin.

5.2.1.9 Permitting and Regulatory Processes

BBARWA will be responsible for acquiring permits needed for the discharge of recycled water to Shay Pond and Stanfield Marsh/Big Bear Lake. Permits for extraction of water from the Lake and discharge to the golf course and Sand Canyon are expected to be issued separately and may be issued to BBLDWP, BBCCSD and/or BBMWD.

Permits have not yet been acquired, but the Replenish Big Bear Team has initiated communications with the Regional Water Quality Control Board (RWQCB), United States Environmental Protection Agency (EPA), and the State Water Resources Control Board Division of Drinking Water (DDW) to discuss the permitting approach for the proposed discharge points. Permits will be pursued as early as possible during the design process. Coordination is underway with the permitting agencies to determine the Project's permitting strategy and the required technical studies. Anticipated new or modified permits/approvals include but are not limited to the following:

Federal Agencies:

- EPA – Total Maximum Daily Load (TMDL) compliance for discharge to Stanfield Marsh / Big Bear Lake

- USBR – National Environmental Policy Act (NEPA) lead agency which may require coordination with other federal agencies such as United States Fish and Wildlife Service, State Historic Preservation Office, Army Corps of Engineers, and National Marine Fisheries Service.

State Agencies:

- RWQCB – National Pollutant Discharge Elimination System (NPDES) for discharge to Stanfield Marsh / Big Bear Lake
- RWQCB – NPDES or Waste Discharge Requirement (WDR) for discharge to Shay Pond
- RWQCB – General Construction Permit
- RWQCB –WDR modification for changes in operation and the addition of RO brine evaporation in Big Bear.
- RWQCB – WDR for discharge to Sand Canyon
- SWRCB – Recycled Water Use Statewide General Permit
- DDW – Permitting requirements to be determined following ongoing coordination
- Caltrans – Encroachment permits for pipelines within the Caltrans Right-of-Way
- California Department of Fish and Wildlife – Approval for discharge to Shay Pond including a Lake and Streambed Alteration permit

Local Agencies:

- The City of Big Bear Lake and/or San Bernardino County – Encroachment permits for improvements within the respective Rights-of-Way
- The City of Big Bear Lake and/or San Bernardino County – Grading and building permits for treatment upgrades and the recharge basin
- South Coast Air Quality Management District – Authority to Construct and Permit to Operate the WWTP upgrades
- The Big Bear Watermaster

The Replenish Big Bear Team will work with the RWQCB, DDW, CDFW and USFWS to obtain the appropriate discharge permit(s) for Shay Pond and the Lake.

In accordance with CEQA, the Replenish Big Bear Team will prepare an Environmental Impact Report (EIR). Since federal funding is being pursued through Reclamation's Title XVI Program, an Environmental Impact Statement (EIS) or Environmental Assessment (EA) will also be prepared to comply with NEPA. All environmental documentation will require Replenish Big Bear to comply with endangered species laws, including the California Endangered Species Act and the Federal Endangered Species Act.

The Replenish Big Bear Team intends to proactively monitor and manage permitting needs and timelines to implement construction and operation of Replenish Big Bear in an efficient and timely manner.

5.2.1.10 Public Notice and Outreach

Information about Replenish Big Bear, project status updates and public meetings are shared with the public on the project website, ReplenishBigBear.com, as well as on social media, and in press releases and newspaper articles. In addition, members of the project team routinely present project updates at community meetings and public meetings, including BVBGSA meetings and the meetings of the BVBGSA members.

5.2.2 Groundwater Pumping Facilities

One of the primary strategies Bear Valley Basin agencies have used to maintain Basin-wide groundwater sustainability is adaptive management of groundwater pumping among the various Management Areas. This strategy works by shifting groundwater pumping from localized areas with declining groundwater levels to other areas with more stable groundwater levels. Basin groundwater levels and conditions change over time and may vary by Management Area so operational flexibility in the BBLDWP and BBCCSD water systems is necessary to support this adaptive management strategy. This flexibility is achieved by maintaining groundwater pumping facilities distributed throughout the Basin and by maintaining more pumping capacity than the minimum required to meet demands, particularly peak demands. This allows the agencies to turn off some wells for a period of time if groundwater levels indicate the need to reduce pumping, while still being able to provide reliable water service to the community.

There are a few Management Areas of the Bear Valley Basin that are underutilized with respect to groundwater resources. These include East Baldwin, Lake Williams, and Mill Creek. In East Baldwin, aside from private well pumping, there is no municipal pumping currently in the Management Area. The BBCCSD is currently drilling and constructing a new well in this Management Area to take advantage of the groundwater resources and increase operational flexibility. No new wells are currently planned for the Lake Williams and Mill Creek Management Areas. In Lake Williams, the existing wells are adequate to meet demand and in Mill Creek, naturally occurring groundwater quality issues (i.e. arsenic and uranium) prevent the groundwater in that area from being utilized for municipal supply. The groundwater resources in both of these Management Areas are underutilized. Future wells could be drilled in both Management Areas to provide additional operational flexibility for the agencies as well as address expected growth projections.

In addition to developing underutilized groundwater resources in the basin, maintenance of existing groundwater production facilities is essential to maintain operational flexibility to meet water demands. Currently, the BBLDWP and BBCCSD have more than 60 active wells in the Bear Valley Basin. Many of these wells and their associated pumping plants are nearing the end of their useful life of approximately 50 to 60 years and need to be repaired or replaced. In some cases, well replacement can be coordinated with the development of groundwater resources in underutilized Management Areas. Such projects are typically identified in an agency's Water Master Plan and consider expected growth projections.

In summary, there are numerous types of projects related to groundwater pumping facilities that may be needed to support the adaptive management strategy:

- Routine inspection and maintenance of wells
- Abandonment of wells that have reached the end of their life
- Drilling of new wells to replace abandoned wells
- Drilling of new wells to meet future growth
- Routine inspection, maintenance and replacement of well pumping equipment

These types of are projects routinely undertaken by BBLDWP and BBCCSD as part of their water system maintenance and will vary over time, so specific projects are not detailed in this GSP. Rather, the types of projects are described in this GSP to underscore the importance of these activities to maintaining long term Basin-wide groundwater sustainability.

The groundwater benefits associated with these projects and the Sustainable Management Criteria addressed are detailed in Table 5-1.

Table 5-2. Groundwater Pumping Facility Project Groundwater Benefits

Project	Groundwater Benefit	Sustainable Management Criteria Addressed
Well Maintenance and Replacement Pumping Equipment Maintenance and Replacement Drilling New Wells	Maintenance and expansion of groundwater pumping capacity in various locations throughout the Basin is critical to maintaining the operational flexibility needed to support adaptive management of groundwater pumping. Adaptive management may enable agencies to shift pumping away from localized areas of groundwater decline to limit decline to an acceptable level and recover through recharge.	CHRONIC LOWERING OF GROUNDWATER LEVELS REDUCTION OF GROUNDWATER STORAGE

5.2.2.1 Project Costs

The cost of groundwater pumping facility projects varies depending on the scope of necessary repairs or replacements. These costs are typically planned for in the annual operating and capital budgets adopted by BBLDWP and BBCCSD for their respective water systems and are funded by revenue from water sales, connection fees and grants, as appropriate.

5.2.2.2 Project Implementation

BBLDWP and BBCCSD will continue to be responsible for identifying and implementing projects as needed to maintain or expand their respective groundwater pumping facilities. Projects are typically identified and annual budgets and periodic Water Master Plan documents or other studies.

5.2.2.3 Basin Uncertainty

Maintaining operational flexibility will help the agencies respond to changes in actual Basin conditions based on routine monitoring, which mitigates uncertainty in the Basin setting information.

5.2.2.4 Legal Authority

BBLDWP and BBCCSD own their respective groundwater pumping facilities and have the legal authority to maintain or replace them as needed.

5.2.2.5 Permitting and Regulatory Processes

BBLDWP and BBCCSD will continue to be responsible for acquiring any permits needed for the drilling of new or replacement groundwater wells. Routine maintenance activities typically do not require permits. Discharges related to well maintenance are conducted under each agencies National Pollutant Discharge Elimination System (NPDES) permit.

Anticipated permits/approvals for new or replacement wells may include but are not limited to the following:

- San Bernardino County Department of Public Health Well Permit
- RWQCB –Construction Stormwater General Permit
- DDW – Modification of Drinking Water System Permit to include the new facility
- Caltrans – Encroachment permits for improvements or construction activities within the Caltrans Right-of-Way
- The City of Big Bear Lake and/or San Bernardino County – Encroachment permits for improvements within the respective Rights-of-Way
- South Coast Air Quality Management District – Authority to Construct and Permit to Operate a new well

In accordance with CEQA, the Replenish Big Bear Team will prepare an Environmental Impact Report (EIR). Since federal funding is being pursued through Reclamation's Title XVI Program, an Environmental Impact Statement (EIS) or Environmental Assessment (EA) will also be prepared to comply with NEPA.

The Replenish Big Bear Team intends to proactively monitor and manage permitting needs and timelines to implement construction and operation of Replenish Big Bear in an efficient and timely manner.

5.2.2.6 Public Notice and Outreach (§ 354.44B)

Information about planned groundwater pumping facility projects is presented at public meetings of the BBLDWP and BBCCSD Boards of Directors and is included in proposed and adopted annual budget materials and planning documents, which are public records available to the public.

5.3 Management Actions

The management actions in this Plan include continuing the existing adaptive management activities and water use efficiency measures the purveyors have implemented for many years.

5.3.1 Technical Review Team

A Technical Review Team (TRT) for the BBLDWP has been meeting routinely since 2004 to review Basin conditions and pumping in their service area and recommend actions needed to maintain Basin-wide sustainability. BBCCSD has historically provided their groundwater level data as input to the TRT process but has not been directly involved. The TRT will be expanded to include direct participation by the BBCCSD and will continue to meet routinely to evaluate data and make basin management decisions in the context of the Sustainable Management Criteria in this GSP. The TRT will meet a minimum of once per year but may increase the frequency to twice or more per year during drought conditions. The TRT will review the groundwater levels at each of the Representative Monitoring Stations and compare them with the Interim Milestones and Measurable Objectives established for each Management Area. The TRT will also review pumping data for the prior year for comparison with the estimated Sustainable Yield of the Basin.

The TRT may provide recommendations for adaptive basin management based on review of basin conditions and pumping. The TRT may recommend shifting pumping from a localized area with declining groundwater levels to areas with more stable groundwater levels. The General Manager of the respective agencies may then authorize a change to their respective operating strategy based on the recommendations of the TRT. The TRT may also recommend declaration of a water supply shortage stage in BBLDWP and BBCCSD's respective Water Shortage Contingency Plans, as discussed further in Section **Error! Reference source not found.**. Any such recommendation w ould be provided to the Board of Directors of the respective agencies for consideration; the TRT has no authority to declare a shortage.

5.3.2 Water Use Efficiency

BBLDWP and BBCCSD have implemented a variety of water use efficiency measures over the course of many years and have been successful in reducing demand; total potable consumption has been maintained below the Sustainable Yield of the groundwater basin. In the past decade, BBLDWP and BBCCSD have maintained a decreasing trend in per capita demands through conservation efforts.

BBLDWP and BBCCSD continue to implement a range of programs to help improve water use efficiency in the Valley. These programs, also known as Demand Management Measures, are summarized in Table 5-3 and described in detail in their respective 2020 Urban Water Management

Plans (UWMPs), which were adopted in June 2021 following a public comment period. These strategies are aimed to reduce water demands and comply with the state efficiency mandates.

Table 5-3. Demand Management Measures

MEASURE	DESCRIPTION
Water waste prevention ordinances	An ordinance that explicitly states the waste of water is to be prohibited. The ordinance may prohibit specific actions that waste water, such as excessive runoff from landscape irrigation, or use of a hose outdoors without a shut off nozzle.
Metering	Metering supply facilities and customer connections helps agencies and customers accurately account for water use and water loss and identify opportunities to improve water use efficiency. Advanced metering infrastructure (AMI) provides agencies and customers with access to more frequent and timely water use data that can be used to quickly identify leaks and evaluate use patterns that may lead to change in water use behaviors.
Conservation pricing	Tiered water rates where the cost per unit of water increases as the total volume of water used increase has been shown to encourage conservation.
Public education and outreach	Public awareness of the importance of water use efficiency and opportunities and incentives to reduce water use is critical to achieving demand reduction. Methods include bill inserts, media advertising, public signs, school programs for children, website and social media postings, community events and others.
Programs to assess and manage distribution system real loss	Water agencies conduct annual water loss audits to estimate the amount of water loss. Methods to reduce water loss include monitoring and fixing detected leaks, replacing old leaking water mains, and proactively detecting leaks using AMI meter data.
Water conservation program coordination and staffing	An established water conservation program and staff resources to support the program are critical for continued success.
Other demand management measures	Other measures include incentive and rebate programs for water-efficient items and indoor and outdoor conservation audits to help customers identify conservation opportunities.

5.3.3 Water Shortage Contingency Plan

The California Water Code requires urban water suppliers, including BBLDWP and BBCCSD, to have Water Shortage Contingency Plans (WSCPs), which are detailed plans for how each agency intends to predict and respond to foreseeable and unforeseeable water shortages. BBLDWP and BBCCSD most recently updated their WSCPs in June 2021 along with the 2020 UWMPs. Detailed information on the respective WSCPs can be found in the 2020 UWMPs, and a summary is provided here.

A water shortage occurs when the water supply is reduced to a level that cannot support typical demand at any given time. Water shortages can be triggered by a hydrologic limitation in supply (i.e., a prolonged period of below normal precipitation and runoff), limitations or failure of supply and treatment infrastructure, or a combination of conditions. Hydrologic or drought limitations tend to develop and abate more slowly, whereas infrastructure failure tends to happen quickly and

relatively unpredictably, such as during an earthquake. A WSCP is used to provide guidance to an agency's Board of Directors (Board), staff, and the public by identifying anticipated shortages and a range of potential response actions to allow for efficient management of any water shortage with predictability and accountability.

The current WSCPs include a new process to conduct an Annual Water Supply and Demand Assessment (AWSDA) each year, assuming that the following year will be dry, and submit the results to DWR beginning in July 2022. The groundwater level monitoring and pumping data evaluated by the TRT will also support each agency's determination of expected supplies and demands for the coming year. If the result of the TRT review and the AWSDA indicate that a water supply shortage is likely based on either on a shortage of supplies to meet demands or an unacceptable reduction in groundwater levels, the General Manager of the agency may recommend that the Board declare a water shortage at a level needed to address the supply shortage. BBLDWP's WSCP includes seven shortage levels and BBCCSD's includes six shortage levels, ranging from 0% water shortage to a greater than 50% water shortage. Each shortage level has a corresponding set of potential shortage actions that may be implemented as appropriate, with more severe actions corresponding to higher levels of water shortage. The specific shortage response actions vary by agency and can be found in the adopted BBLDWP and BBCCSD WSCPs. Examples of potential shortage response actions that may be implemented at various stages are:

- Limiting landscape irrigation to specific days and times
- Increased public outreach and education to increase awareness of current water supply conditions and the need to conserve water
- Using an intertie between BBLDWP and BBCCSD to transfer water supplies from one to another

The WSCPs are a tool that can be used in coordination with other projects and water management actions as part of GSP implementation to help prevent or address a supply shortage and promote long term groundwater sustainability.

6. Implementation Plan

This chapter is intended to serve as a conceptual roadmap for the BVBGSA to start implementing the GSP over the first five years and discusses implementation effects in accordance with the SGMA regulations sections 354.8(f)(2) and (3).

The implementation plan provided in this chapter is based on current understanding of Bear Valley Basin conditions and includes consideration of the projects and management actions included in Chapter 5, as well as other actions that are needed to successfully implement the GSP including the following:

- GSP implementation, administration, and management
- Funding
- Reporting, including annual reports and 5-year evaluations and updates

6.1 GSP Implementation, Administration, and Management

6.1.1 Administrative Approach/Governance Structure

The BVBGSA will continue to operate under the existing JPA that formed the GSA, unless and until actions are taken amending/revising the existing JPA.

6.1.2 Implementation Schedule

A general summary showing the major activities and estimated timeline for the GSP implementation is provided in Table 6-1. Additional details about the activities included in the schedule are provided in these activities' respective sections of this GSP.

6.1.3 Implementation Costs

Development of this GSP was funded through a Proposition 1 Sustainable Groundwater Planning Grant from DWR, along with in-kind contributions from the BVBGSA members.

The GSA may play a role in pursuing grants and low-interest financing to help pay for GSP implementation costs to the extent possible to offset costs for the GSA members. However, external funding/financing may only be eligible for projects and management action implementation and not ongoing GSP administrative expenses. Ongoing implementation of the GSP is expected to include contributions from the GSA member agencies, which are ultimately funded through customer fees or other public funds.

Costs related to the various activities anticipated for the first five years are shown in Table 6-1. The costs shown are limited to costs of support from consultants and do not include the costs of staff time contributed by BVBGSA member agencies.

Implementation of this GSP is estimated to cost an average of approximately $47,000 per year for the first five years of implementation, excluding the planning and development of the specific projects listed in Chapter 5, which are being implemented and funded separately. Estimates of future annual implementation costs (Years 6 through 20) will be developed during future updates of the GSP based on actual costs incurred in the first 5 years and expected changes for future implementation.

6.1.3.1 DWR Coordination for GSP Approval

After the adopted GSP is submitted to DWR, it will be posted to DWR's website for a public comment period of at least 60 days. DWR will also perform an evaluation of the GSP within two years of submittal and issue a written assessment indicating whether the GSP is approved or requires modifications prior to approval. Coordination with DWR may be needed to support the evaluation process and respond to any questions or comments from DWR. It is anticipated that DWR coordination will be conducted by staff of the of the BVBGSA member agencies with support from consultants as needed.

As shown in Table 6-1, the estimated cost of DWR Coordination for GSP Approval is estimated at approximately $5,000 , but actual costs will depend on the feedback received from DWR.

6.1.3.2 Monitoring Network Implementation

The Monitoring Network will consist of the existing monitoring network used by BBLDWP and BBCCSD to obtain groundwater level and quality data. BBLDWP and BBCCSD routinely collect groundwater level data as part of system operation and monitory water quality in accordance with the State Water Resources Control Board Division of Drinking Water requirements. No additional monitoring requirements are anticipated as part of the GSP. The cost of monitoring is already included in the BBLDWP and BBCCSD annual operating budgets, so no additional costs are included for GSP implementation, as shown in Table 6-1.

6.1.3.3 Technical Review Team

The TRT will meets a minimum of once per year but may increase the frequency to twice or more per year during drought conditions. The TRT will review the groundwater levels at each of the Representative Monitoring Stations and compare them with the Interim Milestones and Measurable Objectives established for each Management Area. The TRT will also review

pumping data for the prior year for comparison with the estimated safe Sustainable Yield of the Basin. Results and recommendations will be documented and included in the GSP Annual Report.

The TRT may provide recommendations for adaptive basin management based on review of basin conditions and pumping. The TRT may also recommend declaration of a water supply shortage stage in BBLDWP and BBCCSD's respective Water Shortage Contingency Plans, as discussed further in Section 5.3.3. The TRT will be led by staff from BBLDWP and BBCCSD with support from a hydrogeologist. In addition, support from a hydrogeologist may be needed between meetings. The annual cost for two (2) TRT meetings and as-needed support throughout a year is estimated to be approximately $9,400.

6.1.3.4 Project Implementation

The costs of specific projects and management actions will like vary year by year, based in part on needed adaptive management activities and the maintenance needs of groundwater pumping facilities.

Groundwater pumping facility maintenance and expansion will continue to be implemented as needed and funded by the owners of the respective facilities through a combination of rates, connection fees and grants.

The Replenish Big Bear project is a joint project with multiple benefits and beneficiaries and funding and financing discussions are underway and have not yet been finalized. The project has already been awarded approximately $6.7 million in grant funding and additional grants funding is being pursued. The GSA may play a role in pursuing additional grants and low-interest financing to help pay for a portion of Replenish Big Bear costs to the extent possible.

6.1.3.5 Reporting

SGMA regulations require the GSAs to submit annual reports to DWR on the status of GSP implementation. SGMA regulations require the GSAs to evaluate the GSP at least every 5 years and whenever the Plan is amended. The reporting requirements for the periodic evaluation are presented in Section 6.2.

It is anticipated that the BVBGSA will obtain the services of a hydrogeology consultant to lead preparation of the annual report, and BVBGSA member agency staff will support by preparing updated hydrographs and summarizing annual groundwater extractions. The estimated cost to prepare an annual report is $22,000/year.

The initial 5-year GSP evaluation is due for submission to DWR in 2027. It is anticipated that the GSA would obtain the services of a hydrogeology consultant to lead preparation of the initial 5-year update. The cost for the initial Five Year GSP update is estimated to be $75,000.

The total cost of reporting over the initial five years of the GSP implementation is estimated to be $185,000.

It is anticipated that the Reporting Costs will be paid for by the GSA member agencies.

6.1.4 Outreach and Communication

To meet the requirements of SGMA, implementation of the GSP will require additional communication and outreach efforts and coordination among the GSA Agencies. The GSA member agency staff will continue to post information and updates on the website and share information and updates at public meetings.

6.2 Reporting

As part of GSP implementation, SGMA Regulation §356.2 requires GSAs to develop annual reports and more detailed five-year evaluations, which could lead to updates of the GSP. The following sections describe the reporting requirements for both the annual reports and five-year evaluations.

6.2.1 Annual Reports

Annual reports will be developed to address current needs in the Basin and the legal requirements of SGMA. As defined by DWR, annual reports must be submitted for DWR review by April 1st of each year following the GSP adoption, except in years when five-year or periodic assessments are submitted. Annual reports are anticipated to include three key sections: General Information, Basin Conditions, and Implementation Progress. The GSA will compile information relevant to annual reports and coordinate collection of information and submit a single annual report for the Basin to DWR.

Development of an annual report will begin following the end of the water year, September 30, and will include an assessment of the previous water year. The annual report will be submitted to DWR before April 1st of the following year. The 2021 annual report covering water year 2021 will be submitted by the GSA by April 1, 2022. Five annual reports for the Basin will be submitted to DWR between 2022 and 2026, prior to the first five-year assessment of this GSP, which is to be submitted to DWR in January 2027.

6.2.1.1 General Information

The General Information section will include an executive summary that highlights the key content of the annual report. This section will include a map of the Basin, a description of the sustainability goals, a description of GSP projects and their progress, as well as an annual update to the GSP implementation schedule.

6.2.1.2 Basin Conditions

Basin conditions will describe the current groundwater conditions and monitoring results in the Basin. This section will include an evaluation of how conditions have changed over the previous year and will compare groundwater data for the water year to historical groundwater data.

Pumping data, effects of project implementation (if applicable), total water use, and groundwater storage data will be included. Key required components include:

- Groundwater level data from the monitoring network, including contour maps of seasonal high and seasonal low water level maps
- Hydrographs of groundwater elevation data at RMS
- Groundwater extraction data by water use sector (including springs and slant wells)
- Groundwater Quality at RMS
- Total water use data
- Change in groundwater in storage
- Subsidence rates and associated survey data

6.2.1.3 Implementation Progress

Progress toward GSP implementation will be included in the annual report. This section of the annual report will describe the progress made toward achieving interim milestones as well as implementation of projects and management actions. Key required components include:

- GSP implementation progress, including proposed changes to the GSP
- Progress toward achieving the Basin sustainability goals

6.2.2 Five-Year Evaluation Reports

As required by SGMA regulations, an evaluation of the GSP and the progress toward meeting the approved sustainable management criteria and the sustainability goal will occur at least every five years and with every amendment to the GSP. A written five-year evaluation report (or periodic evaluation report) will be prepared and submitted to DWR. The information to be included in the evaluation reports is provided in the sections below.

6.2.2.1 Sustainability Evaluation

A Sustainability Evaluation will contain a description of current groundwater conditions for each applicable sustainability indicator and will include a discussion of overall sustainability in the Basin. Progress toward achieving interim milestones and measurable objectives will be included, along with an evaluation of status relative to minimum thresholds.

6.2.2.2 Plan Implementation Progress

A Plan Implementation Progress section will describe the current status of project and management action implementation and whether any adaptive management actions have been implemented since the previous report. An updated project implementation schedule will be included, along with any new projects identified that support the sustainability goals of the GSP and a description of any projects that are no longer included in the GSP. The benefits of projects and management actions that have been implemented will be described and updates on projects and management actions that are underway at the time of the report will be documented.

6.2.2.3 Reconsideration of GSP Elements

As additional monitoring data are collected, land uses and community characteristics change, and GSP projects and management actions are implemented, it may become necessary to reconsider elements of this GSP and revise the GSP as appropriate. GSP elements to be reassessed may include basin setting, management areas, undesirable results, minimum thresholds, and measurable objectives. If appropriate, a revised GSP, completed at the end of the five-year assessment period, will include revisions informed by findings from the monitoring program and changes in the Basin, including changes to groundwater uses, demands, or supplies, and results of project and management action implementation.

6.2.2.4 Monitoring Network Description

A description of the monitoring network will be provided. An assessment of the monitoring network's function will be included, along with an analysis of data collected to date. If data gaps are identified, the GSP will be revised to include a method for addressing these data gaps, along with an implementation schedule for addressing gaps and a description of how the GSA will incorporate updated data into the GSP.

6.2.2.5 New Information

New information available since the last five-year evaluation or GSP amendment will be described and evaluated. If the new information should warrant a change to the GSP, this will also be included, as described previously in Reconsideration of GSP Elements.

6.2.2.6 Regulations or Ordinances

A summary of the regulations or ordinances related to the GSP that have been implemented by DWR or others since the previous report will be provided. The report will include a discussion of any required updates to the GSP.

6.2.2.7 Legal or Enforcement Actions

Legal or enforcement actions taken by the GSA in relation to the GSP will be summarized, including an explanation of how such actions support sustainability in the Basin.

6.2.2.8 Plan Amendments

A description of amendments to the GSP will be provided in the five-year evaluation report, including adopted amendments, recommended amendments for future updates, and amendments that are underway.

6.2.2.9 Coordination

Ongoing coordination will be required among the GSA. The five-year evaluation report will describe coordination activities between these entities such as meetings, joint projects, data collection and sharing, and adaptive management efforts.

6.2.2.10 Reporting to Stakeholders and the Public

Outreach activities associated with the GSP implementation, assessment, and GSP updates will be documented in the five-year evaluation report.

GSP Implementation Activities and Costs (2022-2027)

GSP Implementation Activity	Description	Estimated Cost[2]	Unit	Anticipated Timeframe	Estimated Costs (2022 - 2027)
DWR Coordination for GSP Approval	Coordination with DWR during their evaluation process and response to any questions or comments from DWR	$5,000	Lump Sum	2022 - 2023	$5,000
Monitoring Network Implementation	Complete routine monitoring of groundwater levels and water quality	No additional cost			No additional cost
Technical Review Team	Conduct bi-annual reviews of basin conditions and document results	$9,400	Annual	2022 - 2026	$47,000
Project Implementation[3]	Implementation of Replenish Big Bear and Groundwater Pumping Facility projects	Varies			Budgeted separately
Annual Reports	Compile data and prepare GSP Annual Report	$22,000	Annual	2022 - 2026	$110,000
5-Yr GSP Updates	Compile data and prepare 5-yr GSP Updates,	$75,000	Lump Sum	Q2, 2026 - Q1, 2027	$75,000
				Total Estimated Costs (2022 - 2027)	$237,000
				Average Annual Estimated Cost (2022 - 2027)	$47,000

Notes:

[2]Consultant costs only, does not include staff time contributed by BVBGSA member agencies

[3]The cost for Replenish Big Bear and Groundwater Pumping Facility projects are not included in the Implementation cost estimate. Implementation and funding of these projects will be coordinated and budgeted separately.

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In Association with:

WSC

Bear Valley Basin
Groundwater Sustainability Agency

Technical Memorandum

To: Ms. Antonia Estevez
Water Systems Consulting, Inc.

From: Thomas Harder, P.G., CH.G.
Thomas Harder & Co.

Date: 8-Mar-23

Re: Response to Comments Regarding Potential Impacts of the Replenish Big Bear Project on the Lucerne Valley Land Discharge Location

The purpose of this Technical Memorandum (TM) is to provide supporting documentation and analysis to address comments received regarding the Replenish Big Bear Project (the Project) Notice of Preparation. Specifically, two comments are addressed herein pertaining to potential impacts of reduction in discharges from the Big Bear Area Regional Wastewater Agency (BBARWA) plant in Big Bear City to the Lucerne Valley Land Discharge Location (LVDL):

1. Have current and historical discharges to the LVDL contributed to surface or near-surface water flow in the natural wash located approximately 1-mile north of the site?
2. Have discharges to the LVDL caused higher Total Dissolved Solids (TDS) and nitrate concentrations in groundwater beneath the site than otherwise would have occurred absent the discharges?

Potential for Contributions to Surface Flow in the Wash North of the LVDL

It is assumed that the wash in question is the unnamed wash located approximately 0.8-mile northeast of the LVDL (see Figure 1). This wash is ephemeral, meaning that surface water flows in the channel only during periods of extreme above-normal precipitation. A review of historical aerial imagery (i.e. Google Earth) shows that this wash is dry in all historical images available since 1985 although its presence indicates that water has flowed in it periodically.

Based on a review of groundwater level data from wells located north of the LVDL and within or adjacent to the wash, it is not possible that groundwater recharge from surface discharges to the LVDL have caused surface and/or near-surface flow of water in the wash. Available

groundwater level records from 1994 through 2020 indicate that groundwater near the wash has never been shallower than approximately 110 feet below the land surface (see Figure 2). Records from two wells were obtained from the United States Geological Survey (USGS) National Water Information System (NWIS) online water database. Groundwater levels near the wash haven't varied more than approximately 10 feet and for the well with the longest period of record, was approximately the same elevation in 2020 as it was in 1994. As discharges to the LVDL were occurring throughout this time, and as there is no evidence groundwater levels have ever reached the ground surface at the wash, it is not possible that recharge from the LVDL has ever caused surface water flow in the wash.

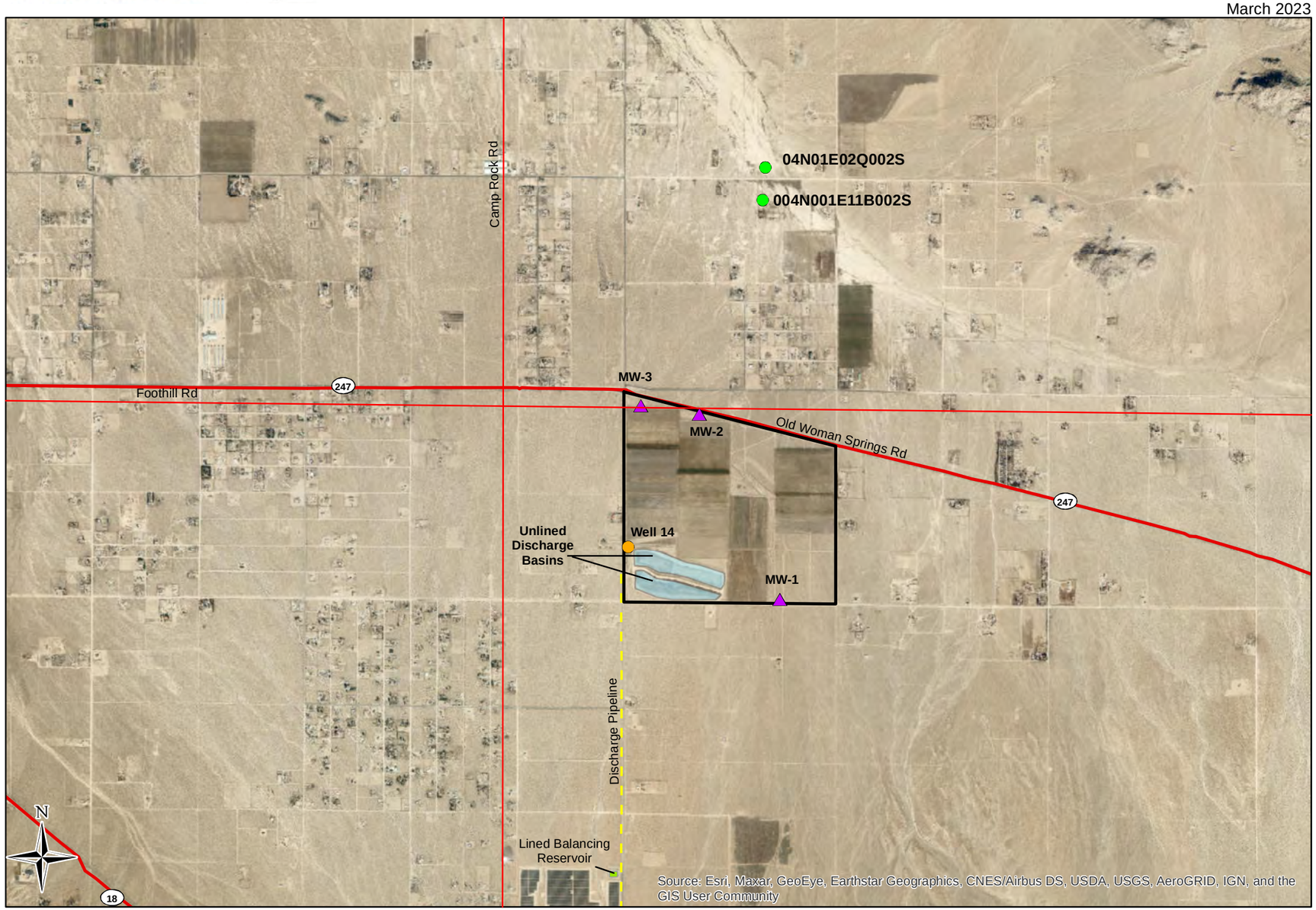
Potential for Groundwater Quality Impacts from BBARWA Discharges at the LVDL

TDS and nitrate concentrations in BBARWA effluent discharged at the LVDL have historically been lower than the TDS and nitrate concentrations detected in samples from the downgradient monitoring wells at the Site (MW-2 and MW-3).[1] Updated TDS and nitrate data in both the onsite monitoring wells and the BBARWA effluent since 2017 support the previous conclusion that the delivered water from BBARWA is not the source of the high TDS and nitrate concentrations in groundwater (see Figures 3 and 4). TDS concentrations in BBARWA effluent since 2017 show a slightly decreasing trend, while TDS concentrations in the groundwater from downgradient Monitoring Wells MW-2 and MW-3 show a slightly increasing trend (see Figure 3) suggesting the two are not correlated. Further, the downgradient concentrations are higher than the BBARWA effluent concentrations. From a mass balance standpoint, recharge of BBARWA effluent cannot be the source of the higher groundwater TDS concentrations. Similarly, nitrate concentrations in groundwater from all onsite monitoring wells are higher than concentrations in the BBARWA effluent. Thus, while the detection of low concentrations of nitrate in the BBARWA effluent contributes to nitrate in groundwater, the significantly higher nitrate concentrations detected in groundwater beneath the site indicates the BBARWA effluent is only a minor contributor and not the primary source.

[1] TH&Co, 2017. Groundwater Quality Evaluation at the Lucerne Valley Land Discharge Location. Prepared for WSC and the Big Bear Area Regional Wastewater Agency. Dated December 22, 2017.

Groundwater Wells at the Lucerne Valley Land Discharge Location

March 2023



0 0.5 1 2 Miles

NAD 83 UTM Zone 11

Map Features

- BBARWA Monitoring Well
- Well 14
- Well with Groundwater Level
- Discharge Pipeline
- Freeway
- BBARWA Property Boundary
- Balancing Reservoir
- Unlined Discharge Basin

Well locations are from USGS National Water Information System (NWIS), 2023

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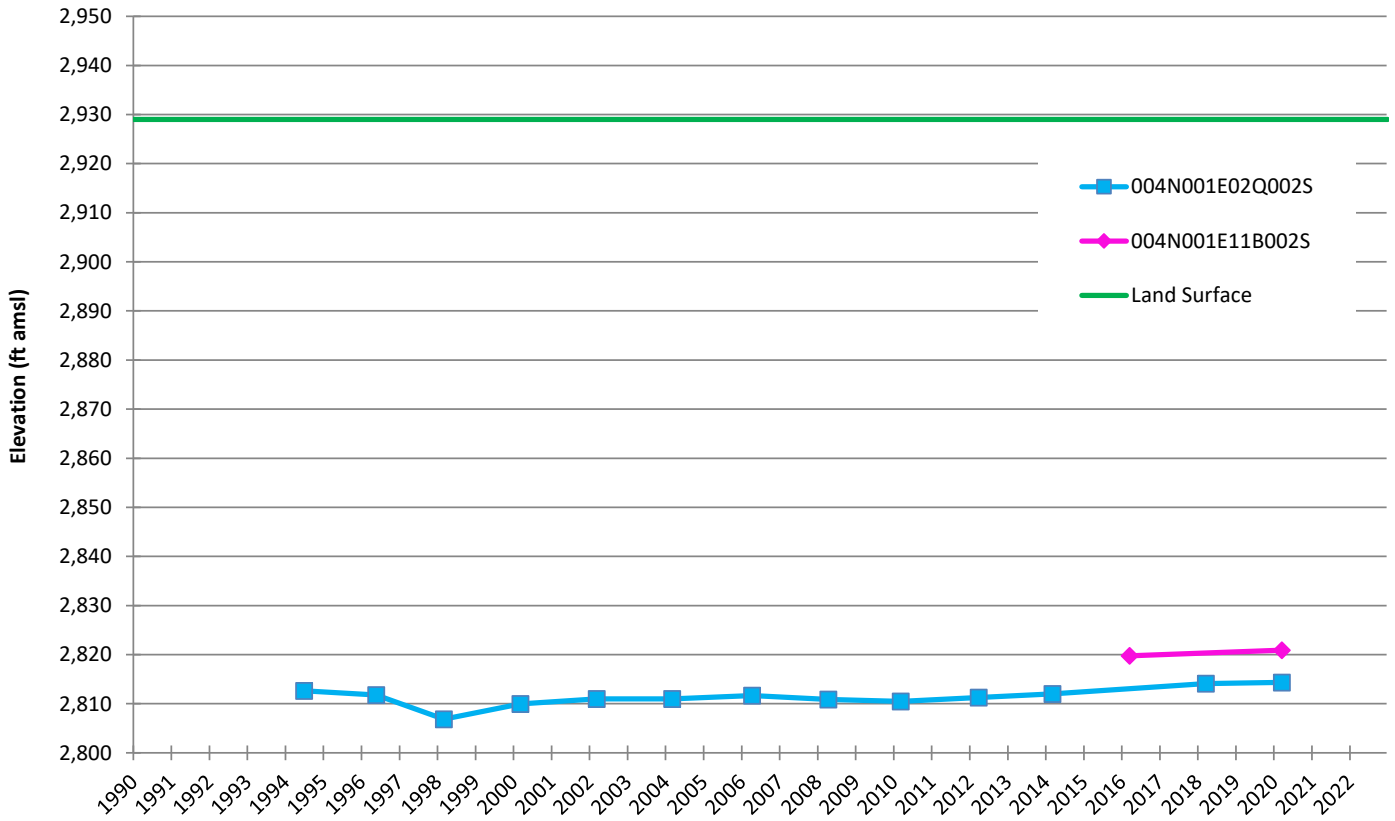
Lucerne Valley Land Discharge Location

Figure 1

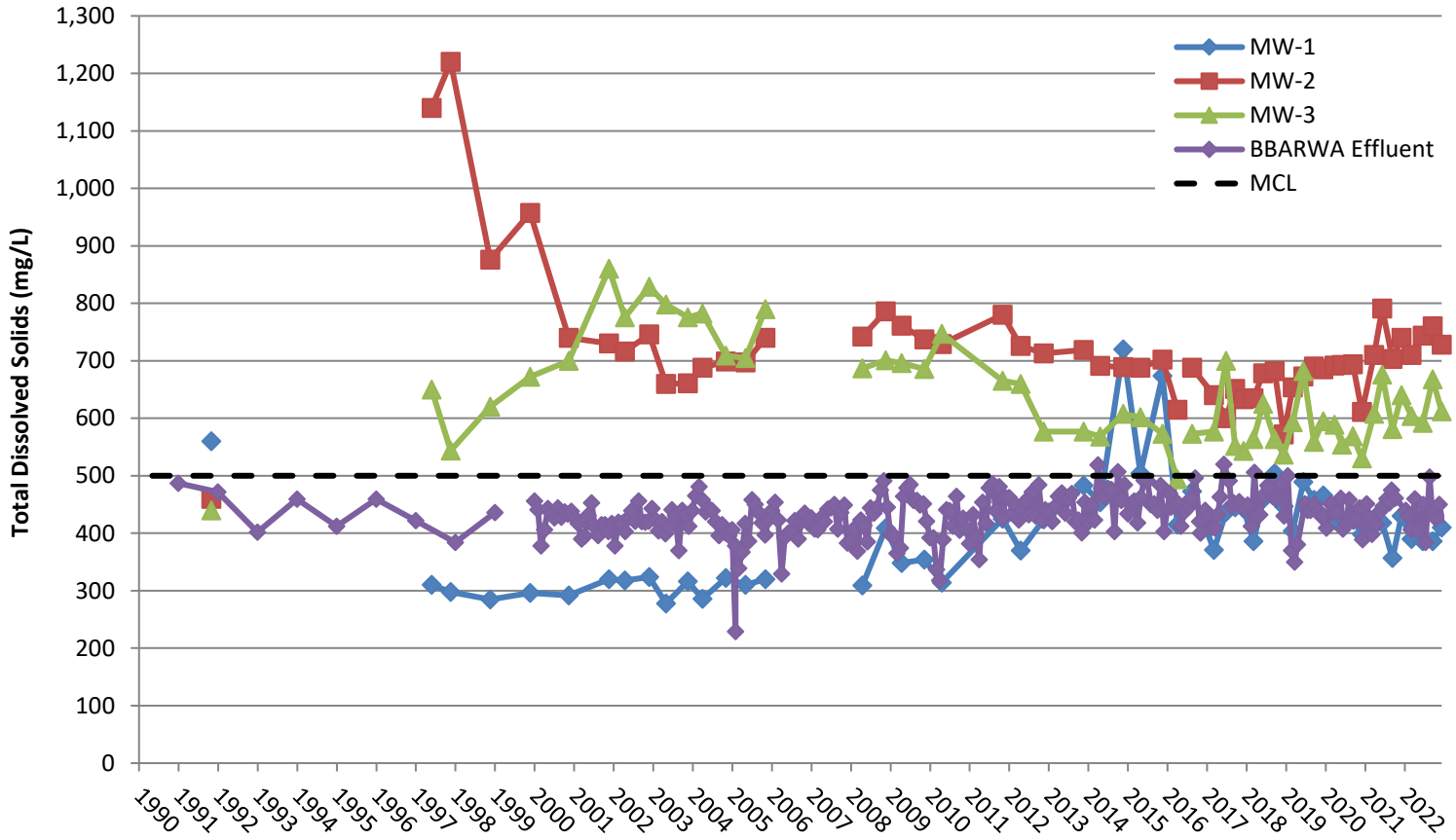
Figure 2

USGS Wells Groundwater Elevations



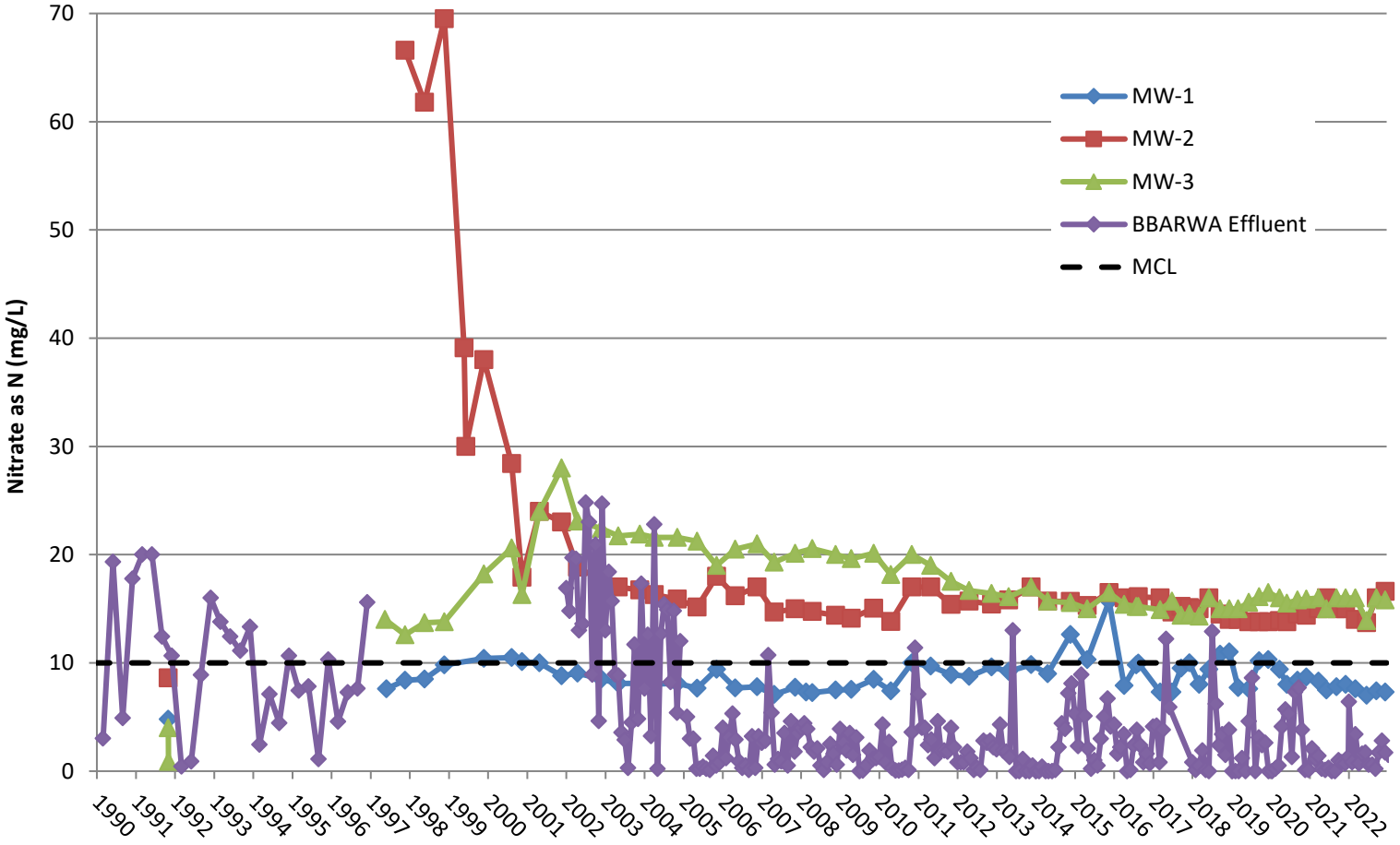
Notes: ft amsl = feet above mean sea level
Data from USGS National Water Information System (NWIS), 2023.
https://nwis.waterdata.usgs.gov/nwis/gwlevels?search_station_nm=004N001E

Total Dissolved Solids Concentrations
Lucerne Valley Monitoring Wells



Note: mg/L = milligrams per liter

Nitrate (as N) Concentrations
Lucerne Valley Monitoring Wells



Note: mg/L = milligrams per liter

Thomas Harder & Co.
Groundwater Consulting

REPLENISH BIG BEAR: MODELING OF HIGHER FLOWS AND WITH ZERO TP LOAD

Michael A. Anderson, Ph.D.

Coeur d'Alene, ID

February 24, 2022

Acknowledgement of Credit

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Introduction

It was previously noted that water quality was predicted to vary markedly with the level of treatment of added Replenish Big Bear (RBB) recycled water, with Alternative 1 (TIN and TP removal) significantly degrading water quality in Big Bear Lake relative to predicted baseline conditions, while Alternative 2 (70% RO) modestly increased average predicted concentrations of TN, TP and chlorophyll-a, and Alternative 3 (100% RO) was predicted to slightly improve average water quality for the 2009-2019 period (Anderson, 2021, Table 22). Long-term simulations for different hydrologic scenarios yielded similar results, with 100% RO yielding predicted water quality typically comparable to baseline conditions. Notwithstanding, some subtle differences were observed between predicted median baseline concentrations and those for Alternative 3 which assumed steady annual flows of 1920 af/yr of 100% RO water (Anderson, 2021, Table 25).

Recent engineering work indicates that slightly higher inflows, up to 2210 af/yr, can be attained by the Replenish Big Bear project by employing additional brine minimization technology (Table 1). Note that a portion of the water produced by RBB may be discharged to Shay Pond and the earlier "Alternative 3" scenario had excluded those flows (up to 80 af/yr) from the analysis. However, to be conservative for permitting purposes, this analysis is based on discharging all of the recycled water produced to the Lake.

Table 1. Initial and recently updated Replenish Big Bear (RBB) flow projections.

Scenario	**Annual RBB Inflow (af)**	**Daily RBB Inflow (MGD)**
Baseline	0	0
Alternative 3 [(a)]	1920	1.71
High Flow (99% recovery) [(b)]	2210	1.57 – 2.18
Mid Flow (90% recovery) [(b)]	2009	1.42 – 1.98

Notes:

[(a)]Alternative 3 was assessed in the 2021 Lake Analysis and assumed that of the total Replenish Big Bear effluent contribution considered in the Lake Analysis (i.e., 2,000 AFY), 80 AFY would be delivered to Shay Pond. Therefore, only 1,920 AFY would be discharged to the Lake.

[(b)]The updated model analysis assumed that no discharge to Shay Pond would occur and all recycled water would be discharged to the Lake under two different total recovery rates scenarios.

Moreover, deliveries are expected to vary seasonally (Fig 1), thus varying from the earlier "Alternative 3" scenario that assumed uniform flows of 1.71 MGD throughout the year. Inflows to the WWTP are lower in the summer months due to reduced inflow.

Since the Replenish Big Bear project does not have a waste load allocation for total P (TP) in the current TMDL, it is proposing to offset the TP load in the project inflows delivered to Big Bear Lake. While RO is extremely effective at removing dissolved and particulate substances, there nonetheless is a small quantity of TP that is expected to evade treatment (the projected RO effluent concentration is 0.03 mg/L, principally as o-PO_4-P). Elimination of all TP through the treatment process is not practicable, so removal of an equivalent load of TP (up to 200 lbs/yr) from elsewhere in the lake or watershed will be necessary.

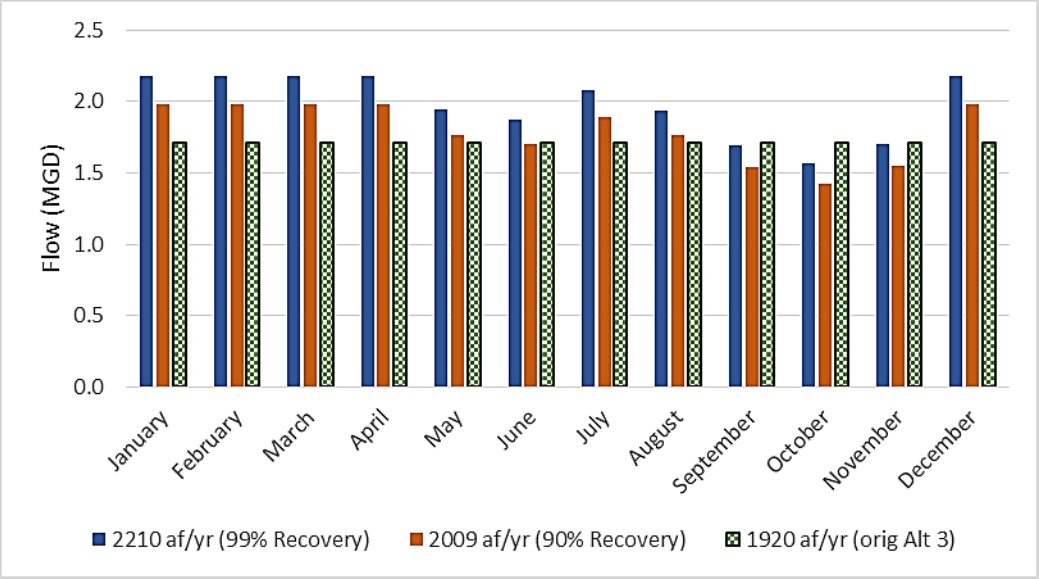

Fig. 1. Monthly flow rates (projected 2040) for Replenish Big Bear under three project inflow scenarios.

In light of these factors, further modeling was conducted to evaluate predicted water quality under these operational scenarios (increased and time-varying flows, with and without TP offset) for comparison with the previously predicted baseline condition and Alternative 3 scenario. Given the complexity of nutrient budgets of lakes, array of possible offset strategies, and equivalence of a given form of nutrient irrespective of its particular origin, TP offset will be modeled as equivalent to 0 influent concentration. This is an approximation that holds when considering whole-lake nutrient budget, but is nonetheless a simplification; depending upon details of offset, hydrodynamic considerations and other factors, some modest lateral gradients in water quality may result. The 50th percentile hydrologic scenario for 2009-2050 was used in this analysis, noting that it includes a wide array of runoff conditions, included extended drought and as well as periods of high runoff. All other hydrologic, meteorological, biological, chemical and sedimentological factors, variables and conditions were identical to those used in prior simulations of long-term future conditions (Anderson, 2021).

Results

Long-term averaged predicted concentrations of TDS, TIN, total P, total N and chlorophyll-a were lower with addition of RBB water compared with predicted baseline conditions (no supplementation) (Table 2). For reference, TMDL target values are included in the table. Focusing on chlorophyll-a as the key response target, baseline conditions were predicted to yield growing-season average chlorophyll-a concentration that slightly exceeded (by 0.1 µg/L) the TMDL target value of 14 µg/L, while Alternative 3 matched the target value, and larger inputs of RBB inflow that varied seasonally (Fig. 1) yielded values below baseline and TMDL target values (Table 2). Zeroing out the load of TP in RBB inflow yielded further reductions in chlorophyll-a; larger inflow volumes with reduced summer flows and no net TP loading were predicted to yield growing season average chlorophyll-a concentrations as low as 9.5 - 10.2 µg/L, significantly below predicted baseline and TMDL concentrations (Table 2).

Table 2. Long-term average predicted concentrations of total P, total N and chlorophyll-a in Big Bear Lake under different operational scenarios (total P and total N expressed as annual average concentrations; chlorophyll-a shown as growing season average concentrations).

Operational Scenario (all at 50th % hydrology)	**TDS (mg/L)**	**TIN (mg/L**	**Total P (µg/L)**	**Total N (mg/L)**	**Chlorophyll-a (µg/L)**
Baseline	**195**	**0.069**	**47.7**	**1.15**	**14.1**
Alternative 3 (1920 af)	182	0.052	43.3	1.07	14.0
2210 af (99% recovery)	**179**	**0.045**	**42.3**	**1.04**	**13.1**
2009 af (90% recovery)	**180**	**0.041**	**43.4**	**1.06**	**12.9**
2210 af + 0 total P	179	0.072	39.9	1.00	10.2
2009 af + 0 total P	180	0.040	40.9	1.00	9.5
TMDL target			***35.0***		***14.0***

Supplementation with RBB inflow also lowered concentrations of total P and total N relative to predicted baseline levels (Table 2). This is consistent with the reduced concentrations of total N and total P (and most dissolved forms of N and P) in RO water relative to watershed runoff concentrations (Anderson, 2021, Table 20), with concentrations projected to be only 40% - 80% of average watershed runoff concentrations (Anderson, 2021, Table 21). Interestingly, zeroing out the influent TP concentration not only lowered the predicted average total P concentration but also reduced the predicted total N concentrations, highlighting the complex biogeochemical coupling of these two key nutrients. While it is important to recognize the uncertainty in model predictions, it is nonetheless noteworthy that revised project flows, with varying seasonal flow and TP offset, yielded average chlorophyll-a concentrations significantly below baseline and TMDL values and also yielded long-term average TN concentrations approaching or reaching 1 mg/L, which is being considered by the Regional Water Board. Predicted long-term average TP concentrations remained above the TMDL target, but were nonetheless meaningfully lower than the predicted baseline level (Table 2). Average TDS and TIN concentrations were also lower than predicted baseline conditions (with exception of 2210 af + 0 TP, where a period of higher NO_3-N was predicted).

Inter-annual differences in water quality are nonetheless expected to persist. Cumulative distributions functions (CDFs) highlight the predicted wide range in annual and growing season average concentrations (Fig. 2). While addition of RBB inflow shifted CDFs to lower annual average total P and total N concentrations and growing season average chlorophyll-a concentrations, wide ranges in predicted concentrations remained in place (Fig. 2). Thus, the growing season average chlorophyll-a target of 14 µg/L was predicted to be exceeded about 53% of the time under baseline conditions, and exceeded about 41% and 31% of the time with RBB inflows of 2210 af/yr without and with TP offset, respectively (Fig. 2c; Table 3). Results for all scenarios are summarized in Table 3.

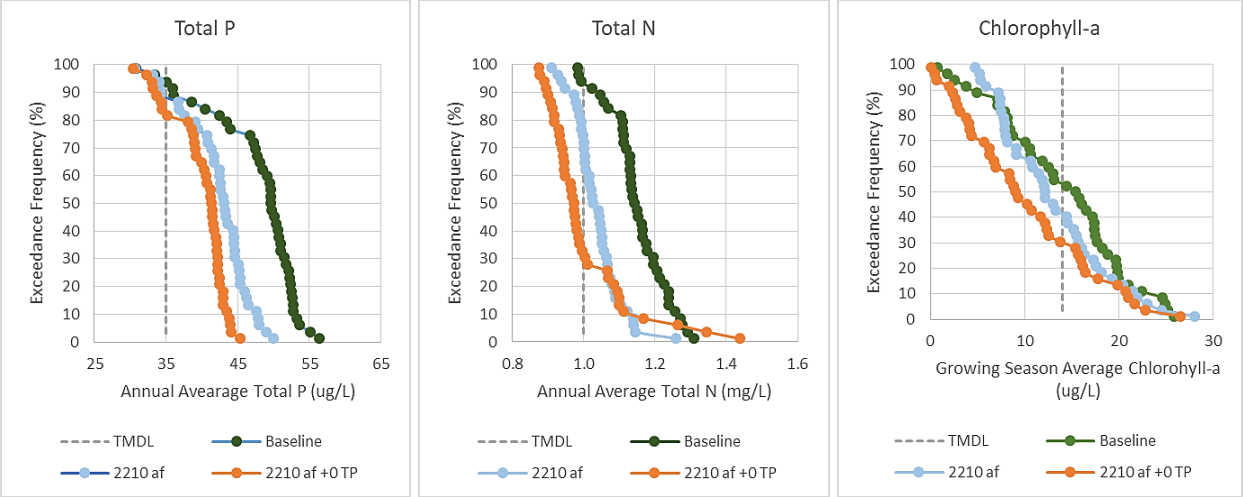

Fig. 2. Cumulative distribution functions for predicted annual total P and total N concentrations and growing season average chlorophyll-a concentrations for baseline condition and with 2210 af RBB inflow with and without TP offset.

Table 3. Predicted frequency of exceeding TMDL target under baseline conditions and different RBB inflow and TP offset scenarios (annual average or growing season average basis). Observed annual exceedance frequencies for 2009-19 period shown in parentheses under Baseline.

Variable	**Baseline**	**1920 af**	**2210 af**	**2210 af+0 TP**	**2009 af**	**2009 af+0 TP**
Total P	94 % (100%)	87 %	87 %	82 %	91 %	90 %
Total N[a]	91 % (na)	72 %	72 %	30 %	80 %	55 %
Chlorophyll-a	53 % (55%)	51 %	41 %	31 %	40 %	22 %

[a]*possible TMDL target*

References

Anderson, M.A. 2021. *Big Bear Lake Analysis: Replenish Big Bear.* Final Report. 65 pp.

Replenish Big Bear Program

AIR QUALITY IMPACT ANALYSIS

BIG BEAR AREA REGIONAL WASTEWATER AGENCY

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SEPTEMBER 7, 2023

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LIST OF ABBREVIATED TERMS

%	Percent
°F	Degrees Fahrenheit
(1)	Reference
µg/m^3	Microgram per Cubic Meter
AB 2595	California Clean Air Act
af	Acre-Feet
AQIA	Air Quality Impact Analysis
AQMD	Air Quality Management District
AQMP	Air Quality Management Plan
BACM	Best Available Control Measures
BAAQMD	Bay Area Air Quality Management District
BBARWA	Big Bear Area Regional Wastewater Agency
C_2H_3Cl	Vinyl Chloride
CAA	Federal Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
CalEPA	California Environmental Protection Agency
CALGreen	California Green Building Standards Code
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCR	California Code of Regulations
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CO	Carbon Monoxide
COHb	carboxyhemoglobin
EMFAC	EMissions FACtor Model
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
H_2S	Hydrogen Sulfide
HI	Hazard Index
hp	Horsepower
lbs/day	Pounds Per Day
LF	Linear Feet
LST	Localized Significance Threshold
LST METHODOLOGY	Final Localized Significance Threshold Methodology
MAR	Managed Aquifer Recharge

MICR	Maximum Individual Cancer Risk
MM	Mitigation Measures
mph	Miles Per Hour
MS4	Municipal Separate Storm Sewer System
MWELO	California Department of Water Resources' Model Water Efficient
N_2	Nitrogen
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
O_2	Oxygen
O_3	Ozone
O_2 Deficiency	Chronic Hypoxemia
Pb	Lead
PM_{10}	Particulate Matter 10 microns in diameter or less
$PM_{2.5}$	Particulate Matter 2.5 microns in diameter or less
ppm	Parts Per Million
Project	Replenish Big Bear Program
ROG	Reactive Organic Gases
RTP/SCS	Regional Transportation Plan/ Sustainable Communities Strategy
Rule 403	Fugitive Dust
Rule 1113	Architectural Coating
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SO_2	Sulfur Dioxide
SO_4	Sulfates
SO_X	Sulfur Oxides
SRA	Source Receptor Area
Title 24	California Building Code
TITLE I	Non-Attainment Provisions
TITLE II	Mobile Sources Provisions
C_2H_3Cl	Vinyl Chloride
VOC	Volatile Organic Compounds
vph	Vehicles Per Hour

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EXECUTIVE SUMMARY

ES.1 SUMMARY OF FINDINGS

The results of this *Replenish Big Bear Program Air Quality Impact Analysis* (AQIA) are summarized below based on the significance criteria in Section 3 of this report consistent with Appendix G of the California Environmental Quality Act (CEQA) Guidelines (1). Table ES-1 shows the findings of significance for each potential air quality impact under CEQA before and after any required mitigation measures (MM) described below.

TABLE ES-1: SUMMARY OF CEQA SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
Regional Construction Emissions	3.4	*Potentially Significant*	*Less Than Significant*
Localized Construction Emissions	3.7	*Potentially Significant*	*Less Than Significant*
Regional Operational Emissions	3.5	*Less Than Significant*	*n/a*
Localized Operational Emissions	3.8	*Less Than Significant*	*n/a*
CO "Hot Spot" Analysis	3.9	*Less Than Significant*	*n/a*
Air Quality Management Plan	3.10	*Potentially Significant*	*Less Than Significant*
Sensitive Receptors	3.11	*Less Than Significant*	*n/a*
Odors	3.12	*Less Than Significant*	*n/a*
Cumulative Impacts	3.13	*Potentially Significant*	*Less Than Significant*

ES.2 REGULATORY REQUIREMENTS

There are numerous requirements that development projects must comply with by law, and that were put in place by federal, State, and local regulatory agencies for the improvement of air quality.

Any operation or activity that might cause the emission of any smoke, fly ash, dust, fumes, vapors, gases, or other forms of air pollution, which can cause damage to human health, vegetation, or

other forms of property, or can cause excessive soiling on any other parcel shall conform to the requirements of the SCAQMD.

SCAQMD RULES

SCAQMD Rules that are currently applicable during construction activity for this Project are described below.

SCAQMD RULE 402

A person shall not discharge from any source whatsoever such quantities of air contaminants or other material that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or that endanger the comfort, repose, health, or safety of any such persons or the public, or that cause, or have a natural tendency to cause, injury or damage to business or property. The provisions of this rule do not apply to odors emanating from agricultural operations necessary for the growing of crops or the raising of fowl or animals.

Odor Emissions. All uses shall be operated in a manner such that no offensive odor is perceptible at or beyond the property line of that use.

SCAQMD RULE 403

This rule is intended to reduce the amount of particulate matter entrained in the ambient air as a result of anthropogenic (human-made) fugitive dust sources by requiring actions to prevent and reduce fugitive dust emissions. Rule 403 applies to any activity or human-made condition capable of generating fugitive dust and requires best available control measures to be applied to earth moving and grading activities.

The contractor shall adhere to the following applicable measures of Rule 403 including, but not limited to:

- All clearing, grading, earth-moving, or excavation activities shall cease when winds exceed 25 miles per hour (mph) per SCAQMD guidelines in order to limit fugitive dust emissions.
- The contractor shall ensure that all disturbed unpaved roads and disturbed areas within the Project are watered at least three (3) times daily during dry weather. Watering, with complete coverage of disturbed areas, shall occur at least three times a day, preferably in the mid-morning, afternoon, and after work is done for the day.
- All access points to the Project site shall have track out devices installed.
- The contractor shall ensure that traffic speeds on unpaved roads and Project site areas are limited to 15 mph or less

Dust Control, Operations. Any operation or activity that might cause the emission of any smoke, fly ash, dust, fumes, vapors, gases, or other forms of air pollution, which can cause damage to human health, vegetation, or other forms of property, or can cause excessive soiling on any other parcel, shall conform to the requirements of the SCAQMD.

SCAQMD RULE 1113

This rule serves to limit the VOC content of architectural coatings used on projects in the SCAQMD. Any person who supplies, sells, offers for sale, or manufactures any architectural coating for use on projects.

ES.3 CONSTRUCTION-SOURCE MITIGATION MEASURES

MM AQ-1

When using construction equipment greater than 150 horsepower (>150 hp), the Construction Contractor shall ensure that off-road diesel construction equipment complies with the Environmental Protection Agency (EPA)/California Air Resources Board (CARB) Tier 4 emissions standards or equivalent and shall ensure that all construction equipment is tuned and maintained in accordance with the manufacturer's specifications.

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1 INTRODUCTION

This report presents the results of the AQIA prepared by Urban Crossroads, Inc., for the proposed Replenish Big Bear Program (Project). The purpose of this AQIA is to evaluate the potential impacts to air quality associated with construction and operation of the proposed Project and, if warranted, recommend measures to mitigate impacts considered potentially significant in comparison to thresholds established by the SCAQMD.

1.1 SITE LOCATION

The Project site is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are located in the middle of this Basin. The overall project area consists of the Valley in the County of San Bernardino, as shown on Exhibit 1-A.

1.2 PROJECT DESCRIPTION

The proposed Project includes upgrades and additions to Big Bear Area Regional Wastewater Agency's (BBARWA) wastewater treatment plant (WWTP) to produce purified water through full advanced treatment to protect the receiving waters and their beneficial uses. The Replenish Big Bear Program would upgrade BBARWA's WWTP to produce full advanced treated water that would be retained within the Big Bear Valley watershed to be used to increase the sustainability of local water supplies, consequently, wastewater currently delivered to Lucerne Valley will be modified. The proposed Project consists of construction and operation of the various facilities which are separated into five project categories: 1) Replenish Big Bear Component 1: Lake Discharge Pipeline Alignment; 2) Replenish Big Bear Component 2: Shay Pond; 3) Replenish Big Bear Component 3: Evaporation Pond; 4) Replenish Big Bear Component 4: BBARWA WWTP Upgrades; and 5) Replenish Big Bear Component 5: Sand Canyon.

REPLENISH BIG BEAR COMPONENT 1: BBARWA WWTP UPGRADES

This Replenish Big Bear Component includes upgrades to the BBARWA WWTP, to include 2.2 MGD of full advanced treatment, producing up to 2,210 AFY of purified water. The upgrades include the construction of a 40,000 SF building which would provide the following upgrades and new construction in order of process flow:

- Upgrades to the Oxidation Ditches
- New Denitrification Filter
- New UF and RO filtration membranes
- New UV Disinfection
- New AOP
- New Pellet Reactor: 0.22 MGD

The BBARWA WWTP Treatment Upgrades also includes the installation of about 1,350 LF of brine pipeline anticipated to be sized between 8" to 10" from the pellet reactor to the solar evaporation ponds. Additionally, the BBARWA WWTP Treatment Upgrades also includes installation of a 50 gpm brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

REPLENISH BIG BEAR COMPONENT 2: LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12" in diameter.

REPLENISH BIG BEAR COMPONENT 3: SHAY POND CONVEYANCE PIPELINE

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells.

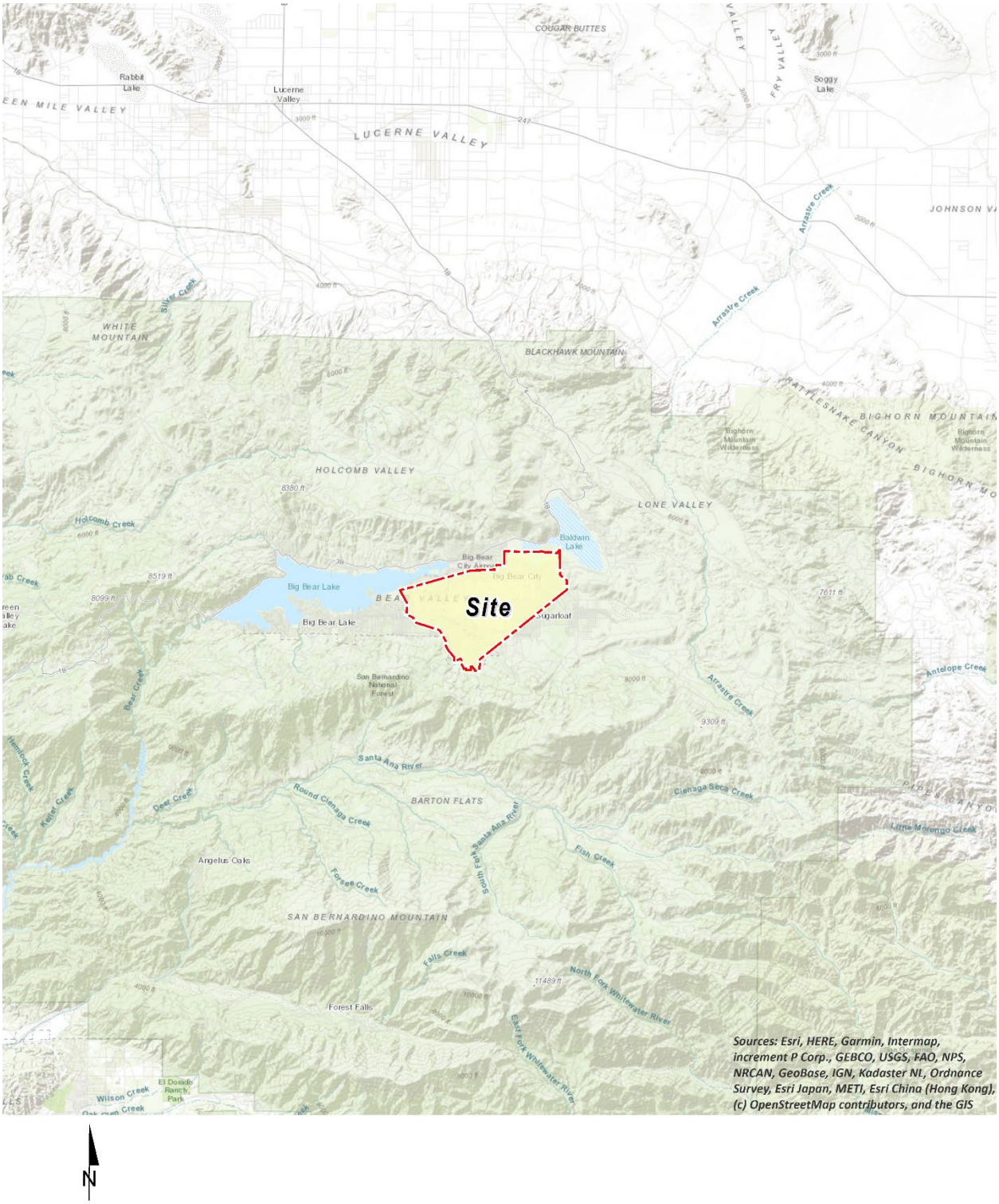
REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

The Sand Canyon groundwater recharge project involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline.

As part of the Replenish Big Bear Program, the following will be constructed:

- A new 471 gpm pump station near the snowmaking pond, at the BBLDWP Sand Canyon Well site, to convey water to Sand Canyon.
- A new 8-inch pipeline that will discharge into Sand Canyon and will be approximately 7,200 feet in length.
- Two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.
- Installation of erosion control using rip rap or similar erosion control methods, at Sand Canyon

EXHIBIT 1-A: PROJECT LOCATION MAP



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2 AIR QUALITY SETTING

This section provides an overview of the existing air quality conditions in the Project area and region.

2.1 SOUTH COAST AIR BASIN

The Project site is located in the South Coast Air Basin (SCAB) within the jurisdiction of SCAQMD (2). The SCAQMD was created by the 1977 Lewis-Presley Air Quality Management Act, which merged four county air pollution control bodies into one regional district. Under the Act, the SCAQMD is responsible for bringing air quality in areas under its jurisdiction into conformity with federal and state air quality standards. As previously stated, the Project site is located within the SCAB, a 6,745-square mile subregion of the SCAQMD, which includes portions of Los Angeles, Riverside, and San Bernardino Counties, and all of Orange County.

The SCAB is bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east. The Los Angeles County portion of the Mojave Desert Air Basin is bounded by the San Gabriel Mountains to the south and west, the Los Angeles / Kern County border to the north, and the Los Angeles / San Bernardino County border to the east. The Riverside County portion of the Salton Sea Air Basin is bounded by the San Jacinto Mountains in the west and spans eastward up to the Palo Verde Valley.

2.2 REGIONAL CLIMATE

The regional climate has a substantial influence on air quality in the SCAB. In addition, the temperature, wind, humidity, precipitation, and amount of sunshine influence the air quality.

The annual average temperatures throughout the SCAB vary from the low to middle 60s degrees Fahrenheit (°F). Due to a decreased marine influence, the eastern portion of the SCAB shows greater variability in average annual minimum and maximum temperatures. January is the coldest month throughout the SCAB, with average minimum temperatures of 47°F in downtown Los Angeles and 36°F in San Bernardino. All portions of the SCAB have recorded maximum temperatures above 100°F.

Although the climate of the SCAB can be characterized as semi-arid, the air near the land surface is quite moist on most days because of the presence of a marine layer. This shallow layer of sea air is an important modifier of SCAB climate. Humidity restricts visibility in the SCAB, and the conversion of sulfur dioxide (SO_2) to sulfates (SO_4) is heightened in air with high relative humidity. The marine layer provides an environment for that conversion process, especially during the spring and summer months. The annual average relative humidity within the SCAB is 71% along the coast and 59% inland. Since the ocean effect is dominant, periods of heavy early morning fog are frequent and low stratus clouds are a characteristic feature. These effects decrease with distance from the coast.

More than 90% of the SCAB's rainfall occurs from November through April. The annual average rainfall varies from approximately nine inches in Riverside to fourteen inches in downtown Los

Angeles. Monthly and yearly rainfall totals are extremely variable. Summer rainfall usually consists of widely scattered thunderstorms near the coast and slightly heavier shower activity in the eastern portion of the SCAB with frequency being higher near the coast.

Due to its generally clear weather, about three-quarters of available sunshine is received in the SCAB. The remaining one-quarter is absorbed by clouds. The ultraviolet portion of this abundant radiation is a key factor in photochemical reactions. On the shortest day of the year there are approximately 10 hours of possible sunshine, and on the longest day of the year there are approximately 14½ hours of possible sunshine.

The importance of wind to air pollution is considerable. The direction and speed of the wind determines the horizontal dispersion and transport of the air pollutants. During the late autumn to early spring rainy season, the SCAB is subjected to wind flows associated with the traveling storms moving through the region from the northwest. This period also brings five to ten periods of strong, dry offshore winds, locally termed "Santa Anas" each year. During the dry season, which coincides with the months of maximum photochemical smog concentrations, the wind flow is bimodal, typified by a daytime onshore sea breeze and a nighttime offshore drainage wind. Summer wind flows are created by the pressure differences between the relatively cold ocean and the unevenly heated and cooled land surfaces that modify the general northwesterly wind circulation over southern California. Nighttime drainage begins with the radiational cooling of the mountain slopes. Heavy, cool air descends the slopes and flows through the mountain passes and canyons as it follows the lowering terrain toward the ocean. Another characteristic wind regime in the SCAB is the "Catalina Eddy," a low level cyclonic (counterclockwise) flow centered over Santa Catalina Island which results in an offshore flow to the southwest. On most spring and summer days, some indication of an eddy is apparent in coastal sections.

In the SCAB, there are two distinct temperature inversion structures that control vertical mixing of air pollution. During the summer, warm high-pressure descending (subsiding) air is undercut by a shallow layer of cool marine air. The boundary between these two layers of air is a persistent marine subsidence/inversion. This boundary prevents vertical mixing which effectively acts as an impervious lid to pollutants over the entire SCAB. The mixing height for the inversion structure is normally situated 1,000 to 1,500 feet above mean sea level.

A second inversion-type forms in conjunction with the drainage of cool air off the surrounding mountains at night followed by the seaward drift of this pool of cool air. The top of this layer forms a sharp boundary with the warmer air aloft and creates nocturnal radiation inversions. These inversions occur primarily in the winter, when nights are longer and onshore flow is weakest. They are typically only a few hundred feet above mean sea level. These inversions effectively trap pollutants, such as nitrogen oxides (NO_X) and carbon monoxide (CO) from vehicles, as the pool of cool air drifts seaward. Winter is therefore a period of high levels of primary pollutants along the coastline.

2.3 WIND PATTERNS AND PROJECT LOCATION

The distinctive climate of the Project area and the SCAB is determined by its terrain and geographical location. The SCAB is located in a coastal plain with connecting broad valleys and

low hills, bounded by the Pacific Ocean in the southwest quadrant with high mountains forming the remainder of the perimeter.

Wind patterns across the south coastal region are characterized by westerly and southwesterly onshore winds during the day and easterly or northeasterly breezes at night. Winds are characteristically light although the speed is somewhat greater during the dry summer months than during the rainy winter season.

2.4 CRITERIA POLLUTANTS

Criteria pollutants are pollutants that are regulated through the development of human health based and/or environmentally based criteria for setting permissible levels. Criteria pollutants, their typical sources, and health effects are identified below (3):

TABLE 2-1: CRITERIA POLLUTANTS

Criteria Pollutant	Description	Sources	Health Effects
CO	CO is a colorless, odorless gas produced by the incomplete combustion of carbon-containing fuels, such as gasoline or wood. CO concentrations tend to be the highest during the winter morning, when little to no wind and surface-based inversions trap the pollutant at ground levels. Because CO is emitted directly from internal combustion engines, unlike ozone (O_3), motor vehicles operating at slow speeds are the primary source of CO in the SCAB. The highest ambient CO concentrations are generally found near congested transportation corridors and intersections.	Any source that burns fuel such as automobiles, trucks, heavy construction equipment, farming equipment and residential heating.	Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise, and electrocardiograph changes indicative of decreased oxygen (O_2) supply to the heart. Inhaled CO has no direct toxic effect on the lungs but exerts its effect on tissues by interfering with O_2 transport and competing with O_2 to combine with hemoglobin present in the blood to form carboxyhemoglobin (COHb). Hence, conditions with an increased demand for O_2 supply can be adversely affected by exposure to CO. Individuals most at risk include fetuses, patients with diseases involving heart and blood vessels, and patients with chronic hypoxemia (O_2 deficiency) as seen at high altitudes.

Criteria Pollutant	Description	Sources	Health Effects
SO_2	SO_2 is a colorless, extremely irritating gas or liquid. It enters the atmosphere as a pollutant mainly as a result of burning high sulfur-content fuel oils and coal and from chemical processes occurring at chemical plants and refineries. When SO_2 oxidizes in the atmosphere, it forms SO_4. Collectively, these pollutants are referred to as sulfur oxides (SO_X).	Coal or oil burning power plants and industries, refineries, diesel engines	A few minutes of exposure to low levels of SO_2 can result in airway constriction in some asthmatics, all of whom are sensitive to its effects. In asthmatics, increase in resistance to air flow, as well as reduction in breathing capacity leading to severe breathing difficulties, are observed after acute exposure to SO_2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2. Animal studies suggest that despite SO_2 being a respiratory irritant, it does not cause substantial lung injury at ambient concentrations. However, very high levels of exposure can cause lung edema (fluid accumulation), lung tissue damage, and sloughing off of cells lining the respiratory tract. Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO_2 levels. In these studies, efforts to separate the effects of SO_2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically, or one pollutant alone is the predominant factor.

Criteria Pollutant	Description	Sources	Health Effects
NO_X	NO_X consist of nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O) and are formed when nitrogen (N_2) combines with O_2. Their lifespan in the atmosphere ranges from one to seven days for NO and N_2O, to 170 years for nitrous oxide. NO_X is typically created during combustion processes and are major contributors to smog formation and acid deposition. NO_2 is a criteria air pollutant and may result in numerous adverse health effects; it absorbs blue light, resulting in a brownish-red cast to the atmosphere and reduced visibility. Of the seven types of nitrogen oxide compounds, NO_2 is the most abundant in the atmosphere. As ambient concentrations of NO_2 are related to traffic density, commuters in heavy traffic may be exposed to higher concentrations of NO_2 than those indicated by regional monitoring station.	Any source that burns fuel such as automobiles, trucks, heavy construction equipment, farming equipment and residential heating.	Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children (not infants), is associated with long-term exposure to NO_2 at levels found in homes with gas stoves, which are higher than ambient levels found in Southern California. Increase in resistance to air flow and airway contraction is observed after short-term exposure to NO_2 in healthy subjects. Larger decreases in lung functions are observed in individuals with asthma or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater susceptibility of these sub-groups. In animals, exposure to levels of NO_2 considerably higher than ambient concentrations result in increased susceptibility to infections, possibly due to the observed changes in cells involved in maintaining immune functions. The severity of lung tissue damage associated with high levels of O_3 exposure increases when animals are exposed to a combination of O_3 and NO_2.
O_3	O_3 is a highly reactive and unstable gas that is formed when VOCs and NO_X, both byproducts of internal combustion engine exhaust, undergo slow photochemical reactions in the presence of sunlight. O_3 concentrations are generally	Formed when reactive organic gases (ROG) and NO_X react in the presence of sunlight. ROG sources	Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered to be the most susceptible sub-groups for O_3 effects. Short-

Criteria Pollutant	Description	Sources	Health Effects
	highest during the summer months when direct sunlight, light wind, and warm temperature conditions are favorable to the formation of this pollutant.	include any source that burns fuels, (e.g., gasoline, natural gas, wood, oil) solvents, petroleum processing and storage and pesticides.	term exposure (lasting for a few hours) to O_3 at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. Elevated O_3 levels are associated with increased school absences. In recent years, a correlation between elevated ambient O_3 levels and increases in daily hospital admission rates, as well as mortality, has also been reported. An increased risk for asthma has been found in children who participate in multiple outdoor sports and live in communities with high O_3 levels. O_3 exposure under exercising conditions is known to increase the severity of the responses described above. Animal studies suggest that exposure to a combination of pollutants that includes O_3 may be more toxic than exposure to O_3 alone. Although lung volume and resistance changes observed after a single exposure diminish with repeated exposures, biochemical and cellular changes appear to persist, which can lead to subsequent lung structural changes.
Particulate Matter	PM_{10}: A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. Particulate matter pollution is a major cause of reduce visibility (haze) which is	Sources of PM_{10} include road dust, windblown dust and construction. Also formed from other pollutants (acid	A consistent correlation between elevated ambient fine particulate matter (PM_{10} and $PM_{2.5}$) levels and an increase in mortality rates, respiratory infections,

Criteria Pollutant	Description	Sources	Health Effects
	caused by the scattering of light and consequently the significant reduction air clarity. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the lungs where they may be deposited, resulting in adverse health effects. Additionally, it should be noted that PM_{10} is considered a criteria air pollutant. $PM_{2.5}$: A similar air pollutant to PM_{10} consisting of tiny solid or liquid particles which are 2.5 microns or smaller (which is often referred to as fine particles). These particles are formed in the atmosphere from primary gaseous emissions that include SO_4 formed from SO_2 release from power plants and industrial facilities and nitrates that are formed from NO_X release from power plants, automobiles and other types of combustion sources. The chemical composition of fine particles highly depends on location, time of year, and weather conditions. $PM_{2.5}$ is a criteria air pollutant.	rain, NO_X, SO_X, organics). Incomplete combustion of any fuel. $PM_{2.5}$ comes from fuel combustion in motor vehicles, equipment and industrial sources, residential and agricultural burning. Also formed from reaction of other pollutants (acid rain, NO_X, SO_X, organics).	number and severity of asthma attacks and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, some studies have reported an association between long-term exposure to air pollution dominated by fine particles and increased mortality, reduction in lifespan, and an increased mortality from lung cancer. Daily fluctuations in $PM_{2.5}$ concentration levels have also been related to hospital admissions for acute respiratory conditions in children, to school and kindergarten absences, to a decrease in respiratory lung volumes in normal children, and to increased medication use in children and adults with asthma. Recent studies show lung function growth in children is reduced with long term exposure to particulate matter. The elderly, people with pre-existing respiratory or cardiovascular disease, and children appear to be more susceptible to the effects of high levels of PM_{10} and $PM_{2.5}$.
VOC	VOCs are hydrocarbon compounds (any compound containing various combinations of hydrogen and carbon atoms) that exist in the ambient air. VOCs contribute to the formation of smog through atmospheric photochemical reactions and/or may be toxic. Compounds of carbon (also known as organic compounds) have different levels	Organic chemicals are widely used as ingredients in household products. Paints, varnishes and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic,	Breathing VOCs can irritate the eyes, nose and throat, can cause difficulty breathing and nausea, and can damage the central nervous system as well as other organs. Some VOCs can cause cancer. Not all VOCs have all these health effects, though many have several.

Criteria Pollutant	Description	Sources	Health Effects
	of reactivity; that is, they do not react at the same speed or do not form O_3 to the same extent when exposed to photochemical processes. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints. Exceptions to the VOC designation include CO, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. VOCs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The terms VOC and ROG (see below) interchangeably.	degreasing and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.	
ROG	Similar to VOC, ROGs are also precursors in forming O_3 and consist of compounds containing methane, ethane, propane, butane, and longer chain hydrocarbons, which are typically the result of some type of combustion/decomposition process. Smog is formed when ROG and NO_X react in the presence of sunlight. ROGs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The terms ROG and VOC (see previous) interchangeably.	Sources similar to VOCs.	Health effects similar to VOCs.
Lead (Pb)	Pb is a heavy metal that is highly persistent in the environment and is considered a criteria pollutant. In the past, the primary source of Pb in the air was emissions from vehicles burning leaded gasoline. The major sources of Pb emissions are ore and metals processing, particularly Pb smelters, and piston-engine aircraft operating on leaded aviation gasoline. Other stationary sources include waste incinerators, utilities, and	Metal smelters, resource recovery, leaded gasoline, deterioration of Pb paint.	Fetuses, infants, and children are more sensitive than others to the adverse effects of Pb exposure. Exposure to low levels of Pb can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotient. In adults, increased Pb levels are

Criteria Pollutant	Description	Sources	Health Effects
	lead-acid battery manufacturers. It should be noted that the Project does not include operational activities such as metal processing or Pb acid battery manufacturing. As such, the Project is not anticipated to generate a quantifiable amount of Pb emissions.		associated with increased blood pressure. Pb poisoning can cause anemia, lethargy, seizures, and death; although it appears that there are no direct effects of Pb on the respiratory system. Pb can be stored in the bone from early age environmental exposure, and elevated blood Pb levels can occur due to breakdown of bone tissue during pregnancy, hyperthyroidism (increased secretion of hormones from the thyroid gland) and osteoporosis (breakdown of bony tissue). Fetuses and breast-fed babies can be exposed to higher levels of Pb because of previous environmental Pb exposure of their mothers.
Odor	Odor means the perception experienced by a person when one or more chemical substances in the air come into contact with the human olfactory nerves (4).	Odors can come from many sources including animals, human activities, industry, natures, and vehicles.	Offensive odors can potentially affect human health in several ways. First, odorant compounds can irritate the eye, nose, and throat, which can reduce respiratory volume. Second, studies have shown that the VOCs that cause odors can stimulate sensory nerves to cause neurochemical changes that might influence health, for instance, by compromising the immune system. Finally, unpleasant odors can trigger memories or attitudes linked to unpleasant odors, causing cognitive and emotional effects such as stress.

2.5 EXISTING AIR QUALITY

Existing air quality is measured at established SCAQMD air quality monitoring stations. Monitored air quality is evaluated in the context of ambient air quality standards. These standards are the levels of air quality that are considered safe, with an adequate margin of safety, to protect the public health and welfare. National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) currently in effect are shown in Table 2-2 (5).

The determination of whether a region's air quality is healthful or unhealthful is determined by comparing contaminant levels in ambient air samples to the state and federal standards. At the time of this AQIA, the most recent state and federal standards are presented in Table 2-2. The air quality in a region is considered to be in attainment if the measured ambient air pollutant levels for O_3, CO (except 8-hour Lake Tahoe), SO_2 (1 and 24 hour), NO_2, PM_{10}, and $PM_{2.5}$ are not to be exceeded. All others are not to be equaled or exceeded. It should be noted that the three-year period is presented for informational purposes and is not the basis for how attainment status is determined. Attainment status for a pollutant means that the SCAB meets the standards set by the U.S. Environmental Protection Agency (EPA) or the California EPA (CalEPA). Conversely, nonattainment means that an area has monitored air quality that does not meet the NAAQS or CAAQS. A State Implementation Plan (SIP) is required by the federal Clean Air Act (CAA) for area that are designated non-attainment under the NAAQS. A SIP outlines the measures that a state will take to improve air quality in the area designated nonattainment. Once a nonattainment area meets the standards and additional redesignation requirements, the EPA designates the area as a maintenance area (6).

TABLE 2-2: AMBIENT AIR QUALITY STANDARDS (1 OF 2)

Ambient Air Quality Standards						
Pollutant	**Averaging Time**	**California Standards [1]**		**National Standards [2]**		
		Concentration [3]	**Method [4]**	**Primary [3,5]**	**Secondary [3,6]**	**Method [7]**
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m^3)		0.070 ppm (137 µg/m^3)		
Respirable Particulate Matter (PM10)[9]	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		—		
Fine Particulate Matter (PM2.5)[9]	24 Hour	—	—	35 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	12.0 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m^3)	—	Non-Dispersive Infrared Photometry (NDIR)
	8 Hour	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 µg/m^3)	Gas Phase Chemiluminescence	100 ppb (188 µg/m^3)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m^3)		0.053 ppm (100 µg/m^3)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 µg/m^3)	Ultraviolet Fluorescence	75 ppb (196 µg/m^3)	—	Ultraviolet Flourescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 µg/m^3)	
	24 Hour	0.04 ppm (105 µg/m^3)		0.14 ppm (for certain areas)[11]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas)[11]	—	
Lead[12,13]	30 Day Average	1.5 µg/m^3	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m^3 (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m^3		
Visibility Reducing Particles[14]	8 Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	**No National Standards**		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

See footnotes on next page …

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TABLE 2-2: AMBIENT AIR QUALITY STANDARDS (2 OF 2)

1. California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.
2. National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4. Any equivalent measurement method which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard may be used.
5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
7. Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.
8. On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.
9. On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.
10. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.
11. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

    Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.
12. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.
13. The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
14. In 1989, the ARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

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2.6 REGIONAL AIR QUALITY

Air pollution contributes to a wide variety of adverse health effects. The EPA has established NAAQS for six of the most common air pollutants: CO, Pb, O_3, particulate matter (PM_{10} and $PM_{2.5}$), NO_2, and SO_2 which are known as criteria pollutants. The SCAQMD monitors levels of various criteria pollutants at 37 permanent monitoring stations and 5 single-pollutant source Pb air monitoring sites throughout the air district (7). On December 28, 2021, CARB posted the proposed 2021 amendments to the state and national area designations. See Table 2-3 for attainment designations for the SCAB (8). Appendix 2.1 provides geographic representation of the state and federal attainment status for applicable criteria pollutants within the SCAB.

TABLE 2-3: ATTAINMENT STATUS OF CRITERIA POLLUTANTS IN THE SCAB

Criteria Pollutant	State Designation	Federal Designation
O_3 – 1-hour standard	Nonattainment	--
O_3 – 8-hour standard	Nonattainment	Nonattainment
PM_{10}	Nonattainment	Attainment
$PM_{2.5}$	Nonattainment	Nonattainment
CO	Attainment	Unclassifiable/Attainment
NO_2	Attainment	Unclassifiable/Attainment
SO_2	Attainment	Unclassifiable/Attainment
Pb[1]	Attainment	Unclassifiable/Attainment

Note: See Appendix 2.1 for a detailed map of State/National Area Designations within the SCAB
"-" = The national 1-hour O_3 standard was revoked effective June 15, 2005

2.7 LOCAL AIR QUALITY

The Project site is located within Source Receptor Area (SRA) 38 (9). Within SRA 38, the SCAQMD East San Bernardino Mountains monitoring station, located 0.28 mile north of the Project site, is the nearest long-term air quality monitoring station for $PM_{2.5}$. As the East San Bernardino Mountains monitoring station does not provide data for O3, CO, NO_2, or PM_{10}, the next nearest monitoring stations will be utilized. Data for O_3 and PM_{10} was obtained from the Central San Bernardino Mountains monitoring station, located in SRA 37, approximately 22.31 miles west of the Project site. The nearest station for CO and NO_2 data was obtained from the Central San Bernardino Valley 2 monitoring station which is located approximately 24.18 miles southwest of the Project site in SRA 34. It should be noted that the Central San Bernardino Mountains and Central San Bernardino Valley 2 monitoring stations were utilized in lieu of the East San Bernardino Mountains monitoring station only in instances where data was not available.

The most recent three (3) years of data available is shown on Table 2-4 and is considered to be representative of the local air quality at the Project site (10). Please note, data for SO_2 has been

[1] The Federal nonattainment designation for lead is only applicable towards the Los Angeles County portion of the SCAB.

omitted as attainment is regularly met in the SCAB and few monitoring stations measure SO_2 concentrations.

TABLE 2-4: PROJECT AREA AIR QUALITY MONITORING SUMMARY 2019-2021

Pollutant	Standard	Year		
		2019	2020	2021
O_3				
Maximum Federal 1-Hour Concentration (ppm)		0.137	0.173	0.145
Maximum Federal 8-Hour Concentration (ppm)		0.117	0.136	0.119
Number of Days Exceeding State 1-Hour Standard	> 0.09 ppm	73	104	74
Number of Days Exceeding Federal/State 8-Hour Standard	> 0.070 ppm	109	141	118
CO				
Maximum Federal 1-Hour Concentration	> 35 ppm	1.3	1.9	2.0
Maximum Federal 8-Hour Concentration	> 20 ppm	1.1	1.4	1.6
NO_2				
Maximum Federal 1-Hour Concentration	> 0.100 ppm	0.059	0.054	0.056
Annual Federal Standard Design Value		0.014	0.015	0.015
PM_{10}				
Maximum Federal 24-Hour Concentration (µg/m^3)	> 150 µg/m^3	44	57	44
Annual Federal Arithmetic Mean (µg/m^3)		21.2	23.4	23.2
Number of Days Exceeding Federal 24-Hour Standard	> 150 µg/m^3	0	0	0
Number of Days Exceeding State 24-Hour Standard	> 50 µg/m^3	0	1	0
$PM_{2.5}$				
Maximum Federal 24-Hour Concentration (µg/m^3)	> 35 µg/m^3	31.0	24.3	24.5
Annual Federal Arithmetic Mean (µg/m^3)	> 12 µg/m^3	5.94	7.62	7.04
Number of Days Exceeding Federal 24-Hour Standard	> 35 µg/m^3	0	0	0

ppm = Parts Per Million
Source: Data for O_3, CO, NO_2, PM_{10}, and $PM_{2.5}$ was obtained from SCAQMD Air Quality Data Tables.

2.8 REGULATORY BACKGROUND

2.8.1 FEDERAL REGULATIONS

The EPA is responsible for setting and enforcing the NAAQS for O_3, CO, NO_X, SO_2, PM_{10}, and Pb (11). The EPA has jurisdiction over emissions sources that are under the authority of the federal government including aircraft, locomotives, and emissions sources outside state waters (Outer Continental Shelf). The EPA also establishes emission standards for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission requirements of the CARB.

The Federal Clean Air Act (CAA) was first enacted in 1955 and has been amended numerous times in subsequent years (1963, 1965, 1967, 1970, 1977, and 1990). The CAA establishes the federal

air quality standards, the NAAQS, and specifies future dates for achieving compliance (12). The CAA also mandates that states submit and implement SIPs for local areas not meeting these standards. These plans must include pollution control measures that demonstrate how the standards will be met.

The 1990 amendments to the CAA that identify specific emission reduction goals for areas not meeting the NAAQS require a demonstration of reasonable further progress toward attainment and incorporate additional sanctions for failure to attain or to meet interim milestones. The sections of the CAA most directly applicable to the development of the Project site include Title I (Non-Attainment Provisions) and Title II (Mobile Source Provisions) (13) (14). Title I provisions were established with the goal of attaining the NAAQS for the following criteria pollutants O_3, NO_2, SO_2, PM_{10}, CO, $PM_{2.5}$, and Pb. The NAAQS were amended in July 1997 to include an additional standard for O_3 and to adopt a NAAQS for $PM_{2.5}$. Table 2-3 (previously presented) provides the NAAQS within the SCAB.

Mobile source emissions are regulated in accordance with Title II provisions. These provisions require the use of cleaner burning gasoline and other cleaner burning fuels such as methanol and natural gas. Automobile manufacturers are also required to reduce tailpipe emissions of hydrocarbons and NO_X. NO_X is a collective term that includes all forms of NO_X which are emitted as byproducts of the combustion process.

2.8.2 CALIFORNIA REGULATIONS

CARB

The CARB, which became part of the CalEPA in 1991, is responsible for ensuring implementation of the California Clean Air Act (AB 2595), responding to the federal CAA, and for regulating emissions from consumer products and motor vehicles. AB 2595 mandates achievement of the maximum degree of emissions reductions possible from vehicular and other mobile sources in order to attain the state ambient air quality standards by the earliest practical date. The CARB established the CAAQS for all pollutants for which the federal government has NAAQS and, in addition, establishes standards for SO_4, visibility, hydrogen sulfide (H_2S), and vinyl chloride (C_2H_3Cl). However, at this time, H_2S and C_2H_3Cl are not measured at any monitoring stations in the SCAB because they are not considered to be a regional air quality problem. Generally, the CAAQS are more stringent than the NAAQS (15) (11).

Local air quality management districts, such as the SCAQMD, regulate air emissions from stationary sources such as commercial and industrial facilities. All air pollution control districts have been formally designated as attainment or non-attainment for each CAAQS.

Serious non-attainment areas are required to prepare Air Quality Management Plans (AQMP) that include specified emission reduction strategies in an effort to meet clean air goals. These plans are required to include:

- Application of Best Available Retrofit Control Technology to existing sources;
- Developing control programs for area sources (e.g., architectural coatings and solvents) and indirect sources (e.g. motor vehicle use generated by residential and commercial development);

- A District permitting system designed to allow no net increase in emissions from any new or modified permitted sources of emissions;
- Implementing reasonably available transportation control measures and assuring a substantial reduction in growth rate of vehicle trips and miles traveled;
- Significant use of low emissions vehicles by fleet operators;
- Sufficient control strategies to achieve a 5% or more annual reduction in emissions or 15% or more in a period of three years for ROGs, NO_X, CO and PM_{10}. However, air basins may use alternative emission reduction strategy that achieves a reduction of less than 5% per year under certain circumstances.

TITLE 24 ENERGY EFFICIENCY STANDARDS AND CALIFORNIA GREEN BUILDING STANDARDS

California Code of Regulations (CCR) Title 24 Part 6: The California Energy Code was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption.

The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods. CCR, Title 24, Part 11: California Green Building Standards Code (CALGreen) is a comprehensive and uniform regulatory code for all residential, commercial, and school buildings that went in effect on August 1, 2009, and is administered by the California Building Standards Commission.

CALGreen is updated on a regular basis, with the most recent approved update consisting of the 2022 California Green Building Code Standards that became effective on January 1, 2023. The CEC anticipates that the 2022 energy code will provide $1.5 billion in consumer benefits and reduce GHG emissions by 10 million metric tons (16). The Project would be required to comply with the applicable standards in place at the time plan check submittals are made. These require, among other items (17):

NONRESIDENTIAL MANDATORY MEASURES

- Short-term bicycle parking. If the new project or an additional alteration is anticipated to generate visitor traffic, provide permanently anchored bicycle racks within 200 feet of the visitors' entrance, readily visible to passers-by, for 5% of new visitor motorized vehicle parking spaces being added, with a minimum of one two-bike capacity rack (5.106.4.1.1).
- Long-term bicycle parking. For new buildings with tenant spaces that have 10 or more tenant-occupants, provide secure bicycle parking for 5% of the tenant-occupant vehicular parking spaces with a minimum of one bicycle parking facility (5.106.4.1.2).
- Designated parking for clean air vehicles. In new projects or additions to alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of low-emitting, fuel-efficient and carpool/van pool vehicles as shown in Table 5.106.5.2 (5.106.5.2).
- EV charging stations. New construction shall facilitate the future installation of EV supply equipment. The compliance requires empty raceways for future conduit and documentation that the electrical system has adequate capacity for the future load. The number of spaces to be provided for is contained in Table 5.106. 5.3.3 (5.106.5.3). Additionally, Table 5.106.5.4.1 specifies requirements for the installation of raceway conduit and panel power requirements for medium- and heavy-duty EV supply equipment for warehouses, grocery stores, and retail stores.

- Outdoor light pollution reduction. Outdoor lighting systems shall be designed to meet the backlight, uplight and glare ratings per Table 5.106.8 (5.106.8).
- Construction waste management. Recycle and/or salvage for reuse a minimum of 65% of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1. 5.405.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent (5.408.1).
- Excavated soil and land clearing debris. 100% of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reuse or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed (5.408.3).
- Recycling by Occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage, and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive (5.410.1).
- Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:
    - Water Closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush (5.303.3.1)
    - Urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush (5.303.3.2.1). The effective flush volume of floor- mounted or other urinals shall not exceed 0.5 gallons per flush (5.303.3.2.2).
    - Showerheads. Single showerheads shall have a minimum flow rate of not more than 1.8 gallons per minute and 80 psi (5.303.3.3.1). When a shower is served by more than one showerhead, the combine flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi (5.303.3.3.2).
    - Faucets and fountains. Nonresidential lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi (5.303.3.4.1). Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute of 60 psi (5.303.3.4.2). Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute (5.303.3.4.3). Metering faucets shall not deliver more than 0.20 gallons per cycle (5.303.3.4.4). Metering faucets for wash fountains shall have a maximum flow rate not more than 0.20 gallons per cycle (5.303.3.4.5).
- Outdoor potable water uses in landscaped areas. Nonresidential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent (5.304.1).
- Water meters. Separate submeters or metering devices shall be installed for new buildings or additions in excess of 50,000 sf or for excess consumption where any tenant within a new building or within an addition that is project to consume more than 1,000 gallons per day (GPD) (5.303.1.1 and 5.303.1.2).
- Outdoor water uses in rehabilitated landscape projects equal or greater than 2,500 sf. Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 2,500 sf requiring a building or landscape permit (5.304.3).

- Commissioning. For new buildings 10,000 sf and over, building commissioning shall be included in the design and construction processes of the building project to verify that the building systems and components meet the owner's or owner representative's project requirements (5.410.2).

2.8.3 AIR QUALITY MANAGEMENT PLANNING

Currently, the NAAQS and CAAQS are exceeded in most parts of the SCAB. In response, the SCAQMD has adopted a series of AQMPs to meet the state and federal ambient air quality standards (18). AQMPs are updated regularly in order to more effectively reduce emissions, accommodate growth, and to minimize any negative fiscal impacts of air pollution control on the economy. Under State law, the SCAQMD is required to prepare a plan for air quality improvement for pollutants for which the district is in non-compliance. Each iteration of the SCAQMD's Air Quality Management Plan (AQMP) is an update of the previous plan and has a 20-year horizon. The latest AQMP, the 2022 AQMP, adopted by the SCAQMD Governing Board on December 2, 2022. The 2022 AQMP was developed to address the requirements for meeting the 2015 8-hour O_3 standard. The 2022 AQMP builds upon measures already in place from previous AQMPs. It also includes a variety of additional strategies such as regulation, accelerated deployment of available cleaner technologies (e.g., zero emissions technologies, when cost-effective and feasible, and low NO_X technologies in other applications), best management practices, co-benefits from existing programs (e.g., climate and energy efficiency), incentives, and other FCAA measures to achieve the 2015 8-hour ozone standard. The 2022 AQMP incorporates the latest scientific and technological information and planning assumptions, including the 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) and updated emission inventory methodologies for various source categories. The 2022 AQMP requires CARB's adoption before submittal for the U.S. EPA's final approval, which is expected to occur sometime in 2023. Additional discussion and Project consistency with the AQMP is provided in Section 3. 10.

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3 PROJECT AIR QUALITY IMPACT

3.1 INTRODUCTION

This study quantifies air quality emissions generated by construction and operation of the Project and addresses whether the Project conflicts with implementation of the SCAQMD's AQMP and Lead Agency planning regulations. The analysis of Project-generated air emissions determines whether the Project would result in a cumulatively considerable net increase of any criteria pollutant for which the SCAB is in non-attainment under an applicable NAAQS and CAAQS. Additionally, the Project has been evaluated to determine whether the Project would expose sensitive receptors to substantial pollutant concentrations and the impacts of odors. The significance of these potential impacts is described in the following sections.

3.2 STANDARDS OF SIGNIFICANCE

The criteria used to determine the significance of potential Project-related air quality impacts are taken from the Initial Study Checklist in Appendix G of the State CEQA Guidelines (14 CCR §§15000, et seq.). Based on these thresholds, a project would result in a significant impact related to air quality if it would (1):

- Conflict with or obstruct implementation of the applicable air quality plan.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard.
- Expose sensitive receptors to substantial pollutant concentrations.
- Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.

The SCAQMD has also developed regional significance thresholds for other regulated pollutants, as summarized at Table 3-1 (19). The SCAQMD's CEQA Air Quality Significance Thresholds (March 2023) indicate that any projects in the SCAB with daily emissions that exceed any of the indicated thresholds should be considered as having an individually and cumulatively significant air quality impact.

TABLE 3-1: MAXIMUM DAILY REGIONAL EMISSIONS THRESHOLDS

Pollutant	Construction Regional Thresholds	Operational Regional Thresholds
NO_X	100 lbs/day	55 lbs/day
VOC	75 lbs/day	55 lbs/day
PM_{10}	150 lbs/day	150 lbs/day
$PM_{2.5}$	55 lbs/day	55 lbs/day
SO_X	150 lbs/day	150 lbs/day
CO	550 lbs/day	550 lbs/day

lbs/day = Pounds Per Day

3.3 CALIFORNIA EMISSIONS ESTIMATOR MODEL™ EMPLOYED TO ANALYZE AIR QUALITY

Land uses such as the Project affect air quality through construction-source and operational-source emissions.

In May 2023 the California Air Pollution Control Officers Association (CAPCOA) in conjunction with other California air districts, including SCAQMD, released the latest version of CalEEMod version 2022.1.1.12. The purpose of this model is to calculate construction-source and operational-source criteria pollutant (VOCs, NO_X, SO_X, CO, PM_{10}, and $PM_{2.5}$) and GHG emissions from direct and indirect sources; and quantify applicable air quality and GHG reductions achieved from mitigation measures (20). Accordingly, the latest version of CalEEMod has been used for this Project to determine construction and operational air quality emissions. Output from the model runs for both construction and operational activity are provided in Appendices 3.1 through 3.5.

3.4 REGIONAL CONSTRUCTION EMISSIONS

As previously stated, the Project consists of the construction and operation of the following facilities:

REPLENISH BIG BEAR COMPONENT 1: BBARWA WWTP UPGRADES

This Replenish Big Bear Component includes upgrades to the BBARWA WWTP, to include 2.2 MGD of full advanced treatment, producing up to 2,210 AFY of purified water. The upgrades include the construction of a 40,000 SF building which would provide the following upgrades and new construction in order of process flow:

- Upgrades to the Oxidation Ditches
- New Denitrification Filter
- New UF and RO filtration membranes
- New UV Disinfection
- New AOP
- New Pellet Reactor: 0.22 MGD

The BBARWA WWTP Treatment Upgrades also includes the installation of about 1,350 LF of brine pipeline anticipated to be sized between 8” to 10” from the pellet reactor to the solar evaporation ponds.

Additionally, the BBARWA WWTP Treatment Upgrades also includes installation of a 50 gpm brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

REPLENISH BIG BEAR COMPONENT 2: LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12” in diameter.

REPLENISH BIG BEAR COMPONENT 3: SHAY POND CONVEYANCE PIPELINE

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells.

REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

The Sand Canyon groundwater recharge project involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline.

As part of the Replenish Big Bear Program, the following will be constructed:

- A new 471 gpm pump station near the snowmaking pond, at the BBLDWP Sand Canyon Well site, to convey water to Sand Canyon.
- A new 8-inch pipeline that will discharge into Sand Canyon and will be approximately 7,200 feet in length.
- Two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.
- Installation of erosion control using rip rap or similar erosion control methods, at Sand Canyon

Because few details are known at this time regarding construction of specific projects, it is assumed that construction of any Project facilities may occur simultaneously. As a conservative measure, and in order to identify the maximum daily emissions, this AQIA assumes that the Project would construct the following features simultaneously:

REPLENISH BIG BEAR COMPONENT 1: BBARWA WWTP UPGRADES

- 2 pump stations: 20 gpm and 1,520 gpm
- 1,350 LF of brine pipeline
- Total building area: 40,000 SF total on site
- Installation of 2 MW on existing BBARWA property

REPLENISH BIG BEAR COMPONENT 2 : LAKE DISCHARGE PIPELINE ALIGNMENT

- 19,940 LF of pipeline

REPLENISH BIG BEAR COMPONENT 3: SHAY POND CONVEYANCE PIPELINE

- 6,310 LF of pipeline on unpaved area

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

- 57 acres of evaporation ponds
- 2 monitoring wells

REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

- 1 pump station
- 2 monitoring wells
- 7,210 LF of conveyance pipeline
- Erosion control/rip rap at pipeline discharge

3.4.1 CONSTRUCTION ACTIVITIES

During construction activities associated with individual projects, emissions of VOCs, NO_X, SO_X, CO, PM_{10}, and $PM_{2.5}$ will likely be released through the burning of fossil fuel in construction equipment, grading fugitive dust, asphalt paving, and the application of architectural coatings during painting activity.

DEMOLITION

The site is currently developed with existing uses/structures and asphalt which would require demolition. Per BBARWA and the Project Team provided data, is anticipated that the following tons of demolished material would be hauled off-site. The cubic yards of export will be analyzed using the BBARWA and the Project Team provided hauling trip length of 100 miles.

Replenish Big Bear Component 1: BBARWA WWTP Upgrades, 3,000 tons of asphalt/concrete would be demolished. Additionally, up to 1,350 CY of asphalt export would be needed.

Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment, it is estimated that up to 5,875 tons of asphalt/concrete would be demolished.

Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline, it was estimated that up to 710 CY of asphalt/concrete export would be needed.

Replenish Big Bear Component 5: Sand Canyon, it was estimated that up to 1,500 tons of asphalt/concrete would be demolished.

GRADING ACTIVITIES

Dust is typically a major concern during grading activities. Because such emissions are not amenable to collection and discharge through a controlled source, they are called “fugitive emissions”. Fugitive dust emissions rates vary as a function of many parameters (soil silt, soil moisture, wind speed, area disturbed, number of vehicles, depth of disturbance or excavation, etc.). The CalEEMod model was utilized to calculate fugitive dust emissions resulting from this phase of activity. The Project is anticipated to include soil import and export within the Project

site boundaries as a part of Project construction. Per BBARWA and the Project Team provided data, it is anticipated that the following cubic yards of export would occur. The cubic yards of export will be analyzed using BBARWA and the Project Team provided hauling trip length of 100 miles.

Replenish Big Bear Component 1: BBARWA WWTP Upgrades, it was estimated that up to 8,000 CY of export would be needed during construction of the building.

Replenish Big Bear Component 4: Evaporation Ponds, it was estimated that up to 175,000 CY of material would be hauled off-site during excavation.

Additionally, for purposes of analysis, and as a conservative measure, it is anticipated that the following cubic yards of export would occur during the pipeline installations. The cubic yards of export will be analyzed using BBARWA and the Project Team provided hauling trip length of 100 miles.

Replenish Big Bear Component 1: BBARWA WWTP Upgrades, it was estimated that up to 1,350 CY of export would be needed.

Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment, it was estimated that up to 19,940 CY of export would be needed.

Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline, it was estimated that up to 6,310 CY of export would be needed.

Replenish Big Bear Component 5: Sand Canyon, it was estimated that up to 7,210 CY of export would be needed.

CONSTRUCTION WORKER VEHICLE TRIPS

Construction emissions for construction worker vehicles traveling to and from the Project site, as well as vendor trips (construction materials delivered to the Project site) were estimated based on information from CalEEMod model defaults, BBARWA and the Project Team. Additionally, it should be noted that the trip lengths were adjusted using BBARWA and the Project Team provided trip length of 100 miles.

3.4.2 CONSTRUCTION DURATION

Based on information provided by BBARWA and the Project Team, construction activities for Replenish Big Bear Component 1 is expected to occur over a 24-month period while construction activities for Project Categories 2 through 5 will occur over a 17-month period. Construction duration utilized in the analysis represents a “worst-case” analysis scenario should construction occur any time after the respective dates since emission factors for construction decrease as the analysis year increases.

TABLE 3-2: CONSTRUCTION DURATION

Construction Activity	Start Date	End Date	Days
Replenish Big Bear Component 1: BBARWA WWTP Upgrades	Jan 2025	Jan 2027	515
Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment	May 2025	Oct 2026	370
Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline	May 2025	Oct 2026	370
Replenish Big Bear Component 4: Evaporation Pond	May 2025	Oct 2026	370
Replenish Big Bear Component 5: Sand Canyon	May 2025	Oct 2026	370

3.4.3 CONSTRUCTION EQUIPMENT

Associated equipment was based on information provided by the Project Description. Please refer to specific detailed modeling inputs/outputs contained in Appendices 3.1 through 3.5 of this AQIA. A detailed summary of construction equipment is provided on Table 3-3.

TABLE 3-3: CONSTRUCTION EQUIPMENT ASSUMPTIONS

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Replenish Big Bear Component 1: BBARWA WWTP Upgrades			
Dozers	Rubber Tired Dozers	1	8
Graders	Graders	1	8
Cranes	Cranes	1	8
Backhoes	Tractors/Loaders/Backhoes	1	8
Drill Rig	Bore/Drill Rig	1	8
Cement Trucks	Off-Highway Trucks	1	8
Forklifts	Forklifts	1	4
Backhoes	Tractors/Loaders/Backhoes	1	4
Front Loaders	Crawler Tractors	1	4
Dump/Delivery Trucks	Off-Highway Trucks	2	8
Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment			
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Paver	Paver	1	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Pavement Cutter	Concrete/Industrial Saws	1	6
Grinder	Concrete/Industrial Saws	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Paving Machine	Pavers	1	2
Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline			
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Replenish Big Bear Component 4: Evaporation Pond			
Bulldozers	Rubber Tired Dozers	2	8
Front End Loaders	Crawler Tractors	2	8
Water Truck	Off-Highway Trucks	2	8

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Scrapers	Scraper	7	8
Excavators	Excavator	2	8
Dump Trucks	Off-Highway Trucks	4	8
Replenish Big Bear Component 5: Sand Canyon			
Drill Rig	Bore/Drill Rig	1	8
Cranes	Cranes	1	4
Forklifts	Forklifts	1	4
Backhoes	Tractors/Loaders/Backhoes	1	4
Front Loaders	Crawler Tractors	1	4
Cement Trucks	Off-Highway Trucks	1	8
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Paver	Paver	1	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Pavement Cutter	Concrete/Industrial Saws	1	6
Grinder	Concrete/Industrial Saws	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Paving Machine	Pavers	1	2
Compactor	Plate Compactor	1	2

Source: Construction equipment based on information provided by BBARWA and the Project Team. It should be noted that the Haul/Dump/Delivery trucks are modeled into the Trips & VMT section of CalEEMod.

It is assumed that the construction of analyzed features would use the equipment listed in Table 3-3 simultaneously. Furthermore, the construction equipment provided in Table 3-3 represent a "worst-case" (i.e. overestimation) of actual construction equipment that may likely be used during construction activities.

3.4.4 REGIONAL CONSTRUCTION EMISSIONS SUMMARY

The estimated maximum daily construction emissions without mitigation are summarized on Table 3-4. Detailed unmitigated construction model outputs are presented in Appendices 3.1 through 3.5. Under the assumed scenarios, emissions resulting from the Project construction would exceed criteria pollutant thresholds established by the SCAQMD for emissions of NO_X.

TABLE 3-4: OVERALL CONSTRUCTION EMISSIONS SUMMARY – WITHOUT MITIGATION

Year	Emissions (lbs/day)					
	VOC	NO_X	CO	SO_X	PM_{10}	$PM_{2.5}$
Summer						
Replenish Big Bear Component 1	3.82	27.47	44.30	0.08	7.30	2.95
Replenish Big Bear Component 2	1.41	28.15	27.16	0.15	9.00	2.52
Replenish Big Bear Component 3	0.92	10.79	10.24	0.06	1.95	0.73
Replenish Big Bear Component 4	25.23	77.74	92.44	0.20	7.07	2.41
Replenish Big Bear Component 5	1.73	24.18	28.67	0.11	7.46	2.16
Total	33.11	168.33	202.81	0.59	32.78	10.77
Winter						
Replenish Big Bear Component 1	4.63	30.88	56.16	0.16	13.44	3.82
Replenish Big Bear Component 2	1.53	22.04	25.79	0.11	6.09	1.89
Replenish Big Bear Component 3	1.33	13.76	14.21	0.07	2.05	0.82
Replenish Big Bear Component 4	25.22	77.94	91.34	0.20	7.07	2.41
Replenish Big Bear Component 5	2.37	24.67	36.02	0.10	6.16	2.03
Total	35.08	169.29	223.52	0.63	34.81	10.96
Maximum Daily Emissions	**35.08**	**169.29**	**223.52**	**0.63**	**34.81**	**10.96**
SCAQMD Regional Threshold	75	100	550	150	150	55
Threshold Exceeded?	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**

Source: The unmitigated CalEEMod regional construction-source emissions are presented in Appendices 3.1 through 3.5.

IMPACTS WITH MITIGATION

The estimated maximum daily construction emissions with mitigation are summarized on Table 3-5. Detailed mitigated construction model outputs are presented in Appendices 3.6 through 3.10. MM AQ-1 is recommended to reduce the severity of the impacts. After implementation of

MM AQ-1, Project construction-source emissions of NO_X would not exceed the applicable SCAQMD thresholds for any criteria pollutant. Thus, a less than significant impact would occur for Project-related construction-source emissions.

TABLE 3-5: OVERALL CONSTRUCTION EMISSIONS SUMMARY – WITH MITIGATION

Year	Emissions (lbs/day)					
	VOC	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Summer						
Replenish Big Bear Component 1	2.06	11.73	52.47	0.08	6.65	2.36
Replenish Big Bear Component 2	1.09	26.07	30.75	0.15	8.93	2.46
Replenish Big Bear Component 3	0.60	8.71	13.84	0.06	1.88	0.66
Replenish Big Bear Component 4	19.05	15.43	123.73	0.20	7.82	3.08
Replenish Big Bear Component 5	1.41	22.09	32.26	0.11	7.39	2.10
Total	24.21	84.03	253.04	0.59	32.66	10.66
Winter						
Replenish Big Bear Component 1	2.61	25.00	68.39	0.16	13.44	3.38
Replenish Big Bear Component 2	1.05	19.20	31.16	0.11	5.99	1.80
Replenish Big Bear Component 3	0.86	10.92	19.58	0.07	1.96	0.73
Replenish Big Bear Component 4	19.05	15.62	122.63	0.20	7.82	3.08
Replenish Big Bear Component 5	1.75	20.35	42.30	0.10	6.00	1.89
Total	25.32	91.08	284.06	0.63	35.21	10.88
Maximum Daily Emissions	**25.32**	**91.08**	**284.06**	**0.63**	**35.21**	**10.88**
SCAQMD Regional Threshold	75	100	550	150	150	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Source: The mitigated CalEEMod regional construction-source emissions are presented in Appendices 3.6 through 3.10.

3.5 REGIONAL OPERATIONAL EMISSIONS

Long-term air quality impacts occur from mobile source emission generated from project-related traffic and from stationary source emissions generated from natural gas. The proposed Project primarily involves construction activity. For on-going operations, mobile emissions would be generated by the motor vehicles traveling to and from the Project sites during on-going maintenance. However, the Project would generate a nominal number of traffic trips for periodic maintenance and inspections and would not result in any substantive new long-term emissions sources. Stationary area source emissions are typically generated by the consumption of natural gas for space and water heating devices and the use of consumer products. As this Project involves the construction of monitoring wells, conveyance facilities and ancillary facilities, evaporation ponds, advanced water purification facilities, and associated improvements, heating

and consumer products would not be used. Stationary energy emissions would result from energy consumption associated with the proposed Project. However, the proposed Project may include the use of an emergency diesel generator, allowing the pump station to run on backup power in case of emergency. If a backup generator is installed, the lead agency would be required to obtain the applicable permits from SCAQMD for operation of such equipment. The SCAQMD is responsible for issuing permits for the operation of stationary sources in order to reduce air pollution, and to attain and maintain the national and California ambient air quality standards in the SCAB. The Project would not result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment. Backup generators would be used only in emergency situations and for routine testing and maintenance purposes and would not contribute a substantial amount of emissions capable of exceeding SCAQMD thresholds. As shown on Table 3-6, project operations would not exceed SCAQMD thresholds, the project would not violate an air quality standard or contribute to an existing violation. Therefore, project operations would not result in a cumulatively considerable net increase of any criteria pollutant and impacts would be less than significant.

TABLE 3-6: SUMMARY OF PEAK OPERATIONAL EMISSIONS

Source	Emissions (lbs/day)					
	VOC	**NO_X**	**CO**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Summer (Smog Season)						
Area Source	1.61	0.01	1.74	0.00	0.00	0.00
Energy Source	0.01	0.20	0.17	0.00	0.02	0.02
Stationary Source	2.76	14.38	12.73	0.01	1.47	1.47
Total Maximum Daily Emissions	**4.38**	**14.60**	**14.64**	**0.01**	**1.49**	**1.49**
SCAQMD Regional Threshold	55	55	550	150	150	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Winter						
Area Source	1.33	0.00	0.00	0.00	0.00	0.00
Energy Source	0.01	0.20	0.17	0.00	0.02	0.02
Stationary Source	2.76	14.38	12.73	0.01	1.47	1.47
Total Maximum Daily Emissions	**4.10**	**14.58**	**12.90**	**0.01**	**1.49**	**1.49**
SCAQMD Regional Threshold	55	55	550	150	150	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

3.6 LOCALIZED SIGNIFICANCE

BACKGROUND ON LST DEVELOPMENT

The analysis makes use of methodology included in the SCAQMD *Final Localized Significance Threshold Methodology* (LST Methodology). The SCAQMD has established that impacts to air

quality are significant if there is a potential to contribute or cause localized exceedances of the federal and/or state ambient air quality standards (NAAQS/CAAQS). Collectively, these are referred to as Localized Significance Thresholds (LSTs).

The SCAQMD established LSTs in response to the SCAQMD Governing Board's Environmental Justice Initiative I-4[2]. LSTs represent the maximum emissions from a project that would not cause or contribute to an exceedance of the most stringent applicable federal or state ambient air quality standard at the nearest residence or sensitive receptor. The SCAQMD states that lead agencies can use the LSTs as another indicator of significance in its air quality impact analyses.

LSTs were developed in response to environmental justice and health concerns raised by the public regarding exposure of individuals to criteria pollutants in local communities. To address the issue of localized significance, the SCAQMD adopted LSTs that show whether a project would cause or contribute to localized air quality impacts and thereby cause or contribute to potential localized adverse health effects. The analysis makes use of methodology included in the *LST Methodology* (21).

APPLICABILITY OF LSTS FOR THE PROJECT

For this Project, the appropriate SRA for the LST analysis is the SCAQMD East San Bernardino Mountains (SRA 38). LSTs apply to CO, NO_2, PM_{10}, and $PM_{2.5}$. The SCAQMD produced look-up tables for projects less than or equal to 5 acres in size.

In order to determine the appropriate methodology for determining localized impacts that could occur as a result of Project-related construction, the following process is undertaken:

- Identify the maximum daily on-site emissions that would occur during construction activity:
    - The maximum daily on-site emissions could be based on information provided by the Project Applicant; or
    - The SCAQMD's *Fact Sheet for Applying CalEEMod to Localized Significance Thresholds* and CalEEMod User's Guide *Appendix A: Calculation Details for CalEEMod* can be used to determine the maximum site acreage that is actively disturbed based on the construction equipment fleet and equipment hours as estimated in CalEEMod (22) (23).
- If the total acreage disturbed is less than or equal to 5 acres per day, then the SCAQMD's screening look-up tables are utilized to determine if a Project has the potential to result in a significant impact. The look-up tables establish a maximum daily emissions threshold in lbs/day that can be compared to CalEEMod outputs.
- If the total acreage disturbed is greater than 5 acres per day, then LST impacts may still be conservatively evaluated using the LST look-up tables for a 5-acre disturbance area. Use of the 5-acre disturbance area thresholds can be used to show that even if the daily emissions from all construction activity were emitted within a 5-acre area, and therefore concentrated over a

[2] The purpose of SCAQMD's Environmental Justice program is to ensure that everyone has the right to equal protection from air pollution and fair access to the decision-making process that works to improve the quality of air within their communities. Further, the SCAQMD defines Environmental Justice as "…equitable environmental policymaking and enforcement to protect the health of all residents, regardless of age, culture, ethnicity, gender, race, socioeconomic status, or geographic location, from the health effects of air pollution."

smaller area which would result in greater site adjacent concentrations, the impacts would still be less than significant if the applicable 5-acre thresholds are utilized.

- The *LST Methodology* presents mass emission rates for each SRA, project sizes of 1, 2, and 5 acres, and nearest receptor distances of 25, 50, 100, 200, and 500 meters. For project sizes between the values given, or with receptors at distances between the given receptors, the methodology uses linear interpolation to determine the thresholds.

EMISSIONS CONSIDERED

Based on SCAQMD's *LST Methodology*, emissions for concern during construction activities are on-site NO_X, CO, $PM_{2.5}$, and PM_{10}. The *LST Methodology* clearly states that "off-site mobile emissions from the Project should not be included in the emissions compared to LSTs (24)." As such, for purposes of the construction LST analysis, only emissions included in the CalEEMod "on-site" emissions outputs were considered.

MAXIMUM DAILY DISTURBED-ACREAGE

Based on information provided, it was assumed that 2 acres would be disturbed per day for all Project Categories. This is conservative as the construction impacts are assessed against a smaller acreage threshold which would represent a more conservative assessment.

RECEPTORS

As previously stated, LSTs represent the maximum emissions from a project that would not cause or contribute to an exceedance of the most stringent applicable NAAQS and CAAQS at the nearest residence or sensitive receptor. Receptor locations are off-site locations where individuals may be exposed to emissions from Project activities.

Some people are especially sensitive to air pollution and are given special consideration when evaluating air quality impacts from projects. These groups of people include children, the elderly, and individuals with pre-existing respiratory or cardiovascular illness. Structures that house these persons or places where they gather are defined as "sensitive receptors". These structures typically include uses such as residences, hotels, and hospitals where an individual can remain for 24 hours. Consistent with the LST Methodology, the nearest land use where an individual could remain for 24 hours to the Project site has been used to determine construction and operational air quality impacts for emissions of PM_{10} and $PM_{2.5}$, since PM_{10} and $PM_{2.5}$ thresholds are based on a 24-hour averaging time.

LSTs apply, even for non-sensitive land uses, consistent with *LST Methodology* and SCAQMD guidance. Per the *LST Methodology*, commercial and industrial facilities are not included in the definition of sensitive receptor because employees and patrons do not typically remain onsite for a full 24 hours but are typically onsite for 8 hours or less. However, *LST Methodology* explicitly states that "*LSTs based on shorter averaging periods, such as the NO_2 and CO LSTs, could also be applied to receptors such as industrial or commercial facilities since it is reasonable to assume that a worker at these sites could be present for periods of one to eight hours* (24)." Therefore, any adjacent land use where an individual could remain for 1 or 8-hours, that is located at a closer distance to the Project site than the receptor used for PM_{10} and $PM_{2.5}$ analysis, must be

considered to determine construction and operational LST air impacts for emissions of NO_2 and CO since these pollutants have an averaging time of 1 and 8-hours.

PROJECT-RELATED RECEPTORS

The SCAQMD recommends that the nearest sensitive receptor be considered when determining the Project's potential to cause an individual and cumulatively significant impact. As a conservative measure it is assumed that the nearest sensitive receptor could potentially be located immediately adjacent to construction activities. It should be noted that the LST Methodology also explicitly states that "It is possible that a project may have receptors closer than 25 meters. Projects with boundaries located closer than 25 meters to the nearest receptor should use the LSTs for receptors located at 25 meters (25)." Consistent with the SCAQMD's LST Methodology, a 25-meter receptor distance is utilized in this analysis and provide for a conservative i.e. "health protective" standard of care.

3.7 LOCALIZED CONSTRUCTION-SOURCE EMISSIONS

3.7.1 LOCALIZED THRESHOLDS FOR CONSTRUCTION ACTIVITY

Since the total acreage disturbed is less than five acres per day for construction activities, the SCAQMD's screening look-up tables are utilized in determining impacts. It should be noted that since the look-up tables identifies thresholds at only 1 acre, 2 acres, and 5 acres, linear regression has been utilized to determine localized significance thresholds. Consistent with SCAQMD guidance, the thresholds presented in Table 3-7 were calculated by interpolating the threshold values for the Project's disturbed acreage.

TABLE 3-7: MAXIMUM DAILY LOCALIZED EMISSIONS THRESHOLDS

Pollutant	Construction Localized Thresholds
All Project Categories	
NO_X	170 lbs/day
CO	1,174 lbs/day
PM_{10}	7 lbs/day
$PM_{2.5}$	5 lbs/day

Source: Localized Thresholds presented in this table are based on the SCAQMD Final Localized Significance Threshold Methodology, July 2008

3.7.2 CONSTRUCTION-SOURCE LOCALIZED EMISSIONS

IMPACTS WITHOUT MITIGATION

Table 3-8 identifies the localized impacts at the nearest receptor location in the vicinity of the Project. Without mitigation, localized construction emissions would exceed the applicable SCAQMD LSTs for emissions of PM_{10} during Replenish Big Bear Component 3. Outputs from the model runs for construction LSTs are provided in Appendix 3.1 through 3.5.

TABLE 3-8: LOCALIZED SIGNIFICANCE SUMMARY OF CONSTRUCTION – WITHOUT MITIGATION

On-Site Construction Emissions	Emissions (lbs/day)			
	NO_X	CO	PM_{10}	$PM_{2.5}$
Replenish Big Bear Component 1				
Maximum Daily Emissions	**24.02**	**23.88**	**3.24**	**1.88**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 2				
Maximum Daily Emissions	**4.92**	**6.11**	**1.68**	**0.30**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 3				
Maximum Daily Emissions	**5.81**	**7.09**	**0.22**	**0.20**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 4				
Maximum Daily Emissions	**73.58**	**86.55**	**8.53**	**4.85**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**YES**	**NO**
Replenish Big Bear Component 5				
Maximum Daily Emissions	**8.12**	**9.44**	**1.68**	**0.35**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**

Source: CalEEMod unmitigated localized construction-source emissions are presented in Appendix 3.1 through 3.5.

IMPACTS WITH MITIGATION

Table 3-9 identifies mitigated localized impacts at the receptors nearest the Project site. After implementation of mitigation measure (MM AQ-1), construction-source emissions would not exceed the applicable SCAQMD LSTs thresholds and would be less-than-significant. Outputs from the model runs for mitigated localized construction-source emissions are provided in Appendix 3.6 through 3.10.

TABLE 3-9: LOCALIZED SIGNIFICANCE SUMMARY OF CONSTRUCTION – WITH MITIGATION

On-Site Construction Emissions	Emissions (lbs/day)			
	NO_X	CO	PM_{10}	$PM_{2.5}$
Replenish Big Bear Component 1				
Maximum Daily Emissions	**8.28**	**32.04**	**3.24**	**1.29**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 2				
Maximum Daily Emissions	**2.84**	**9.69**	**1.88**	**0.33**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 3				
Maximum Daily Emissions	**3.73**	**10.68**	**0.14**	**0.13**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 4				
Maximum Daily Emissions	**11.26**	**117.83**	**6.04**	**2.58**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**
Replenish Big Bear Component 5				
Maximum Daily Emissions	**6.04**	**13.03**	**1.68**	**0.30**
SCAQMD Localized Threshold	170	1,174	7	5
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**

Source: CalEEMod mitigated localized construction-source emissions are presented in Appendix 3.6 through 3.10.

3.8 LOCALIZED OPERATIONAL-SOURCE EMISSIONS

According to SCAQMD localized significance threshold methodology, LSTs would apply to the operational phase of a proposed project if the project includes stationary sources or attracts mobile sources that may spend extended periods queuing and idling at the site (e.g., warehouse or transfer facilities). As previously discussed, the Project would generate a nominal number of traffic trips in the context of on-going maintenance resulting in a negligible amount of new mobile source emissions. Additionally, all pumps associated with the Project are assumed to be electrically powered and would not directly generate air emissions. However, the proposed Project may include the use of an emergency diesel generators, allowing pump stations to run on backup power in case of emergency. If backup generator would be installed, the lead agency would be required to obtain the applicable permits from SCAQMD for operation of such equipment. The SCAQMD is responsible for issuing permits for the operation of stationary

sources in order to reduce air pollution, and to attain and maintain the national and California ambient air quality standards in the SCAB. Upon compliance with SCAQMD permitting procedures, localized emissions from any potential diesel generator would not result in substantial pollutant concentrations capable of exceeding operational LST thresholds. Therefore, the Project would not expose sensitive receptors to substantial pollutant concentrations and impacts would be less than significant.

3.9 CO "HOT SPOT" ANALYSIS

As discussed below, the Project would not result in potentially adverse CO concentrations or "hot spots." An adverse CO concentration, known as a "hot spot", would occur if an exceedance of the state one-hour standard of 20 ppm or the eight-hour standard of 9 ppm were to occur.

It has long been recognized that CO hotspots are caused by vehicular emissions, primarily when idling at congested intersections. In response, vehicle emissions standards have become increasingly stringent in the last twenty years. Currently, the allowable CO emissions standard in California is a maximum of 3.4 grams/mile for passenger cars (there are requirements for certain vehicles that are more stringent). With the turnover of older vehicles, introduction of cleaner fuels, and implementation of increasingly sophisticated and efficient emissions control technologies, CO concentration in the SCAB is now designated as attainment.

To establish a more accurate record of baseline CO concentrations affecting the SCAB, a CO "hot spot" analysis was conducted in 2003 for four busy intersections in Los Angeles at the peak morning and afternoon time periods[3]. This "hot spot" analysis did not predict any exceedance e of the 1-hour (20.0 ppm) or 8-hour (9.0 ppm) CO standards, as shown on Table 3-10.

TABLE 3-10: CO MODEL RESULTS

Intersection Location	CO Concentrations (ppm)		
	Morning 1-hour	Afternoon 1-hour	8-hour
Wilshire Boulevard/Veteran Avenue	4.6	3.5	3.7
Sunset Boulevard/Highland Avenue	4	4.5	3.5
La Cienega Boulevard/Century Boulevard	3.7	3.1	5.2
Long Beach Boulevard/Imperial Highway	3	3.1	8.4

Source: 2003 AQMP, Appendix V: Modeling and Attainment Demonstrations
Notes: Federal 1-hour standard is 35 ppm and the deferral 8-hour standard is 9.0 ppm.

Based on the SCAQMD's 2003 AQMP and the 1992 Federal Attainment Plan for Carbon Monoxide (*1992 CO Plan*), peak carbon monoxide concentrations in the SCAB were a result of unusual meteorological and topographical conditions and not a result of traffic volumes and congestion at a particular intersection. As evidence of this, for example, of the 8.4 ppm 8-hr CO concentration measured at the Long Beach Blvd. and Imperial Hwy. intersection (i.e., the highest CO generating intersection within the "hot spot" analysis), only 0.7 ppm was attributable to the

[3] The CO "hot spot" analysis conducted in 2003 is the most current study used for CO "hot spot" analysis in the SCAB.

traffic volumes and congestion at this intersection; the remaining 7.7 ppm were due to the ambient air measurements at the time the 2003 AQMP was prepared (26). In contrast, an adverse CO concentration, known as a "hot spot", would occur if an exceedance of the state one-hour standard of 20 parts per million (ppm) or the eight-hour standard of 9 ppm were to occur.

The ambient 1-hr and 8-hr CO concentration within the Project study area is estimated to be 2.0 ppm and 1.6 ppm, respectively (data from East San Bernardino Mountains monitoring station for 2021). Therefore, even if the traffic volumes for the proposed Project were ten times the traffic volumes generated at the Long Beach Blvd. and Imperial Hwy. intersection, due to the on-going improvements in ambient air quality and vehicular emissions controls, the Project would not be capable of resulting in a CO "hot spot" at any study area intersections. As noted above, only 0.7 ppm were attributable to the traffic volumes and congestion at one of the busiest intersections in the SCAB. Therefore if these traffic volumes were multiplied by ten times, it could be expected that the CO attributable to traffic would increase tenfold as well, resulting in 7 ppm – even if this were added to either the 1-hour or 8-hour CO concentrations within the Project study area, this would result in 9.0 ppm and 8.6 ppm for the 1-hr and 8-hr timeframes, respectively. Neither of which would exceed the applicable 1-hr standard of 20 ppm or the 8-hr standard of 9 ppm.

Similar considerations are also employed by other Air Districts when evaluating potential CO concentration impacts. More specifically, the Bay Area Air Quality Management District (BAAQMD) concludes that under existing and future vehicle emission rates, a given project would have to increase traffic volumes at a single intersection by more than 44,000 vehicles per hour (vph)—or 24,000 vph where vertical and/or horizontal air does not mix—in order to generate a significant CO impact (27). Traffic volumes generating the CO concentrations for the "hot spot" analysis is shown on Table 3-11. The busiest intersection evaluated was that at Wilshire Boulevard and Veteran Avenue, which had AM/PM traffic volumes of 8,062 vph and 7,719 vph respectively (26).

At buildout of the Project, the highest daily traffic volumes generated at the roadways within the vicinity of the Project are expected to generate less than the highest daily traffic volumes generated at the busiest intersection in the CO "hot spot" analysis. As such, the Project would not likely exceed the most stringent 1-hour CO standard.

TABLE 3-11: TRAFFIC VOLUMES

Intersection Location	Peak Traffic Volumes (vph)				
	Eastbound (AM/PM)	Westbound (AM/PM)	Southbound (AM/PM)	Northbound (AM/PM)	Total (AM/PM)
Wilshire Boulevard/Veteran Avenue	4,954/2,069	1,830/3,317	721/1,400	560/933	8,062/7,719
Sunset Boulevard/Highland Avenue	1,417/1,764	1,342/1,540	2,304/1,832	1,551/2,238	6,614/5,374
La Cienega Boulevard/Century Boulevard	2,540/2,243	1,890/2,728	1,384/2,029	821/1,674	6,634/8,674
Long Beach Boulevard/Imperial Highway	1,217/2,020	1,760/1,400	479/944	756/1,150	4,212/5,514

Source: 2003 AQMP

3.10 AIR QUALITY MANAGEMENT PLANNING

The Project site is located within the SCAB, which is characterized by relatively poor air quality. The SCAQMD has jurisdiction over an approximately 10,743 square-mile area consisting of the four-county Basin and the Los Angeles County and Riverside County portions of what use to be referred to as the Southeast Desert Air Basin. In these areas, the SCAQMD is principally responsible for air pollution control, and works directly with the Southern California Association of Governments (SCAG), county transportation commissions, local governments, as well as state and federal agencies to reduce emissions from stationary, mobile, and indirect sources to meet state and federal ambient air quality standards.

Currently, these state and federal air quality standards are exceeded in most parts of the SCAB. In response, the SCAQMD has adopted a series of AQMPs to meet the state and federal ambient air quality standards. AQMPs are updated regularly in order to more effectively reduce emissions, accommodate growth, and to minimize any negative fiscal impacts of air pollution control on the economy.

In December 2022, the SCAQMD released the *Final 2022 AQMP* (*2022 AQMP*). The *2022 AQMP* continues to evaluate current integrated strategies and control measures to meet the CAAQS, as well as explore new and innovative methods to reach its goals. Some of these approaches include utilizing incentive programs, recognizing existing co-benefit programs from other sectors, and developing a strategy with fair-share reductions at the federal, state, and local levels (28). Similar to the 2016 AQMP, the *2022 AQMP* incorporates scientific and technological information and planning assumptions, including the *2020-2045 RTP/SCS*, a planning document that supports the integration of land use and transportation to help the region meet the federal CAA requirements (29). The Project's consistency with the AQMP will be determined using the *2022 AQMP* as discussed below.

Criteria for determining consistency with the AQMP are defined in Chapter 12, Section 12.2 and Section 12.3 of the SCAQMD's CEQA Air Quality Handbook (1993) (30). These indicators are discussed below:

3.10.1 CONSISTENCY CRITERION NO. 1

The proposed Project will not result in an increase in the frequency or severity of existing air quality violations or cause or contribute to new violations or delay the timely attainment of air quality standards or the interim emissions reductions specified in the AQMP.

The violations that Consistency Criterion No. 1 refers to are the CAAQS and NAAQS. CAAQS and NAAQS violations would occur if regional or localized significance thresholds were exceeded.

Construction Impacts – Consistency Criterion 1

The violations that Consistency Criterion No. 1 refers to are the CAAQS and NAAQS. CAAQS and NAAQS violations would occur if localized or regional significance thresholds were exceeded. The Project would not exceed the applicable LST thresholds or regional significance thresholds for

construction activity after implementation of applicable mitigation measures. Therefore, the Project would not conflict with the AQMP according to this criterion.

Operational Impacts – Consistency Criterion 1

As evaluated, the Project's localized and regional operation-source emissions would not exceed applicable regional significance threshold and LST thresholds. As such, a less than significant impact is expected.

On the basis of the preceding discussion, the Project would not conflict with the AQMP according to this criterion.

3.10.2 CONSISTENCY CRITERION NO. 2

The Project will not exceed the assumptions in the AQMP based on the years of Project build-out phase.

The 2022 AQMP demonstrates that the applicable ambient air quality standards can be achieved within the timeframes required under federal law. Growth projections from local general plans adopted by counties in the district are provided to the SCAG, which develops regional growth forecasts, which are then used to develop future air quality forecasts for the AQMP. Development consistent with the growth projections of the Big Bear Area Regional Wastewater Agency is considered to be consistent with the AQMP.

Construction Impacts – Consistency Criterion 2

Peak day emissions generated by construction activities are largely independent of land use assignments, but rather are a function of development scope and maximum area of disturbance. Irrespective of the site's land use designation, development of the site to its maximum potential would likely occur, with disturbance of the entire site occurring during construction activities. As such, when considering that no emissions thresholds will be exceeded, a less than significant impact would result.

Operational Impacts – Consistency Criterion 2

Since the Project's proposed land uses are consistent with the Big Bear Area Regional Wastewater Agency and as the Project's construction and operational-source air pollutant emissions would not exceed the regional or localized significance thresholds, the Project is determined to be consistent with the second criterion.

On the basis of the preceding discussion, the Project is determined to be consistent with the second criterion.

AQMP CONSISTENCY CONCLUSION

The Project would not result in or cause NAAQS or CAAQS violations. The Project proposes to construct but rather involves pump station, well construction, monitoring and associated improvements. The Project is therefore considered to be consistent with the AQMP.

3.11 POTENTIAL IMPACTS TO SENSITIVE RECEPTORS

The potential impact of Project-generated air pollutant emissions at sensitive receptors has also been considered. Sensitive receptors can include uses such as long-term health care facilities, rehabilitation centers, and retirement homes. Residences, schools, playgrounds, childcare centers, and athletic facilities can also be considered as sensitive receptors.

Results of the LST analysis indicate that, the Project would not exceed the SCAQMD localized significance thresholds during construction. Therefore, sensitive receptors would not be exposed to substantial pollutant concentrations during Project construction.

Results of the LST analysis indicate that the Project would not exceed the SCAQMD localized significance thresholds during operational activity. Further Project traffic would not create or result in a CO "hotspot." Therefore, sensitive receptors would not be exposed to substantial pollutant concentrations as the result of Project construction.

3.12 ODORS

The potential for the Project to generate objectionable odors has also been considered. Land uses generally associated with odor complaints include:

- Agricultural uses (livestock and farming)
- Wastewater treatment plants
- Food processing plants
- Chemical plants
- Composting operations
- Refineries
- Landfills
- Dairies
- Fiberglass molding facilities

The Project contains a land use associated with emitting objectionable odors. Potential odor sources associated with the proposed Project may result from construction equipment exhaust during construction activities and the temporary storage of typical solid waste (refuse) associated with the proposed Project's uses. Standard construction requirements would minimize odor impacts from construction. The construction odor emissions would be temporary, short-term, and intermittent in nature and would cease upon completion of the respective phase of construction and is thus considered less than significant.

The Project could potentially emit odors from the evaporation ponds that may result in an odor complaint. However, based on a review of similar solar evaporations pond operations handling brine, odor does not appear to be an issue with operations of this type. BBARWA will maintain the brine evaporation ponds by periodically removing the salt crystals and hauling the precipitated crystal to the local landfill. This is anticipated to prevent odors from accumulating at the solar evaporation ponds and migrating to nearby sensitive receptors. Furthermore, given the

location proposed for installation of the brine evaporation ponds at a 0.25 mile distance from the nearest sensitive receptor (residents, hospitals, senior living, churches, schools, etc.) any odors generated by the brine evaporation ponds are anticipated to dissipate at the nearest sensitive receptor. Furthermore, the operations of the BBARWA WWTP involve a greater potential for odors to travel, and odor nuisance has not been a reported issue in the Community as a result of BBARWA operations. Thus, there has been no indication that odor traveling to sensitive receptors will result from operation of the brine ponds, but mitigation has been identified that would require odor observation for the first year of the Program, with an odor response component in the event that odors are observed by nearby sensitive receptors. Additionally, it is expected that Project-generated refuse would be stored in covered containers and removed at regular intervals in compliance with the lead agency's solid waste regulations. The Project would be required to comply with SCAQMD Rule 402 to prevent occurrences of public nuisances. Therefore, odors associated with the proposed Project construction and operations would be less than significant and no mitigation is required (31).

3.13 CUMULATIVE IMPACTS

As previously shown in Table 2-3, the CAAQS designate the Project site as nonattainment for O_3 PM_{10}, and $PM_{2.5}$ while the NAAQS designates the Project site as nonattainment for O_3 and $PM_{2.5}$.

The AQMD has published a report on how to address cumulative impacts from air pollution: *White Paper on Potential Control Strategies to Address Cumulative Impacts from Air Pollution* (32). In this report the AQMD clearly states (Page D-3):

> *"…the AQMD uses the same significance thresholds for project specific and cumulative impacts for all environmental topics analyzed in an Environmental Assessment or Environmental Impact Report (EIR). The only case where the significance thresholds for project specific and cumulative impacts differ is the Hazard Index (HI) significance threshold for TAC emissions. The project specific (project increment) significance threshold is HI > 1.0 while the cumulative (facility-wide) is HI > 3.0. It should be noted that the HI is only one of three TAC emission significance thresholds considered (when applicable) in a CEQA analysis. The other two are the maximum individual cancer risk (MICR) and the cancer burden, both of which use the same significance thresholds (MICR of 10 in 1 million and cancer burden of 0.5) for project specific and cumulative impacts.*
>
> *Projects that exceed the project-specific significance thresholds are considered by the SCAQMD to be cumulatively considerable. This is the reason project-specific and cumulative significance thresholds are the same. Conversely, projects that do not exceed the project-specific thresholds are generally not considered to be cumulatively significant."*`

Therefore, this analysis assumes that individual projects that do not generate operational or construction emissions that exceed the SCAQMD's recommended daily thresholds for project-specific impacts would also not cause a cumulatively considerable increase in emissions for those

pollutants for which the Basin is in nonattainment, and, therefore, would not be considered to have a significant, adverse air quality impact. Alternatively, individual project-related construction and operational emissions that exceed SCAQMD thresholds for project-specific impacts would be considered cumulatively considerable.

CONSTRUCTION IMPACTS

The Project-specific evaluation of emissions presented in the preceding analysis demonstrates that Project construction-source air pollutant emissions would not result in exceedances of regional thresholds after implementation of MM AQ-1 and MM AQ-2. Therefore, Project construction-source emissions would be considered less than significant on a project-specific and cumulative basis.

OPERATIONAL IMPACTS

The Project-specific evaluation of emissions presented in the preceding analysis demonstrates that proposed Project operation-source air pollutant emissions would not result in exceedances of regional thresholds. Therefore, proposed Project operation-source emissions would be considered less than significant on a project-specific and cumulative basis.

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5 CERTIFICATIONS

The contents of this air study report represent an accurate depiction of the environmental impacts associated with the proposed Replenish Big Bear Program. The information contained in this air quality impact assessment report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at hqureshi@urbanxroads.com

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Master of Science in Environmental Studies
California State University, Fullerton • May 2010

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PROFESSIONAL AFFILIATIONS

AEP – Association of Environmental Planners
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ASTM – American Society for Testing and Materials

PROFESSIONAL CERTIFICATIONS

Environmental Site Assessment – American Society for Testing and Materials • June 2013
Planned Communities and Urban Infill – Urban Land Institute • June 2011
Indoor Air Quality and Industrial Hygiene – EMSL Analytical • April 2008
Principles of Ambient Air Monitoring – California Air Resources Board • August 2007
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APPENDIX 2.1:

STATE/FEDERAL ATTAINMENT STATUS OF CRITERIA POLLUTANTS

Appendix C
Maps and Tables of Area Designations for State and National Ambient Air Quality Standards

Appendix C
Maps and Tables of Area Designations for State and National Ambient Air Quality Standards

This attachment fulfills the requirement of Health and Safety Code section 40718 for CARB to publish maps that identify areas where one or more violations of any State ambient air quality standard (State standard) or national ambient air quality standard (national standard) have been measured. The national standards are those promulgated under section 109 of the federal Clean Air Act (42 U.S.C. § 7409).

This attachment is divided into three parts. The first part comprises a table showing the levels, averaging times, and measurement methods for each of the State and national standards. This is followed by a section containing maps and tables showing the area designations for each pollutant for which there is a State standard in the California Code of Regulations, title 17, section 70200. The last section contains maps and tables showing the most current area designations for the national standards.

Ambient Air Quality Standards

(Updated 5/4/16)

Pollutant	Averaging Time	California Standards [1]		National Standards [1]		
		Concentration [3]	Method [4]	Primary [5,6]	Secondary [5,6]	Method [7]
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m³)		0.070 ppm (137 µg/m³)		
Respirable Particulate Matter (PM10)[9]	**24 Hour**	**50 µg/m³**	**Gravimetric or Beta Attenuation**	**150 µg/m³**	**Same as Primary Standard**	**Inertial Separation and Gravimetric Analysis**
	Annual Arithmetic Mean	**20 µg/m³**		—		
Fine Particulate Matter ($PM_{2.5}$)[9]	24 Hour	—	—	35 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m³	Gravimetric or Beta Attenuation	12.0 µg/m³	15 µg/m³	
Carbon Monoxide (CO)	**1 Hour**	**20 ppm (23 mg/m³)**	**Non-Dispersive Infrared Photometry (NDIR)**	**35 ppm (40 mg/m³)**	—	**Non-Dispersive Infrared Photometry (NDIR)**
	8 Hour	**9.0 ppm (10 mg/m³)**		**9 ppm (10 mg/m³)**	—	
	8 Hour (Lake Tahoe)	**6 ppm (7 mg/m³)**		—	—	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 µg/m³)	Gas Phase Chemiluminescence	100 ppb (188 µg/m³)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m³)		0.053 ppm (100 µg/m³)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	**1 Hour**	**0.25 ppm (655 µg/m³)**	**Ultraviolet Fluorescence**	**75 ppb (196 µg/m³)**	—	**Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)**
	3 Hour	—		—	**0.5 ppm (1300 µg/m³)**	
	24 Hour	**0.04 ppm (105 µg/m³)**		**0.14 ppm (for certain areas)[11]**	—	
	Annual Arithmetic Mean	—		**0.030 ppm (for certain areas)[11]**	—	
Lead[12,13]	30 Day Average	1.5 µg/m³	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m³ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m³		
Visibility Reducing Particles[14]	**8 Hour**	**See footnote 14**	**Beta Attenuation and Transmittance through Filter Tape**	**No National Standards**		
Sulfates	24 Hour	25 µg/m³	Ion Chromatography			
Hydrogen Sulfide	**1 Hour**	**0.03 ppm (42 µg/m³)**	**Ultraviolet Fluorescence**			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 µg/m³)	Gas Chromatography			

See footnotes on next page ...

1. California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1- and 24-hour), nitrogen dioxide, and particulate matter (PM10, PM2.5, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

2. National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. Environmental Protection Agency (U.S. EPA) for further clarification and current national policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent measurement method which can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the U.S. EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the U.S. EPA.

8. On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm.

9. On December 14, 2012, the national annual PM2.5 primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour PM2.5 standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was the annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM10 standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

10. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

11. On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.

    Note that the 1-hour national standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

12. The CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

13. The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$)as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

14. In 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

Area Designations for the State Ambient Air Quality Standards

The following maps and tables show the area designations for each pollutant with a State standard set forth in the California Code of Regulations, title 17, section 60200. Each area is identified as attainment, nonattainment, nonattainment-transitional, or unclassified for each pollutant, as shown below:

Attainment	A
Nonattainment	N
Nonattainment-Transitional	NA-T
Unclassified	U

In general, CARB designates areas by air basin for pollutants with a regional impact and by county for pollutants with a more local impact. However, when there are areas within an air basin or county with distinctly different air quality deriving from sources and conditions not affecting the entire air basin or county, CARB may designate a smaller area. Generally, when boundaries of the designated area differ from the air basin or county boundaries, the description of the specific area is referenced at the bottom of the summary table.

Figure 1

Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 1
California Ambient Air Quality Standards Area Designations for Ozone[1]

	N	NA-T	U	A
GREAT BASIN VALLEYS AIR BASIN				
Alpine County			U	
Inyo County	N			
Mono County	N			
LAKE COUNTY AIR BASIN				A
LAKE TAHOE AIR BASIN				A
MOJAVE DESERT AIR BASIN	N			
MOUNTAIN COUNTIES AIR BASIN				
Amador County		NA-T		
Calaveras County	N			
El Dorado County (portion)	N			
Mariposa County	N			
Nevada County	N			
Placer County (portion)	N			
Plumas County			U	
Sierra County			U	
Tuolumne County	N			
NORTH CENTRAL COAST AIR BASIN				A
NORTH COAST AIR BASIN				A

	N	NA-T	U	A
NORTHEAST PLATEAU AIR BASIN				A
SACRAMENTO VALLEY AIR BASIN				
Colusa and Glenn Counties				A
Shasta County		NA-T		
Sutter/Yuba Counties				
Sutter Buttes	N			
Remainder of Sutter County	N			
Yuba County	N			
Yolo/Solano Counties		NA-T		
Remainder of Air Basin	N			
SALTON SEA AIR BASIN	N			
SAN DIEGO AIR BASIN	N			
SAN FRANCISCO BAY AREA AIR BASIN	N			
SAN JOAQUIN VALLEY AIR BASIN	N			
SOUTH CENTRAL COAST AIR BASIN				
San Luis Obispo County	N			
Santa Barbara County	N			
Ventura County	N			
SOUTH COAST AIR BASIN	N			

[1] AB 3048 (Olberg) and AB 2525 (Miller) signed into law in 1996, made changes to Health and Safety Code, section 40925.5. One of the changes allows nonattainment districts to become nonattainment-transitional for ozone by operation of law.

Figure 2

Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 2
California Ambient Air Quality Standards Area Designation for Suspended Particulate Matter (PM_{10})

	N	U	A
GREAT BASIN VALLEYS AIR BASIN	N		
LAKE COUNTY AIR BASIN			A
LAKE TAHOE AIR BASIN	N		
MOJAVE DESERT AIR BASIN	N		
MOUNTAIN COUNTIES AIR BASIN			
Amador County		U	
Calaveras County	N		
El Dorado County (portion)	N		
Mariposa County			
- Yosemite National Park	N		
- Remainder of County		U	
Nevada County	N		
Placer County (portion)	N		
Plumas County	N		
Sierra County	N		
Tuolumne County		U	

	N	U	A
NORTH CENTRAL COAST AIR BASIN	N		
NORTH COAST AIR BASIN			
Del Norte, Mendocino, Sonoma (portion) and Trinity Counties			A
Remainder of Air Basin	N		
NORTHEAST PLATEAU AIR BASIN			
Siskiyou County			A
Remainder of Air Basin		U	
SACRAMENTO VALLEY AIR BASIN			
Shasta County			A
Remainder of Air Basin	N		
SALTON SEA AIR BASIN	N		
SAN DIEGO AIR BASIN	N		
SAN FRANCISCO BAY AREA AIR BASIN	N		
SAN JOAQUIN VALLEY AIR BASIN	N		
SOUTH CENTRAL COAST AIR BASIN	N		
SOUTH COAST AIR BASIN	N		

Figure 3

Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 3
California Ambient Air Quality Standards Area Designations for Fine Particulate Matter ($PM_{2.5}$)

	N	U	A
GREAT BASIN VALLEYS AIR BASIN			A
LAKE COUNTY AIR BASIN			A
LAKE TAHOE AIR BASIN			A
MOJAVE DESERT AIR BASIN			A
MOUNTAIN COUNTIES AIR BASIN			A
Plumas County			A
- Portola Valley[1]	N		
Remainder of Air Basin		U	
NORTH CENTRAL COAST AIR BASIN			A
NORTH COAST AIR BASIN			A
NORTHEAST PLATEAU AIR BASIN			A
SACRAMENTO VALLEY AIR BASIN			
Butte County	N		
Colusa County			A
Glenn County			A
Placer County (portion)			A
Sacramento County			A
Shasta County			A
Sutter and Yuba Counties			A
Remainder of Air Basin		U	

	N	U	A
SALTON SEA AIR BASIN			
Imperial County			
- City of Calexico[2]	N		
Remainder of Air Basin			A
SAN DIEGO AIR BASIN	N		
SAN FRANCISCO BAY AREA AIR BASIN	N		
SAN JOAQUIN VALLEY AIR BASIN	N		
SOUTH CENTRAL COAST AIR BASIN			A
SOUTH COAST AIR BASIN	N		

[1] California Code of Regulations, title 17, section 60200(c)

[2] California Code of Regulations, title 17, section 60200(a)

Figure 4

2021
Area Designations for State
Ambient Air Quality Standards
CARBON MONOXIDE
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Colusa
Yuba
Lake
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
SAN JOAQUIN VALLEY
Fresno
NORTH CENTRAL COAST
Kings
Tulare
Inyo
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Unclassified
Attainment
Air Basin
County
Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 4
California Ambient Air Quality Standards Area Designation for Carbon Monoxide*

	N	NA-T	U	A
GREAT BASIN VALLEYS AIR BASIN				
Alpine County			U	
Inyo County				A
Mono County				A
LAKE COUNTY AIR BASIN				A
LAKE TAHOE AIR BASIN				A
MOJAVE DESERT AIR BASIN				
Kern County (portion)			U	
Los Angeles County (portion)				A
Riverside County (portion)			U	
San Bernardino County (portion)				A
MOUNTAIN COUNTIES AIR BASIN				
Amador County			U	
Calaveras County			U	
El Dorado County (portion)			U	
Mariposa County			U	
Nevada County			U	
Placer County (portion)			U	
Plumas County				A
Sierra County			U	
Tuolumne County				A
NORTH CENTRAL COAST AIR BASIN				
Monterey County				A
San Benito County			U	
Santa Cruz County			U	
NORTH COAST AIR BASIN				
Del Norte County			U	
Humboldt County				A
Mendocino County				A
Sonoma County (portion)			U	
Trinity County			U	
NORTHEAST PLATEAU AIR BASIN			U	

	N	NA-T	U	A
SACRAMENTO VALLEY AIR BASIN				
Butte County				A
Colusa County			U	
Glenn County			U	
Placer County (portion)				A
Sacramento County				A
Shasta County			U	
Solano County (portion)				A
Sutter County				A
Tehama County			U	
Yolo County				A
Yuba County			U	
SALTON SEA AIR BASIN				A
SAN DIEGO AIR BASIN				A
SAN FRANCISCO BAY AREA AIR BASIN				A
SAN JOAQUIN VALLEY AIR BASIN				
Fresno County				A
Kern County (portion)				A
Kings County			U	
Madera County			U	
Merced County			U	
San Joaquin County				A
Stanislaus County				A
Tulare County				A
SOUTH CENTRAL COAST AIR BASIN				A
SOUTH COAST AIR BASIN				A

* The area designated for carbon monoxide is a county or portion of a county

Figure 5

Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 5
California Ambient Air Quality Standards Area Designations for Nitrogen Dioxide

	N	U	A
GREAT BASIN VALLEYS AIR BASIN			A
LAKE COUNTY AIR BASIN			A
LAKE TAHOE AIR BASIN			A
MOJAVE DESERT AIR BASIN			A
MOUNTAIN COUNTIES AIR BASIN			A
NORTH CENTRAL COAST AIR BASIN			A
NORTH COAST AIR BASIN			A
NORTHEAST PLATEAU AIR BASIN			A
SACRAMENTO VALLEY AIR BASIN			A
SALTON SEA AIR BASIN			A
SAN DIEGO AIR BASIN			A
SAN FRANCISCO BAY AREA AIR BASIN			A
SAN JOAQUIN VALLEY AIR BASIN			A
SOUTH CENTRAL COAST AIR BASIN			A
SOUTH COAST AIR BASIN			
CA 60 Near-road Portion of San Bernardino, Riverside, and Los Angeles Counties			A
Remainder of Air Basin			A

Figure 6

2021
Area Designations for State
Ambient Air Quality Standards
SULFUR DIOXIDE
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Colusa
Yuba
Lake
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
Fresno
SAN JOAQUIN VALLEY
NORTH CENTRAL COAST
Kings
Tulare
Inyo
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Attainment
Air Basin
County
Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 6
California Ambient Air Quality Standards Area Designation for Sulfur Dioxide*

	N	A
GREAT BASIN VALLEYS AIR BASIN		A
LAKE COUNTY AIR BASIN		A
LAKE TAHOE AIR BASIN		A
MOJAVE DESERT AIR BASIN		A
MOUNTAIN COUNTIES AIR BASIN		A
NORTH CENTRAL COAST AIR BASIN		A
NORTH COAST AIR BASIN		A
NORTHEAST PLATEAU AIR BASIN		A

	N	A
SACRAMENTO VALLEY AIR BASIN		A
SALTON SEA AIR BASIN		A
SAN DIEGO AIR BASIN		A
SAN FRANCISCO BAY AREA AIR BASIN		A
SAN JOAQUIN VALLEY AIR BASIN		A
SOUTH CENTRAL COAST AIR BASIN		A
SOUTH COAST AIR BASIN		A

* The area designated for sulfur dioxide is a county or portion of a county. Since all areas in the State are in attainment for this standard, air basins are indicated here for simplicity.

Figure 7

2021
Area Designations for State
Ambient Air Quality Standards
SULFATES
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Colusa
Yuba
Lake
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
SAN JOAQUIN VALLEY
Fresno
NORTH CENTRAL COAST
Kings
Tulare
Inyo
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Attainment
Air Basin
County
Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 7
California Ambient Air Quality Standards Area Designation for Sulfates

	N	U	A
GREAT BASIN VALLEYS AIR BASIN			A
LAKE COUNTY AIR BASIN			A
LAKE TAHOE AIR BASIN			A
MOJAVE DESERT AIR BASIN			A
MOUNTAIN COUNTIES AIR BASIN			A
NORTH CENTRAL COAST AIR BASIN			A
NORTH COAST AIR BASIN			A
NORTHEAST PLATEAU AIR BASIN			A

	N	U	A
SACRAMENTO VALLEY AIR BASIN			A
SALTON SEA AIR BASIN			A
SAN DIEGO AIR BASIN			A
SAN FRANCISCO BAY AREA AIR BASIN			A
SAN JOAQUIN VALLEY AIR BASIN			A
SOUTH CENTRAL COAST AIR BASIN			A
SOUTH COAST AIR BASIN			A

Figure 8

2021
Area Designations for State
Ambient Air Quality Standards
LEAD
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
Nevada
MOUNTAIN COUNTIES
LAKE COUNTY
Lake
Colusa
Yuba
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
SAN JOAQUIN VALLEY
San Benito
Fresno
Inyo
NORTH CENTRAL COAST
Kings
Tulare
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Attainment
Air Basin
County
Last Updated: October 2021
Air Quality Planning and Science Division, CARB

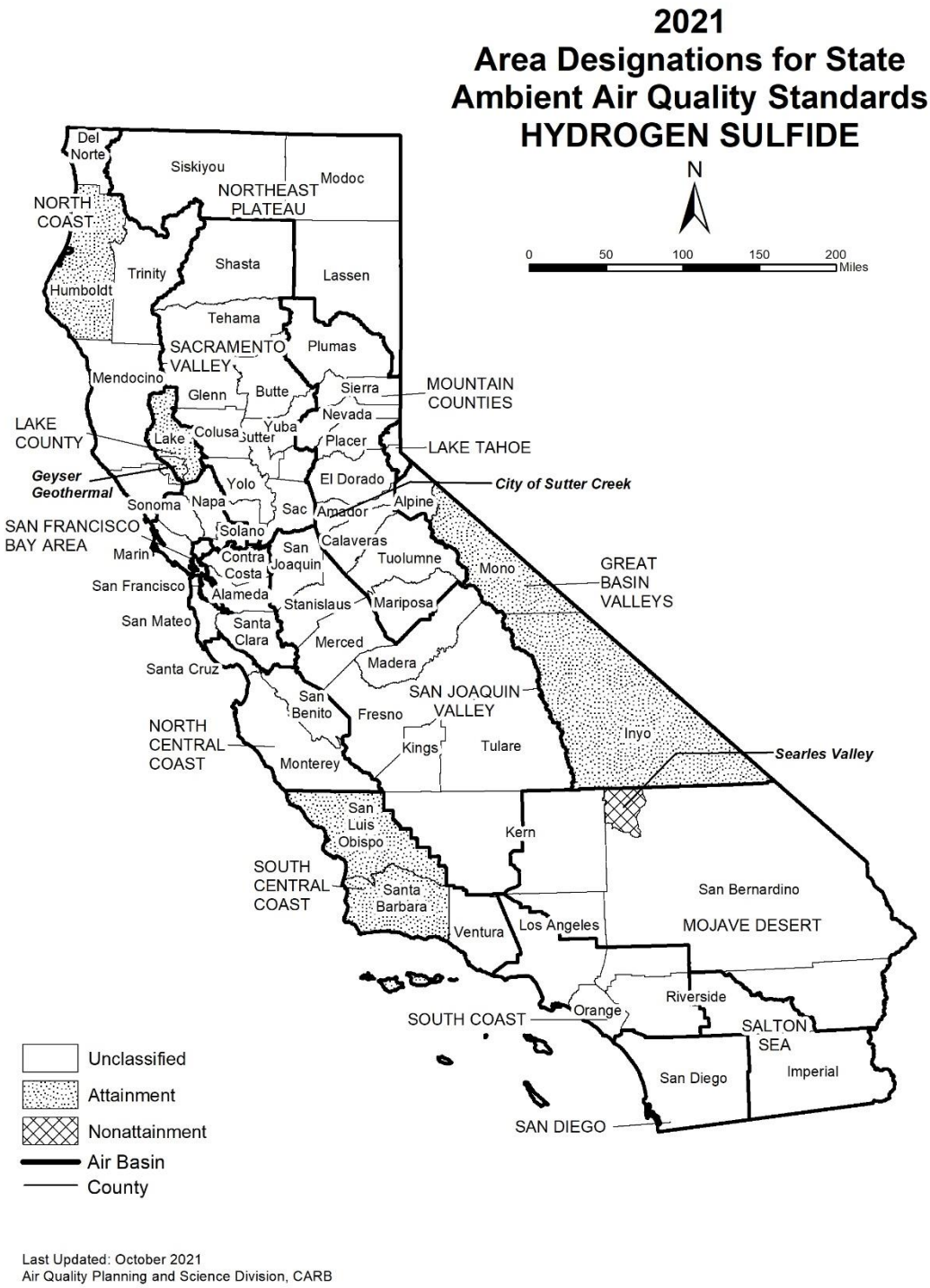
Table 8
California Ambient Air Quality Standards Area Designations for Lead (particulate)*

	N	U	A
GREAT BASIN VALLEYS AIR BASIN			A
LAKE COUNTY AIR BASIN			A
LAKE TAHOE AIR BASIN			A
MOJAVE DESERT AIR BASIN			A
MOUNTAIN COUNTIES AIR BASIN			A
NORTH CENTRAL COAST AIR BASIN			A
NORTH COAST AIR BASIN			A
NORTHEAST PLATEAU AIR BASIN			A
SACRAMENTO VALLEY AIR BASIN			A

	N	U	A
SALTON SEA AIR BASIN			A
SAN DIEGO AIR BASIN			A
SAN FRANCISCO BAY AREA AIR BASIN			A
SAN JOAQUIN VALLEY AIR BASIN			A
SOUTH CENTRAL COAST AIR BASIN			A
SOUTH COAST AIR BASIN			A

* The area designated for lead is a county or portion of a county. Since all areas in the State are in attainment for this standard, air basins are indicated here for simplicity.

Figure 9



Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 9
California Ambient Air Quality Standards Area Designation for Hydrogen Sulfide*

	N	NA-T	U	A
GREAT BASIN VALLEYS AIR BASIN				
Alpine County			U	
Inyo County				A
Mono County				A
LAKE COUNTY AIR BASIN				A
LAKE TAHOE AIR BASIN			U	
MOJAVE DESERT AIR BASIN				
Kern County (portion)			U	
Los Angeles County (portion)			U	
Riverside County (portion)			U	
San Bernardino County (portion)				
- Searles Valley Planning Area[1]	N			
- Remainder of County			U	
MOUNTAIN COUNTIES AIR BASIN				
Amador County				
- City of Sutter Creek	N			
- Remainder of County			U	
Calaveras County			U	
El Dorado County (portion)			U	
Mariposa County			U	
Nevada County			U	
Placer County (portion)			U	
Plumas County			U	
Sierra County			U	
Tuolumne County			U	

	N	NA-T	U	A
NORTH CENTRAL COAST AIR BASIN			U	
NORTH COAST AIR BASIN				
Del Norte County			U	
Humboldt County				A
Mendocino County			U	
Sonoma County (portion)				
- Geyser Geothermal Area[2]				A
- Remainder of County			U	
Trinity County			U	
NORTHEAST PLATEAU AIR BASIN			U	
SACRAMENTO VALLEY AIR BASIN			U	
SALTON SEA AIR BASIN			U	
SAN DIEGO AIR BASIN			U	
SAN FRANCISCO BAY AREA AIR BASIN			U	
SAN JOAQUIN VALLEY AIR BASIN			U	
SOUTH CENTRAL COAST AIR BASIN				
San Luis Obispo County				A
Santa Barbara County				A
Ventura County			U	
SOUTH COAST AIR BASIN			U	

* The area designated for hydrogen sulfide is a county or portion of a county

[1] 52 Federal Register 29384 (August 7, 1987)

[2] California Code of Regulations, title 17, section 60200(d)

Figure 10

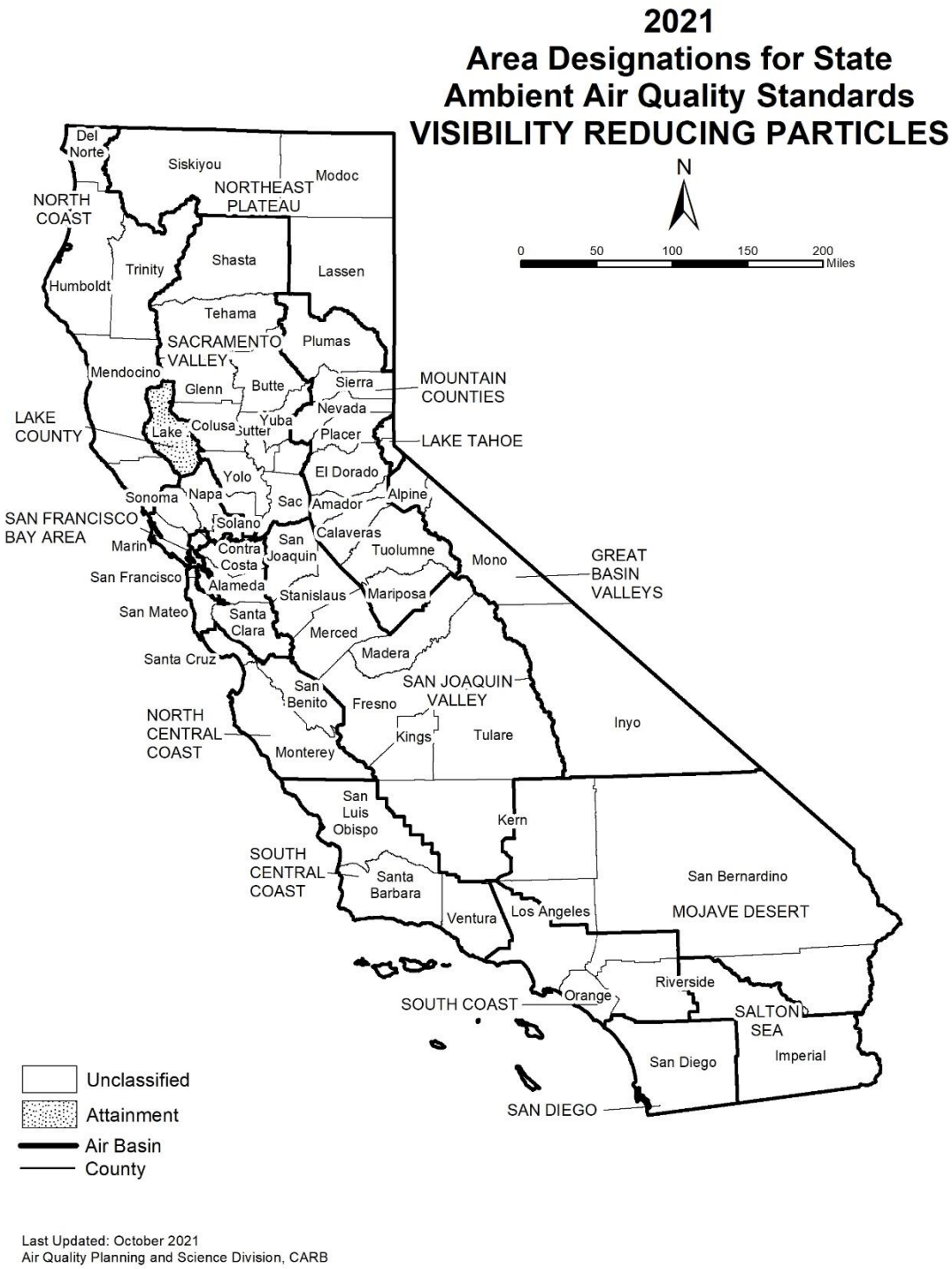

2021
Area Designations for State
Ambient Air Quality Standards
VISIBILITY REDUCING PARTICLES
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
LAKE COUNTY
Colusa
Yuba
Lake
Sutter
Placer
LAKE TAHOE
Yolo
El Dorado
Sonoma
Napa
Sac
Amador
Alpine
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
SAN JOAQUIN VALLEY
San Benito
Fresno
Inyo
NORTH CENTRAL COAST
Kings
Tulare
Monterey
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Ventura
Los Angeles
MOJAVE DESERT
Riverside
Orange
SOUTH COAST
SALTON SEA
San Diego
Imperial
SAN DIEGO
Unclassified
Attainment
Air Basin
County
Last Updated: October 2021
Air Quality Planning and Science Division, CARB

Table 10
California Ambient Air Quality Standards Area Designation for Visibility Reducing Particles

	N	NA-T	U	A
GREAT BASIN VALLEYS AIR BASIN			U	
LAKE COUNTY AIR BASIN				A
LAKE TAHOE AIR BASIN			U	
MOJAVE DESERT AIR BASIN			U	
MOUNTAIN COUNTIES AIR BASIN			U	
NORTH CENTRAL COAST AIR BASIN			U	
NORTH COAST AIR BASIN			U	
NORTHEAST PLATEAU AIR BASIN			U	

	N	NA-T	U	A
SACRAMENTO VALLEY AIR BASIN			U	
SALTON SEA AIR BASIN			U	
SAN DIEGO AIR BASIN			U	
SAN FRANCISCO BAY AREA AIR BASIN			U	
SAN JOAQUIN VALLEY AIR BASIN			U	
SOUTH CENTRAL COAST AIR BASIN			U	
SOUTH COAST AIR BASIN			U	

Area Designations for the National Ambient Air Quality Standards

The following maps and tables show the area designations for each pollutant with a national ambient air quality standard. Additional information about the federal area designations is available on the U.S. Environmental Protection Agency (U.S. EPA) website:

https://www.epa.gov/green-book

Over the last several years, U.S. EPA has been reviewing the levels of the various national standards. The agency has already promulgated new standard levels for some pollutants and is considering revising the levels for others. Information about the status of these reviews is available on the U.S. EPA website:

https://www.epa.gov/criteria-air-pollutants

Designation Categories

Suspended Particulate Matter (PM_{10}). The U.S. EPA uses three categories to designate areas with respect to PM_{10}:

- Attainment (A)
- Nonattainment (N)
- Unclassifiable (U)

Ozone, Fine Suspended Particulate Matter ($PM_{2.5}$), Carbon Monoxide (CO), and Nitrogen Dioxide (NO_2). The U.S. EPA uses two categories to designate areas with respect to these standards:

- Nonattainment (N)
- Unclassifiable/Attainment (U/A)

The national 1-hour ozone standard was revoked effective June 15, 2005, and the area designations map reflects the 2015 national 8-hour ozone standard of 0.070 ppm. Area designations were finalized on August 3, 2018.

On December 14, 2012, the U.S. EPA established a new national annual primary $PM_{2.5}$ standard of 12.0 µg/m^3. Area designations were finalized in December 2014. The current designation map reflects the most recently revised (2012) annual average standard of 12.0 µg/m^3 as well as the 24-hour standard of 35 µg/m^3, revised in 2006.

On January 22, 2010, the U.S. EPA established a new national 1-hour NO_2 standard of 100 parts per billion (ppb) and retained the annual average standard of 53 ppb. Designations for the primary NO_2 standard became effective on February 29, 2012. All areas of California meet this standard.

Sulfur Dioxide (SO_2). The U.S. EPA uses three categories to designate areas with respect to the 24-hour and annual average sulfur dioxide standards. These designation categories are:

- Nonattainment (N),
- Unclassifiable (U), and
- Unclassifiable/Attainment (U/A).

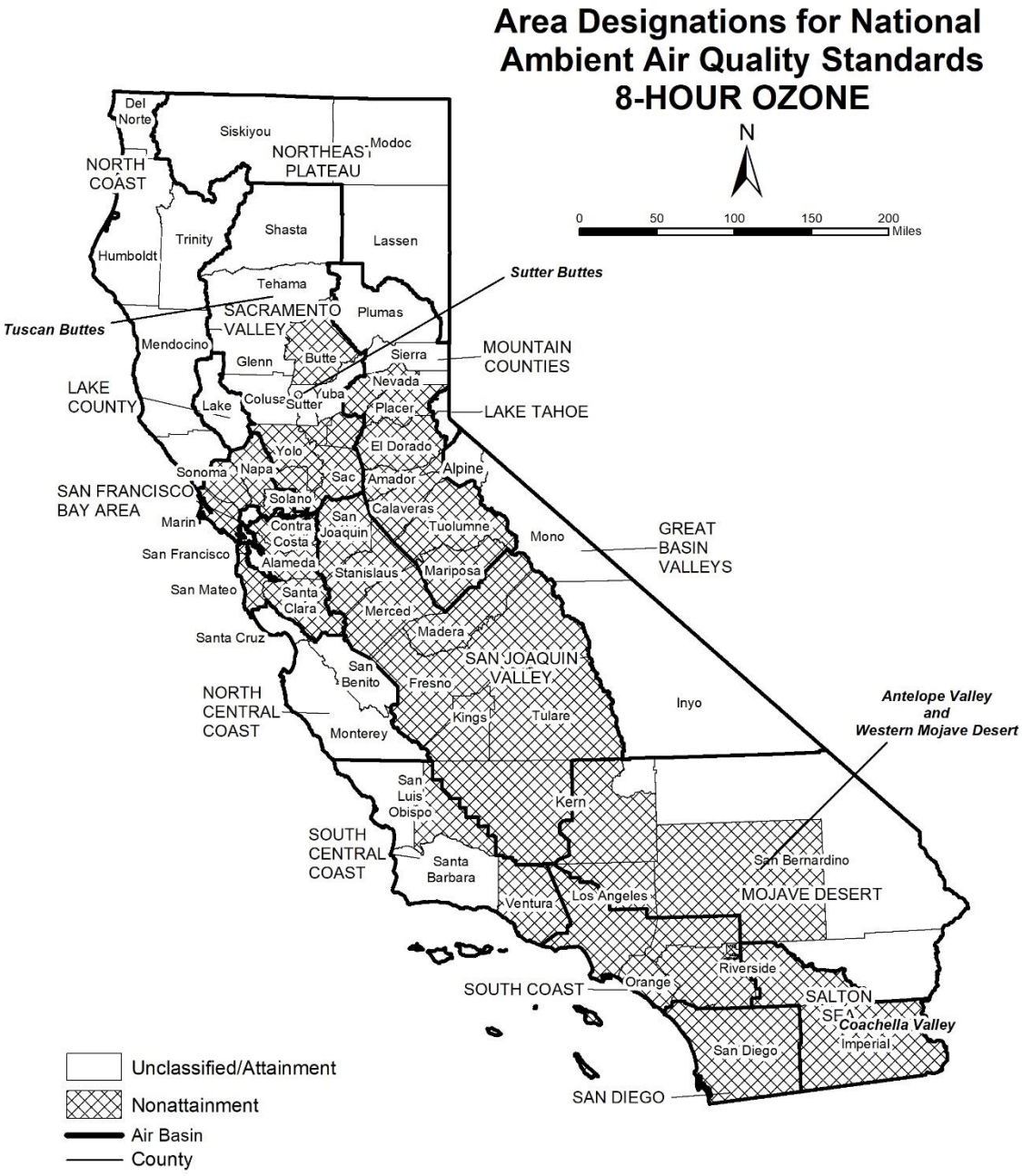
On June 2, 2010, the U.S. EPA established a new primary 1-hour SO_2 standard of 75 parts per billion (ppb). At the same time, U.S. EPA revoked the 24-hour and annual average standards. Area designations for the 1-hour SO_2 standard were finalized on December 21, 2017 and are reflected in the area designations map.

Lead (particulate). The U.S. EPA promulgated a new rolling 3-month average lead standard in October 2008 of 0.15 µg/m^3. Designations were made for this standard in November 2010.

Designation Areas

From time to time, the boundaries of the California air basins have been changed to facilitate the planning process. CARB generally initiates these changes, and they are not always reflected in the U.S. EPA's area designations. For purposes of consistency, the maps in this attachment reflect area designation boundaries and nomenclature as promulgated by the U.S. EPA. In some cases, these may not be the same as those adopted by CARB. For example, the national area designations reflect the former Southeast Desert Air Basin. In accordance with Health and Safety Code section 39606.1, CARB redefined this area in 1996 to be the Mojave Desert Air Basin and Salton Sea Air Basin. The definitions and boundaries for all areas designated for the national standards can be found in Title 40, Code of Federal Regulations (CFR), Chapter I, Subchapter C, Part 81.305. They are available on the web at: *https://ecfr.io/Title-40/se40.20.81_1305*

Figure 11



Last Updated: October 2021
Map reflects the 2015 8-hour ozone standard of 0.070 ppm
Air Quality Planning and Science Division, CARB

Table 11
National Ambient Air Quality Standards Area Designations for 8-Hour Ozone*

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		
Amador County	N	
Calaveras County	N	
El Dorado County (portion)[1]	N	
Mariposa County	N	
Nevada County		
- Western Nevada County	N	
- Remainder of County		U/A
Placer County (portion)[1]	N	
Plumas County		U/A
Sierra County		U/A
Tuolumne County	N	
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A
SACRAMENTO VALLEY AIR BASIN		
Butte County	N	
Colusa County		U/A
Glenn County		U/A
Sacramento Metro Area[1]	N	
Shasta County		U/A
Sutter County		
- Sutter Buttes	N	
- Southern portion of Sutter County[1]	N	
- Remainder of Sutter County		U/A
Tehama County		
- Tuscan Buttes	N	
- Remainder of Tehama County		U/A

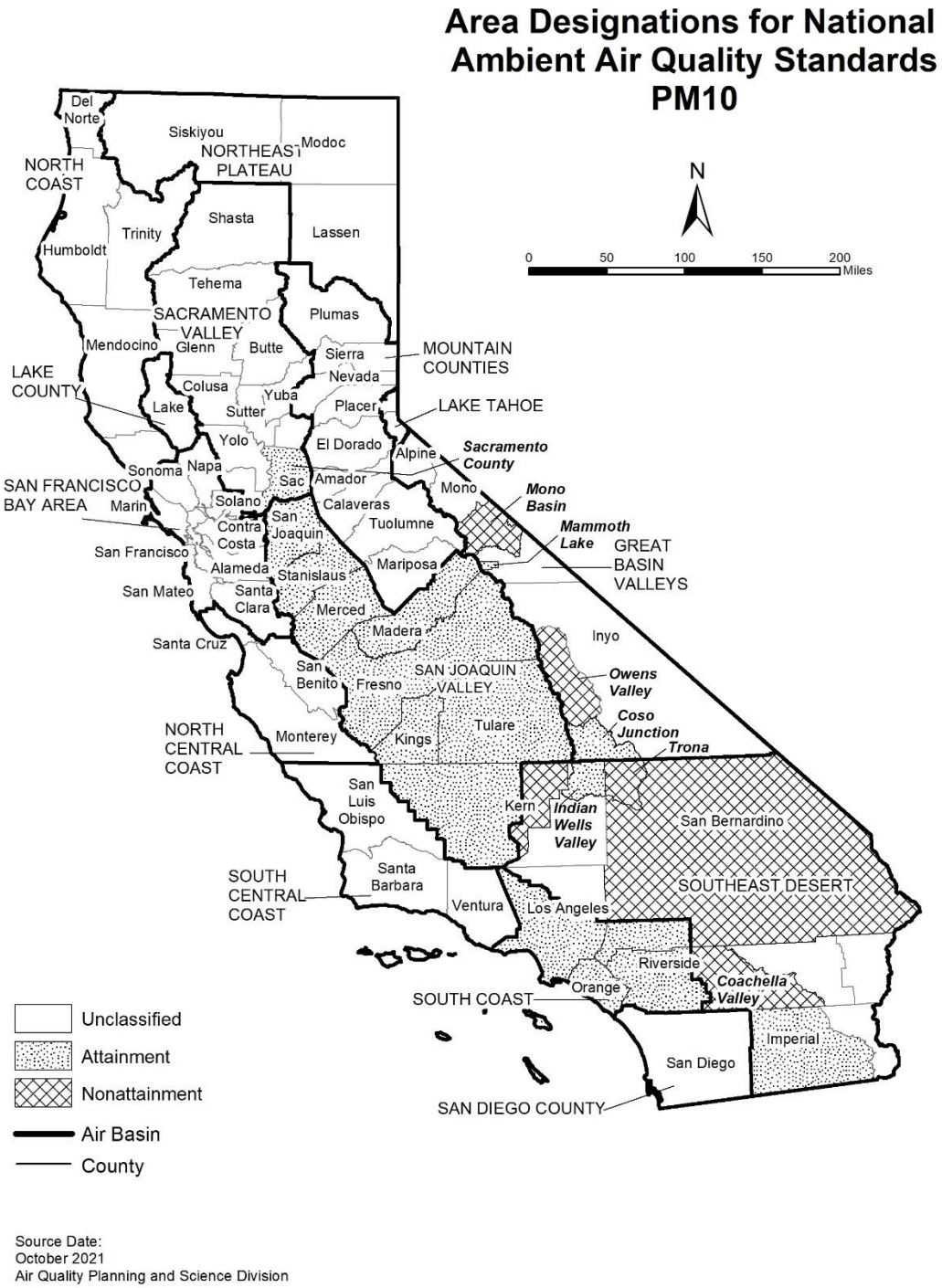
	N	U/A
SACRAMENTO VALLEY AIR BASIN (cont.)		
Yolo County[1]	N	
Yuba County		U/A
SAN DIEGO COUNTY	N	
SAN FRANCISCO BAY AREA AIR BASIN	N	
SAN JOAQUIN VALLEY AIR BASIN	N	
SOUTH CENTRAL COAST AIR BASIN[2]		
San Luis Obispo County		
- Eastern San Luis Obispo County	N	
- Remainder of County		U/A
Santa Barbara County		U/A
Ventura County		
- Area excluding Anacapa and San Nicolas Islands	N	
- Channel Islands[2]		U/A
SOUTH COAST AIR BASIN[2]	N	
SOUTHEAST DESERT AIR BASIN		
Kern County (portion)	N	
- Indian Wells Valley		U/A
Imperial County	N	
Los Angeles County (portion)	N	
Riverside County (portion)		
- Coachella Valley	N	
- Non-AQMA portion		U/A
San Bernardino County		
- Western portion (AQMA)	N	
- Eastern portion (non-AQMA)		U/A

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305.
NOTE: This map and Table reflect the 2015 8-hour ozone standard of 0.070 ppm.

[1] For this purpose, the Sacramento Metro Area comprises all of Sacramento and Yolo Counties, the Sacramento Valley Air Basin portion of Solano County, the southern portion of Sutter County, and the Sacramento Valley and Mountain Counties Air Basins portions of Placer and El Dorado counties.

[2] South Central Coast Air Basin Channel Islands:
Santa Barbara County includes Santa Cruz, San Miguel, Santa Rosa, and Santa Barbara Islands.
Ventura County includes Anacapa and San Nicolas Islands.
South Coast Air Basin:
Los Angeles County includes San Clemente and Santa Catalina Islands.

Figure 12



Source Date:
October 2021
Air Quality Planning and Science Division

Table 12
National Ambient Air Quality Standards Area Designations for Suspended Particulate Matter (PM_{10})*

	N	U	A
GREAT BASIN VALLEYS AIR BASIN			
Alpine County		U	
Inyo County			
- Owens Valley Planning Area	N		
- Coso Junction			A
- Remainder of County		U	
Mono County			
- Mammoth Lake Planning Area			A
- Mono Lake Basin	N		
- Remainder of County		U	
LAKE COUNTY AIR BASIN		U	
LAKE TAHOE AIR BASIN		U	
MOUNTAIN COUNTIES AIR BASIN		U	
NORTH CENTRAL COAST AIR BASIN		U	
NORTH COAST AIR BASIN		U	
NORTHEAST PLATEAU AIR BASIN		U	
SACRAMENTO VALLEY AIR BASIN			
Sacramento County[1]			A
Remainder of Air Basin		U	
SAN DIEGO COUNTY		U	

	N	U	A
SAN FRANCISCO BAY AREA AIR BASIN		U	
SAN JOAQUIN VALLEY AIR BASIN			A
SOUTH CENTRAL COAST AIR BASIN		U	
SOUTH COAST AIR BASIN			A
SOUTHEAST DESERT AIR BASIN			
Eastern Kern County			
- Indian Wells Valley			A
- Portion within San Joaquin Valley Planning Area	N		
- Remainder of County		U	
Imperial County			
- Imperial Valley Planning Area[2]			A
- Remainder of County		U	
Los Angeles County (portion)		U	
Riverside County (portion)			
- Coachella Valley	N		
- Non-AQMA portion		U	
San Bernardino County			
- Trona	N		
- Remainder of County	N		

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305.

[1] Air quality in Sacramento County meets the national PM_{10} standards. The request for redesignation to attainment was approved by U.S. EPA in September 2013.

[2] The request for redesignation to attainment for the Imperial Valley Planning Area was approved by U.S. EPA in September 2020, effective October 2020.

Figure 13

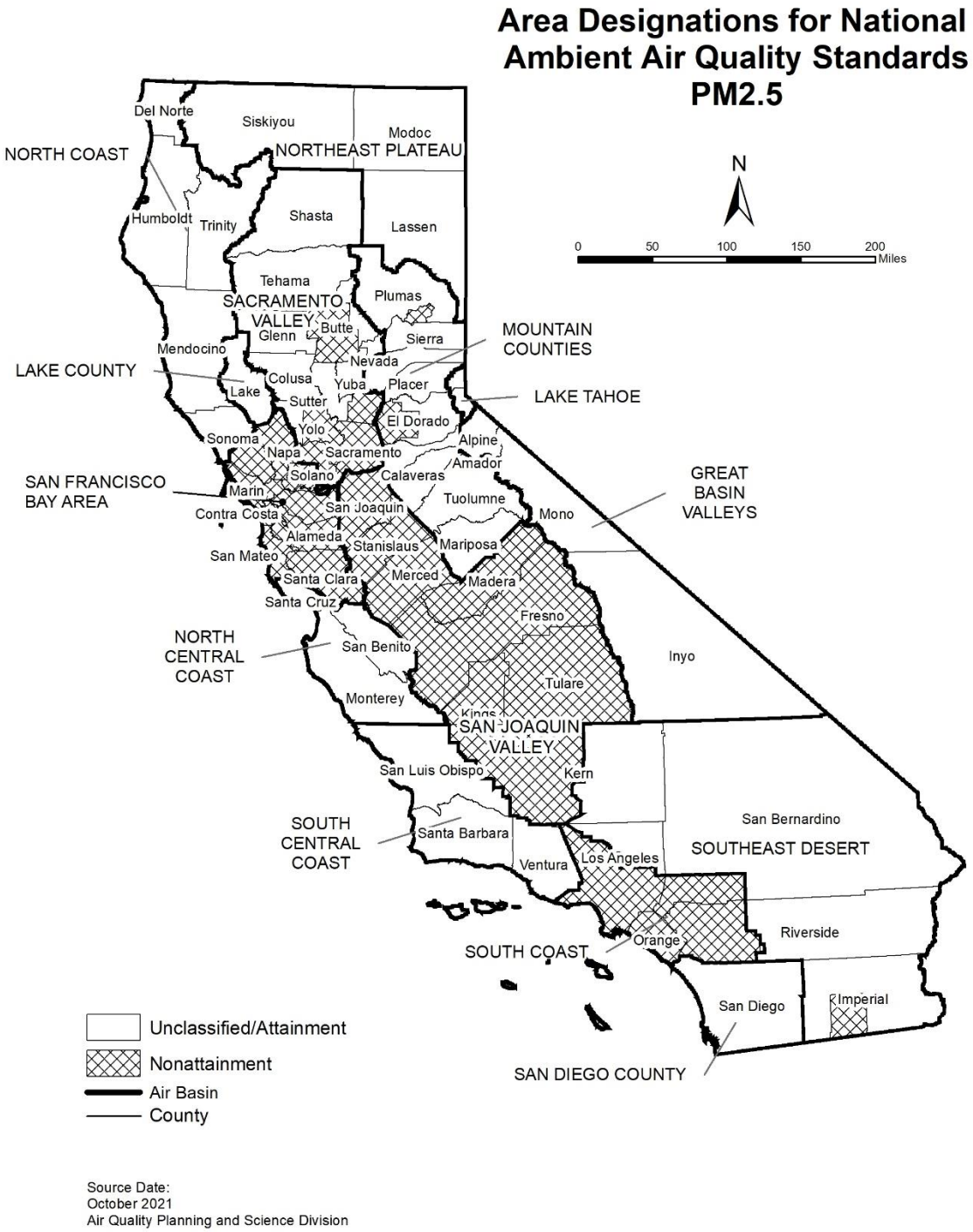

Area Designations for National Ambient Air Quality Standards PM2.5
N
0 50 100 150 200 Miles
Del Norte
Siskiyou
Modoc
NORTH COAST
NORTHEAST PLATEAU
Humboldt
Trinity
Shasta
Lassen
Tehama
Plumas
SACRAMENTO VALLEY
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Mendocino
Nevada
LAKE COUNTY
Colusa
Yuba
Placer
Lake
Sutter
LAKE TAHOE
Yolo
El Dorado
Sonoma
Alpine
Napa
Sacramento
Amador
Solano
Calaveras
SAN FRANCISCO BAY AREA
Marin
Tuolumne
GREAT BASIN VALLEYS
Contra Costa
San Joaquin
Mono
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
Fresno
NORTH CENTRAL COAST
San Benito
Inyo
Tulare
Monterey
Kings
SAN JOAQUIN VALLEY
San Luis Obispo
Kern
San Bernardino
SOUTH CENTRAL COAST
Santa Barbara
SOUTHEAST DESERT
Ventura
Los Angeles
Riverside
Orange
SOUTH COAST
San Diego
Imperial
SAN DIEGO COUNTY
Unclassified/Attainment
Nonattainment
Air Basin
County
Source Date:
October 2021
Air Quality Planning and Science Division

Table 13
National Ambient Air Quality Standards Area Designations for Fine Particulate Matter ($PM_{2.5}$)

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		
Plumas County		
- Portola Valley Portion of Plumas	N	
- Remainder of Plumas County		U/A
Remainder of Air Basin		U/A
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A
SACRAMENTO VALLEY AIR BASIN		
Sacramento Metro Area[1]	N	
Remainder of Air Basin		U/A

	N	U/A
SAN DIEGO COUNTY		U/A
SAN FRANCISCO BAY AREA AIR BASIN[2]	N	
SAN JOAQUIN VALLEY AIR BASIN	N	
SOUTH CENTRAL COAST AIR BASIN		U/A
SOUTH COAST AIR BASIN[3]	N	
SOUTHEAST DESERT AIR BASIN		
Imperial County (portion)[4]	N	
Remainder of Air Basin		U/A

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305. This map reflects the 2006 24-hour $PM_{2.5}$ standard as well as the 1997 and 2012 $PM_{2.5}$ annual standards.

[1] For this purpose, Sacramento Metro Area comprises all of Sacramento and portions of El Dorado, Placer, Solano, and Yolo Counties. Air quality in this area meets the national $PM_{2.5}$ standards. A Determination of Attainment for the 2006 24-hour $PM_{2.5}$ standard was made by U.S. EPA in June 2017.

[2] Air quality in this area meets the national $PM_{2.5}$ standards. A Determination of Attainment for the 2006 24-hour $PM_{2.5}$ standard was made by U.S. EPA in June 2017.

[3] Those lands of the Santa Rosa Band of Cahulla Mission Indians in Riverside County are designated Unclassifiable/Attainment.

[4] That portion of Imperial County encompassing the urban and surrounding areas of Brawley, Calexico, El Centro, Heber, Holtville, Imperial, Seeley, and Westmorland. Air quality in this area meets the national $PM_{2.5}$ standards. A Determination of Attainment for the 2006 24-hour $PM_{2.5}$ standard was made by U.S. EPA in June 2017.

Figure 14

Area Designations for National Ambient Air Quality Standards
CARBON MONOXIDE
N
0 50 100 150 200 Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Shasta
Lassen
Trinity
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
Colusa
Lake
Sutter
Yuba
Placer
LAKE TAHOE
LAKE COUNTY
Yolo
El Dorado
Napa
Alpine
Sonoma
Sac
Amador
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Santa Cruz
Madera
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Tulare
Inyo
Monterey
Kings
San Luis Obispo
Kern
SOUTH CENTRAL COAST
SOUTHEAST DESERT
Santa Barbara
Ventura
Los Angeles
San Bernardino
Riverside
Orange
SOUTH COAST
San Diego
Imperial
SAN DIEGO COUNTY
Unclassified/Attainment
Air Basin
County
Source Date:
October 2021
Air Quality Planning and Science Division

Table 14
National Ambient Air Quality Standards Area Designations for Carbon Monoxide*

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		U/A
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A

	N	U/A
SACRAMENTO VALLEY AIR BASIN		U/A
SAN DIEGO COUNTY		U/A
SAN FRANCISCO BAY AREA AIR BASIN		U/A
SAN JOAQUIN VALLEY AIR BASIN		U/A
SOUTH CENTRAL COAST AIR BASIN		U/A
SOUTH COAST AIR BASIN		U/A
SOUTHEAST DESERT AIR BASIN		U/A

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305.

Figure 15

Area Designations for National Ambient Air Quality Standards
NITROGEN DIOXIDE
N
0 50 100 150 200 Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehema
Plumas
SACRAMENTO VALLEY
Mendocino
Glenn
Butte
Sierra
Nevada
MOUNTAIN COUNTIES
Colusa
Yuba
Placer
LAKE COUNTY
Lake
Sutter
LAKE TAHOE
Yolo
El Dorado
Napa
Alpine
Sonoma
Sac
Amador
SAN FRANCISCO BAY AREA
Solano
Marin
Calaveras
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Santa Cruz
Madera
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Inyo
Tulare
Monterey
Kings
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
SOUTHEAST DESERT
Los Angeles
San Bernardino
Ventura
Riverside
Orange
SOUTH COAST
San Diego
Imperial
SAN DIEGO COUNTY
Unclassified/Attainment
Air Basin
County
Source Date:
October 2021
Air Quality Planning and Science Division

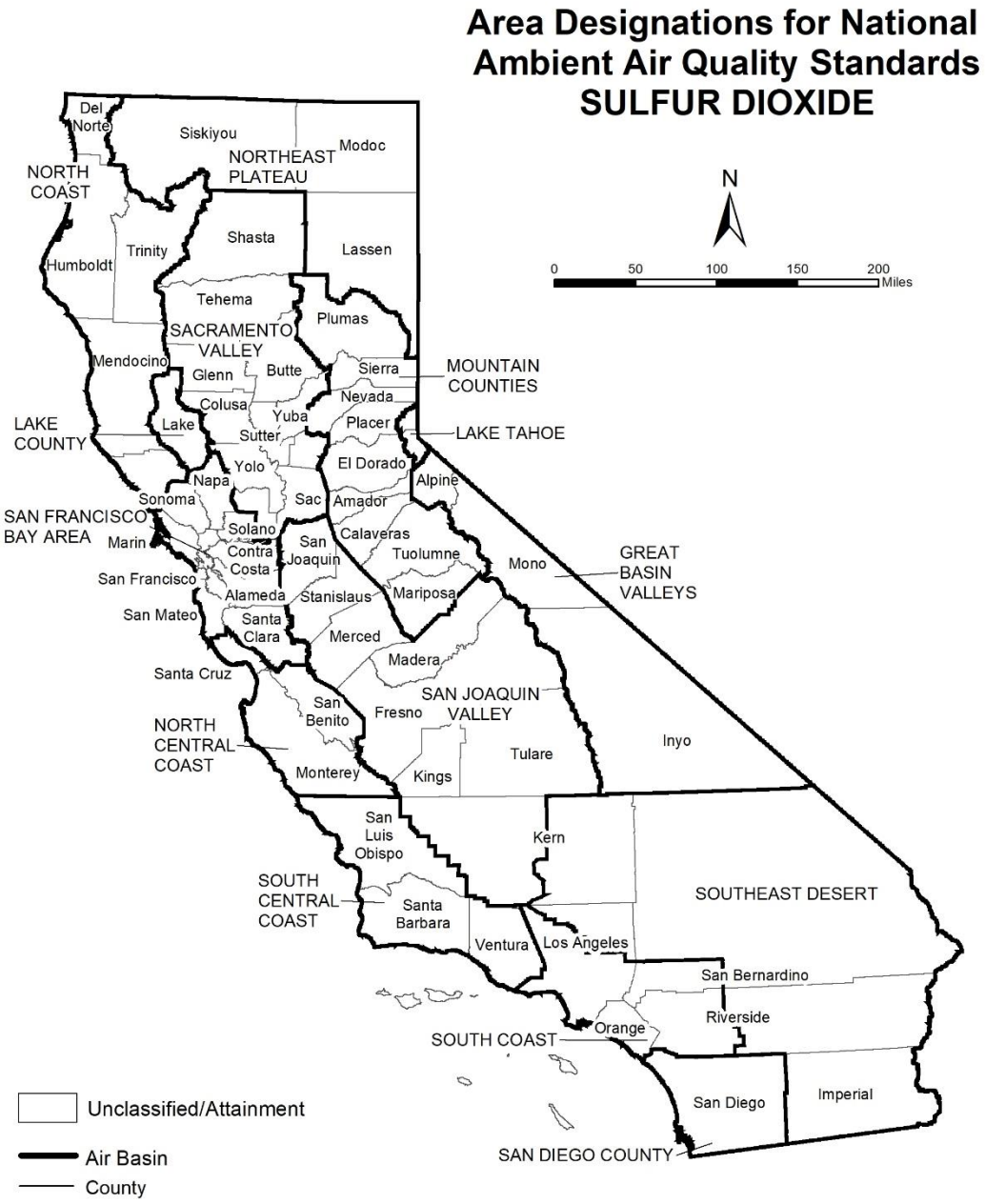
Table 15
National Ambient Air Quality Standards Area Designations for Nitrogen Dioxide*

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		U/A
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A

	N	U/A
SACRAMENTO VALLEY AIR BASIN		U/A
SAN DIEGO COUNTY		U/A
SAN FRANCISCO BAY AREA AIR BASIN		U/A
SAN JOAQUIN VALLEY AIR BASIN		U/A
SOUTH CENTRAL COAST AIR BASIN		U/A
SOUTH COAST AIR BASIN		U/A
SOUTHEAST DESERT AIR BASIN		U/A

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305.

Figure 16



Source Date:
October 2021
Air Quality Planning and Science Division

Table 16
National Ambient Air Quality Standards Area Designations for Sulfur Dioxide*

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		U/A
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A
SACRAMENTO VALLEY AIR BASIN		U/A
SAN DIEGO COUNTY		U/A
SAN FRANCISCO BAY AREA AIR BASIN		U/A
SAN JOAQUIN VALLEY AIR BASIN		U/A
SOUTH CENTRAL COAST AIR BASIN[1]		U/A
SOUTH COAST AIR BASIN		U/A
SOUTHEAST DESERT AIR BASIN		U/A

* Definitions and references for all areas can be found in 40 CFR, Chapter I, Part 81.305.
NOTE: This map and table reflect the 2010 1-hour SO_2 standard of 75 ppb.

[1] South Central Coast Air Basin Channel Islands:
Santa Barbara County includes Santa Cruz, San Miguel, Santa Rosa, and Santa Barbara Islands.
Ventura County includes Anacapa and San Nicolas Islands.
Note that the San Clemente and Santa Catalina Islands are considered part of Los Angeles County, and therefore, are included as part of the South Coast Air Basin.

Figure 17

Area Designations for National Ambient Air Quality Standards
LEAD
N
0 50 100 150 200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
Nevada
Colusa
Lake
Sutter
Yuba
Placer
LAKE TAHOE
LAKE COUNTY
Yolo
El Dorado
Napa
Alpine
Sonoma
Sac
Amador
SAN FRANCISCO BAY AREA
Solano
Calaveras
Marin
Contra Costa
San Joaquin
Tuolumne
Mono
GREAT BASIN VALLEYS
San Francisco
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Santa Cruz
Madera
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Inyo
Tulare
Monterey
Kings
San Luis Obispo
Kern
SOUTH CENTRAL COAST
SOUTHEAST DESERT
Santa Barbara
Ventura
Los Angeles
San Bernardino
Riverside
Orange
SOUTH COAST
San Diego
Imperial
SAN DIEGO COUNTY
Unclassified/Attainment
Nonattainment
Air Basin
County
Source Date:
October 2021
Air Quality Planning and Science Division

Table 17
National Ambient Air Quality Standards Area Designations for Lead (particulate)

	N	U/A
GREAT BASIN VALLEYS AIR BASIN		U/A
LAKE COUNTY AIR BASIN		U/A
LAKE TAHOE AIR BASIN		U/A
MOUNTAIN COUNTIES AIR BASIN		U/A
NORTH CENTRAL COAST AIR BASIN		U/A
NORTH COAST AIR BASIN		U/A
NORTHEAST PLATEAU AIR BASIN		U/A
SACRAMENTO VALLEY AIR BASIN		U/A

	N	U/A
SAN DIEGO COUNTY		U/A
SAN FRANCISCO BAY AREA AIR BASIN		U/A
SAN JOAQUIN VALLEY AIR BASIN		U/A
SOUTH CENTRAL COAST AIR BASIN		U/A
SOUTH COAST AIR BASIN		
Los Angeles County (portion)[1]	N	
Remainder of Air Basin		U/A
SOUTHEAST DESERT AIR BASIN		U/A

[1] Portion of County in Air Basin, not including Channel Islands

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APPENDIX 3.1:

CALEEMOD REPLENISH BIG BEAR COMPONENT 1 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-WWTP Upgrades (Unmitigated) Detailed Report

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5.18.1.2. Mitigated

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5.18.1.2. Mitigated

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-WWTP Upgrades (Unmitigated)
Construction Start Date	1/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Unrefrigerated Warehouse-Rail	40.0	1000sqft	0.92	40,000	0.00	—	—	—
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump Station
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—
User Defined Linear	0.26	Mile	0.14	0.00	0.00	—	—	—
Other Asphalt Surfaces	0.44	Acre	0.44	0.00	0.00	—	—	Remaining SF

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Energy	E-10-B	Establish Onsite Renewable Energy Systems: Solar Power

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	5.21	4.63	30.9	56.2	0.16	1.15	13.1	13.4	1.06	3.06	3.82	—	26,339	26,339	2.04	3.77	1.79	27,515
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.72	2.46	18.6	26.1	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.50	0.45	3.40	4.76	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824

Mit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Mit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Mit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792
Mit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	871	871	0.06	0.01	—	874
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.2. Linear, Grading & Excavation (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.3. Linear, Grading & Excavation (2027) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.4. Linear, Grading & Excavation (2027) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.5. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.6. Demolition (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—

Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.7. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811
Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—

Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.8. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811

Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—
Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.9. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

3.10. Building Construction (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehou	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape Equipme	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	12/1/2026	1/11/2027	5.00	30.0	Pipeline Installation
Demolition	Demolition	1/1/2025	1/29/2025	5.00	20.0	—
Building Construction	Building Construction	2/19/2025	12/1/2026	5.00	465	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43

Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT
Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT

Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Building Construction	0.00	0.00	60,000	20,000	7,684

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	—	0.14	0.00	—

Demolition	—	1,350	0.14	3,000	—
Building Construction	—	8,000	581	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-Rail	0.00	0%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%
User Defined Linear	0.14	100%
Other Asphalt Surfaces	0.44	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005
2027	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	60,000	20,000	7,684

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	3,800,000	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00
Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	0.00	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00

Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	5.00	0.73
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73
Fire Pump	Diesel	1.00	24.0	8,760	15.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.

Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A

Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6

Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582

Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8

Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Based on Client Provided data and construction schedule
Construction: Off-Road Equipment	Client Provided construction equipment list
Construction: Trips and VMT	Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.
Operations: Vehicle Data	No trips data available
Operations: Architectural Coatings	SCAQMD Rule 1113
Construction: Dust From Material Movement	Export expected per Project data

Construction: Architectural Coatings	SCAQMD Rule 1113
Operations: Energy Use	Electricity adjusted based on client provided data
Operations: Water and Waste Water	Taken from 2022 Lake Analysis report

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APPENDIX 3.2:

CALEEMOD REPLENISH BIG BEAR COMPONENT 2 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Lake Pipeline (Unmitigated) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Lake Pipeline (Unmitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	3.78	Mile	2.06	0.00	—	—	—	—
Other Non-Asphalt Surfaces	1.00	Acre	1.00	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.26	2.04	0.86	17,776
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
2026	0.79	0.65	4.07	11.1	0.01	0.14	1.24	1.38	0.13	0.29	0.42	—	2,467	2,467	0.09	0.05	4.47	2,489
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.30	0.98	18.8	16.9	0.10	0.33	4.40	4.73	0.32	1.16	1.48	—	15,029	15,029	1.26	2.04	0.80	15,670
2026	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.20	2.01	0.86	17,776
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
2026	0.50	0.37	2.90	5.68	0.01	0.09	0.82	0.91	0.08	0.20	0.28	—	1,845	1,845	0.07	0.11	1.51	1,880
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506
2026	0.09	0.07	0.53	1.04	< 0.005	0.02	0.15	0.17	0.01	0.04	0.05	—	305	305	0.01	0.02	0.25	311

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.36	2.92	0.01	0.08	—	0.08	0.08	—	0.08	—	862	862	0.03	0.01	—	865
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.43	0.53	< 0.005	0.02	—	0.02	0.01	—	0.01	—	143	143	0.01	< 0.005	—	143
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.16	0.12	0.31	5.78	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,131	1,131	0.04	0.03	4.24	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.0	6.69	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,194	12,194	1.15	1.99	26.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.12	0.34	4.11	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,036	1,036	0.04	0.03	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.5	6.70	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,195	12,195	1.15	2.00	0.69	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.07	0.06	0.18	2.10	0.00	0.00	0.51	0.51	0.00	0.12	0.12	—	504	504	0.02	0.02	0.88	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.64	0.09	6.59	3.21	0.04	0.08	1.60	1.67	0.08	0.44	0.51	—	5,846	5,846	0.55	0.96	5.50	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.03	0.38	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	83.4	83.4	< 0.005	< 0.005	0.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.12	0.02	1.20	0.59	0.01	0.01	0.29	0.31	0.01	0.08	0.09	—	968	968	0.09	0.16	0.91	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.80	0.67	4.65	6.11	0.02	0.16	—	0.16	0.15	—	0.15	—	1,800	1,800	0.07	0.01	—	1,806
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.19	0.25	< 0.005	0.01	—	0.01	0.01	—	0.01	—	74.0	74.0	< 0.005	< 0.005	—	74.2
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.03	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	12.2	12.2	< 0.005	< 0.005	—	12.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.11	0.31	3.81	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,015	1,015	< 0.005	0.03	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.25	0.10	13.0	6.54	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	11,972	11,972	1.07	1.92	0.64	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.17	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	42.3	42.3	< 0.005	< 0.005	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.05	< 0.005	0.54	0.27	< 0.005	0.01	0.14	0.14	0.01	0.04	0.04	—	492	492	0.04	0.08	0.44	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.00	7.00	< 0.005	< 0.005	0.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.01	< 0.005	0.10	0.05	< 0.005	< 0.005	0.03	0.03	< 0.005	0.01	0.01	—	81.5	81.5	0.01	0.01	0.07	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.32	0.27	1.95	2.55	0.01	0.07	—	0.07	0.07	—	0.07	—	612	612	0.02	< 0.005	—	614
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.46	< 0.005	0.01	—	0.01	0.01	—	0.01	—	101	101	< 0.005	< 0.005	—	102
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.14	0.32	6.23	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,292	1,292	0.04	0.04	4.47	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.17	0.13	0.36	4.44	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,184	1,184	< 0.005	0.04	0.12	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.07	0.21	2.45	0.00	0.00	0.64	0.64	0.00	0.15	0.15	—	625	625	< 0.005	0.02	1.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.45	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	103	103	< 0.005	< 0.005	0.17	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.81	1.81	—	0.27	0.27	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.44	0.53	< 0.005	0.01	—	0.01	0.01	—	0.01	—	70.3	70.3	< 0.005	< 0.005	—	70.5
Demolition	—	—	—	—	—	—	0.35	0.35	—	0.05	0.05	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.6	11.6	< 0.005	< 0.005	—	11.7
Demolition	—	—	—	—	—	—	0.06	0.06	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.78	0.11	7.55	3.90	0.05	0.09	1.95	2.04	0.09	0.53	0.63	—	7,108	7,108	0.67	1.16	15.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.15	0.02	1.54	0.75	0.01	0.02	0.37	0.39	0.02	0.10	0.12	—	1,363	1,363	0.13	0.22	1.28	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	226	226	0.02	0.04	0.21	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—
Demolition	Demolition	5/1/2025	8/7/2025	5.00	70.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82

Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	15.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	36.0	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	17.5	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT

Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	21.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	19,940	5.00	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	2.06	0.00	—
Demolition	0.00	0.00	0.00	5,875	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction

Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	5.00	100%
Other Non-Asphalt Surfaces	66.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	172,498

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase in addition to default CalEEMod hauling trucks. Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.

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APPENDIX 3.3:

CALEEMOD REPLENISH BIG BEAR COMPONENT 3 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Shay Ponds (Unmitigated) Detailed Report

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7.2. Healthy Places Index Scores

7.3. Overall Health & Equity Scores

7.4. Health & Equity Measures

7.5. Evaluation Scorecard

7.6. Health & Equity Custom Measures

8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Shay Ponds (Unmitigated)
Construction Start Date	5/1/2025
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.30
Precipitation (days)	1.80
Location	34.253674, -116.80784
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
User Defined Linear	1.20	Mile	0.65	0.00	—	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.39	8,710
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2025	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
2026	0.56	0.47	3.30	4.32	0.01	0.12	0.00	0.12	0.11	0.00	0.11	—	1,087	1,087	0.04	0.01	0.00	1,091
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.44	0.92	11.0	10.00	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,451	7,451	0.47	0.85	0.39	7,717
2026	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.36	8,710
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
2026	0.35	0.28	2.15	2.66	0.01	0.07	0.07	0.14	0.07	0.02	0.09	—	868	868	0.04	0.04	0.25	881
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613
2026	0.06	0.05	0.39	0.49	< 0.005	0.01	0.01	0.03	0.01	< 0.005	0.02	—	144	144	0.01	0.01	0.04	146

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.78	3.40	0.01	0.10	—	0.10	0.09	—	0.09	—	930	930	0.04	0.01	—	933
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.51	0.62	< 0.005	0.02	—	0.02	0.02	—	0.02	—	154	154	0.01	< 0.005	—	155
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.77	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	151	151	< 0.005	< 0.005	0.56	—
Vendor	0.27	0.06	3.28	1.53	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,807	3,807	0.24	0.58	11.1	—
Hauling	0.17	0.02	1.66	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	3.39	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.55	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.06	3.42	1.50	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,808	3,808	0.24	0.58	0.29	—
Hauling	0.17	0.02	1.74	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	0.09	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—
Vendor	0.13	0.03	1.67	0.72	0.01	0.03	0.52	0.55	0.03	0.14	0.17	—	1,826	1,826	0.11	0.28	2.30	—
Hauling	0.08	0.01	0.85	0.41	< 0.005	0.01	0.21	0.21	0.01	0.06	0.07	—	750	750	0.07	0.12	0.71	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.02	0.01	0.30	0.13	< 0.005	0.01	0.10	0.10	0.01	0.03	0.03	—	302	302	0.02	0.05	0.38	—
Hauling	0.01	< 0.005	0.15	0.08	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	124	124	0.01	0.02	0.12	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.96	0.80	5.53	7.09	0.02	0.20	—	0.20	0.18	—	0.18	—	1,942	1,942	0.08	0.02	—	1,948
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.23	0.29	< 0.005	0.01	—	0.01	0.01	—	0.01	—	79.8	79.8	< 0.005	< 0.005	—	80.1
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.2	13.2	< 0.005	< 0.005	—	13.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.51	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	135	135	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.03	3.22	1.44	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,743	3,743	0.21	0.58	0.26	—
Hauling	0.16	0.01	1.66	0.84	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,537	1,537	0.14	0.25	0.08	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.64	5.64	< 0.005	< 0.005	0.01	—
Vendor	0.01	< 0.005	0.13	0.06	< 0.005	< 0.005	0.04	0.05	< 0.005	0.01	0.01	—	154	154	0.01	0.02	0.18	—
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	63.1	63.1	0.01	0.01	0.06	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.93	0.93	< 0.005	< 0.005	< 0.005	—
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	25.5	25.5	< 0.005	< 0.005	0.03	—
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	10.5	10.5	< 0.005	< 0.005	0.01	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.29	0.24	1.72	2.25	0.01	0.06	—	0.06	0.06	—	0.06	—	566	566	0.02	< 0.005	—	568
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.31	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	93.7	93.7	< 0.005	< 0.005	—	94.0
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

4. Operations Emissions Details

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38

Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	2.00	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	13.0	100	HHDT,MHDT
Linear, Grading & Excavation	Hauling	4.62	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	0.00	18.5	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,020	0.65	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.65	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.65	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	39.3	annual days of extreme heat
Extreme Precipitation	4.40	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	31.0	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase.

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APPENDIX 3.4:

CALEEMOD REPLENISH BIG BEAR COMPONENT 4 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Evaporation Ponds Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Evaporation Ponds
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.270764, -116.820355
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Other Non-Asphalt Surfaces	57.0	Acre	57.0	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
2026	26.8	24.9	71.5	90.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,400	23,400	1.12	0.76	10.1	23,665
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
2026	26.8	24.9	71.7	89.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,338	23,338	1.10	0.76	0.26	23,593
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	13.1	12.1	37.4	43.9	0.10	1.55	3.39	4.94	1.41	1.15	2.56	—	11,232	11,232	0.55	0.38	2.26	11,361
2026	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.38	2.21	6.83	8.01	0.02	0.28	0.62	0.90	0.26	0.21	0.47	—	1,860	1,860	0.09	0.06	0.37	1,881
2026	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10
Area	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066

Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	12.8	12.0	35.3	41.5	0.08	1.53	—	1.53	1.38	—	1.38	—	9,110	9,110	0.37	0.07	—	9,141
Dust From Material Movement	—	—	—	—	—	—	2.56	2.56	—	0.94	0.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.34	2.20	6.44	7.57	0.02	0.28	—	0.28	0.25	—	0.25	—	1,508	1,508	0.06	0.01	—	1,513
Dust From Material Movement	—	—	—	—	—	—	0.47	0.47	—	0.17	0.17	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	3.85	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	754	754	0.02	0.02	2.82	764
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.96	2.04	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	8.08	3,924
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.23	2.74	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	690	690	0.02	0.02	0.07	698
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.05	4.13	2.05	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	0.21	3,917
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.12	1.40	0.00	0.00	0.34	0.34	0.00	0.08	0.08	—	336	336	0.01	0.01	0.58	340
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.20	0.03	2.01	0.98	0.01	0.02	0.49	0.51	0.02	0.13	0.16	—	1,786	1,786	0.17	0.29	1.68	1,879
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.26	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	55.6	55.6	< 0.005	< 0.005	0.10	56.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.37	0.18	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	296	296	0.03	0.05	0.28	311

3.3. Site Preparation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	14.8	13.9	37.9	47.6	0.10	1.66	—	1.66	1.50	—	1.50	—	10,673	10,673	0.43	0.09	—	10,710
Dust From Material Movement	—	—	—	—	—	—	3.00	3.00	—	1.10	1.10	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.70	2.54	6.92	8.68	0.02	0.30	—	0.30	0.27	—	0.27	—	1,767	1,767	0.07	0.01	—	1,773
Dust From Material Movement	—	—	—	—	—	—	0.55	0.55	—	0.20	0.20	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.18	3.56	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	738	738	0.02	0.02	2.55	748
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.81	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	7.59	3,848
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	2.54	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	677	677	< 0.005	0.02	0.07	683
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.96	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	0.20	3,841
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.13	1.51	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	385	385	< 0.005	0.01	0.62	390
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.21	0.02	2.25	1.12	0.01	0.03	0.57	0.60	0.03	0.16	0.18	—	2,054	2,054	0.18	0.33	1.84	2,159
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	63.8	63.8	< 0.005	< 0.005	0.10	64.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.41	0.20	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	340	340	0.03	0.05	0.30	357

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	5/1/2025	10/14/2026	5.00	380	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	2.00	8.00	367	0.40
Site Preparation	Crushing/Proc. Equipment	Gasoline	Average	2.00	2.00	12.0	0.85
Site Preparation	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Site Preparation	Scrapers	Diesel	Average	7.00	8.00	423	0.48
Site Preparation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	10.0	100	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	11.0	100	HHDT
Site Preparation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	175,000	3,040	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Other Non-Asphalt Surfaces	57.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	3.00	0.00	0.00	0.00	300

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	148,975

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A

Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1

Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506

Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—

Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided schedule
Construction: Off-Road Equipment	Client provided equipment list
Construction: Trips and VMT	Client provided total worker trips and hauling trips which equals 8,000 round trips.

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APPENDIX 3.5:

CALEEMOD REPLENISH BIG BEAR COMPONENT 5 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Sand Canyon Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Sand Canyon
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.224799, -116.85662
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5157
EDFZ	10
Electric Utility	Southern California Edison
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	1.37	Mile	0.74	0.00	—	—	—	Pipeline
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump/Monitoring Wells
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.86	1.36	0.74	15,893
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
2026	1.48	1.14	9.93	20.8	0.04	0.32	2.27	2.59	0.29	0.55	0.85	—	5,995	5,995	0.25	0.34	11.1	6,114
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.54	1.57	19.2	24.2	0.08	0.55	4.01	4.55	0.51	1.02	1.53	—	12,475	12,475	0.86	1.34	0.66	12,898
2026	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.83	1.36	0.74	15,893
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
2026	0.74	0.57	4.76	8.65	0.02	0.16	1.05	1.21	0.15	0.25	0.40	—	2,633	2,633	0.09	0.13	2.01	2,678
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051
2026	0.13	0.10	0.87	1.58	< 0.005	0.03	0.19	0.22	0.03	0.05	0.07	—	436	436	0.02	0.02	0.33	443

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Stationar	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.51	3.88	4.51	0.01	0.18	—	0.18	0.16	—	0.16	—	1,091	1,091	0.04	0.01	—	1,095
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.71	0.82	< 0.005	0.03	—	0.03	0.03	—	0.03	—	181	181	0.01	< 0.005	—	181

Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.21	0.16	0.41	7.70	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,508	1,508	0.05	0.05	5.65	1,528
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.48	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	13.2	6,422
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.46	5.49	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,381	1,381	0.05	0.05	0.15	1,396
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.76	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	0.34	6,409
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.07	0.24	2.79	0.00	0.00	0.67	0.67	0.00	0.16	0.16	—	669	669	0.02	0.02	1.17	677
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.32	0.04	3.28	1.60	0.02	0.04	0.80	0.83	0.04	0.22	0.26	—	2,911	2,911	0.27	0.48	2.74	3,063
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.19	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.01	0.60	0.29	< 0.005	0.01	0.15	0.15	0.01	0.04	0.05	—	482	482	0.05	0.08	0.45	507

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.23	1.03	7.73	9.43	0.02	0.34	—	0.34	0.31	—	0.31	—	2,286	2,286	0.09	0.02	—	2,294
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.33	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	98.4	98.4	< 0.005	< 0.005	—	98.8
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.3	16.3	< 0.005	< 0.005	—	16.4
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.63	0.05	6.48	3.27	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	5,986	5,986	0.53	0.96	0.32	6,285
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.23	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	59.1	59.1	< 0.005	< 0.005	0.10	59.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.08	< 0.005	0.02	0.02	—	258	258	0.02	0.04	0.23	271
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	9.89
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.05	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.04	44.8

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	3.12	3.84	0.01	0.12	—	0.12	0.11	—	0.11	—	942	942	0.04	0.01	—	945
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.08	0.07	0.57	0.70	< 0.005	0.02	—	0.02	0.02	—	0.02	—	156	156	0.01	< 0.005	—	157
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.37	7.12	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,477	1,477	0.05	0.05	5.11	1,497
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.24	2.80	0.00	0.00	0.73	0.73	0.00	0.17	0.17	—	714	714	< 0.005	0.02	1.15	723
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.13	0.13	0.00	0.03	0.03	—	118	118	< 0.005	< 0.005	0.19	120
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.62	1.62	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.1	20.1	< 0.005	< 0.005	—	20.1
Demolition	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.32	3.32	< 0.005	< 0.005	—	3.34
Demolition	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.69	0.09	6.75	3.49	0.04	0.08	1.74	1.82	0.08	0.48	0.56	—	6,351	6,351	0.60	1.04	13.8	6,689
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.08	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	19.2	19.2	< 0.005	< 0.005	0.03	19.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.01	0.39	0.19	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	348	348	0.03	0.06	0.33	366
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.18	3.18	< 0.005	< 0.005	0.01	3.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	57.6	57.6	0.01	0.01	0.05	60.6

3.9. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.08	0.86	1.53	< 0.005	0.03	—	0.03	0.03	—	0.03	—	241	241	0.01	< 0.005	—	242
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.16	0.28	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	39.9	39.9	< 0.005	< 0.005	—	40.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.13	0.03	1.51	0.71	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	5.11	1,844
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.11	1.37	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	345	345	0.01	0.01	0.04	349
Vendor	0.13	0.03	1.58	0.69	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	0.13	1,839
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.58	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.24	140
Vendor	0.05	0.01	0.63	0.27	0.01	0.01	0.20	0.21	0.01	0.05	0.07	—	695	695	0.04	0.10	0.87	728
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	0.01	0.11	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	22.9	22.9	< 0.005	< 0.005	0.04	23.2
Vendor	0.01	< 0.005	0.12	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	115	115	0.01	0.02	0.14	121
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.11. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.43	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	128
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.2

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.09	1.78	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	369	369	0.01	0.01	1.28	374
Vendor	0.13	0.02	1.43	0.66	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	4.71	1,814
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.27	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	338	338	< 0.005	0.01	0.03	342
Vendor	0.12	0.02	1.49	0.67	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	0.12	1,809
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	71.8	71.8	< 0.005	< 0.005	0.12	72.7
Vendor	0.03	< 0.005	0.32	0.14	< 0.005	0.01	0.11	0.11	0.01	0.03	0.03	—	362	362	0.02	0.06	0.42	379
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.9	11.9	< 0.005	< 0.005	0.02	12.0
Vendor	< 0.005	< 0.005	0.06	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	59.9	59.9	< 0.005	0.01	0.07	62.8
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Total	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/2/2025	1/22/2026	5.00	190	—

Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/22/2026	10/14/2026	5.00	190	—
Demolition	Demolition	5/1/2025	5/29/2025	5.00	20.0	—
Building Construction	Building Construction	6/13/2025	4/17/2026	5.00	220	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Linear, Grading & Excavation	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Drainage, Utilities, & Sub-Grade	Cranes	Diesel	Average	1.00	4.00	367	0.29
Linear, Drainage, Utilities, & Sub-Grade	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37

Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73
Building Construction	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Building Construction	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	18.8	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	18.0	100	HHDT

Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	5.00	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.00	100	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,210	0.74	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.74	0.00	—

Demolition	0.00	0.00	0.00	1,500	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.74	100%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	349	0.03	< 0.005
2026	29.4	346	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	6,534

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	532	0.0330	0.0040	0.00
Parking Lot	19,079	532	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

Parking Lot	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.1	annual days of extreme heat
Extreme Precipitation	8.60	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	32.4	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.

The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	98.7
AQ-PM	4.43
AQ-DPM	1.14

Drinking Water	70.5
Lead Risk Housing	65.1
Pesticides	4.55
Toxic Releases	18.1
Traffic	3.04
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	1.80
Impaired Water Bodies	90.1
Solid Waste	75.7
Sensitive Population	—
Asthma	26.6
Cardio-vascular	44.6
Low Birth Weights	67.2
Socioeconomic Factor Indicators	—
Education	9.73
Housing	12.8
Linguistic	0.26
Poverty	55.9
Unemployment	35.0

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	53.62504812

Employed	15.8475555
Median HI	38.16245348
Education	—
Bachelor's or higher	57.65430515
High school enrollment	0.372128834
Preschool enrollment	1.873476197
Transportation	—
Auto Access	44.50147568
Active commuting	57.28217631
Social	—
2-parent households	49.63428718
Voting	87.82240472
Neighborhood	—
Alcohol availability	85.88476838
Park access	61.54240985
Retail density	2.078788656
Supermarket access	11.39484152
Tree canopy	94.22558707
Housing	—
Homeownership	62.4534839
Housing habitability	66.86770178
Low-inc homeowner severe housing cost burden	47.83780316
Low-inc renter severe housing cost burden	50.78916977
Uncrowded housing	77.4541255
Health Outcomes	—
Insured adults	70.78147055
Arthritis	0.0

Asthma ER Admissions	68.5
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	87.1
Cognitively Disabled	32.0
Physically Disabled	7.5
Heart Attack ER Admissions	26.6
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	97.6
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	72.7
SLR Inundation Area	0.0
Children	75.0
Elderly	8.4
English Speaking	75.9

Foreign-born	3.5
Outdoor Workers	55.8
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.3
Traffic Density	2.9
Traffic Access	23.0
Other Indices	—
Hardship	33.2
Other Decision Support	—
2016 Voting	97.1

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	24.0
Healthy Places Index Score for Project Location (b)	21.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Characteristics: Project Details	Rural Big Bear
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client provided schedule
Construction: Trips and VMT	Client provided pump station trips

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APPENDIX 3.6:

CALEEMOD REPLENISH BIG BEAR COMPONENT 1 MITIGATED EMISSIONS MODEL OUTPUTS

15309-WWTP Upgrades (Mitigated) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-WWTP Upgrades (Mitigated)
Construction Start Date	1/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Unrefrigerated Warehouse-Rail	40.0	1000sqft	0.92	40,000	0.00	—	—	—
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump Station
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—
User Defined Linear	0.26	Mile	0.14	0.00	0.00	—	—	—
Other Asphalt Surfaces	0.44	Acre	0.44	0.00	0.00	—	—	Remaining SF

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Energy	E-10-B	Establish Onsite Renewable Energy Systems: Solar Power

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.00	2.06	11.7	52.5	0.08	0.46	6.19	6.65	0.43	1.93	2.36	—	12,560	12,560	0.56	0.57	21.3	12,766
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.73	2.61	25.0	68.4	0.16	0.49	13.1	13.4	0.46	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.37	1.33	8.88	32.0	0.06	0.30	4.55	4.85	0.28	1.36	1.65	—	9,047	9,047	0.46	0.56	7.33	9,233

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.25	0.24	1.62	5.83	0.01	0.05	0.83	0.88	0.05	0.25	0.30	—	1,498	1,498	0.08	0.09	1.21	1,529

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.00	2.06	11.7	52.5	0.08	0.46	6.19	6.65	0.43	1.93	2.36	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	1.92	1.98	11.0	50.9	0.08	0.42	6.19	6.61	0.39	1.93	2.33	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.73	2.04	25.0	46.9	0.16	0.46	13.1	13.4	0.43	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	2.70	2.61	14.6	68.4	0.09	0.49	9.73	10.2	0.46	2.76	3.22	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	0.78	0.64	3.23	21.7	0.02	0.07	3.53	3.60	0.06	0.83	0.89	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.37	1.30	8.88	31.0	0.06	0.30	4.55	4.85	0.28	1.36	1.65	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	1.30	1.33	7.63	32.0	0.05	0.28	4.27	4.55	0.26	1.32	1.58	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.02	0.01	0.07	0.48	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.25	0.24	1.62	5.65	0.01	0.05	0.83	0.88	0.05	0.25	0.30	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.24	0.24	1.39	5.83	0.01	0.05	0.78	0.83	0.05	0.24	0.29	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.01	0.09	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.00	2.06	11.7	52.5	0.08	0.46	6.19	6.65	0.43	1.93	2.36	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	1.92	1.98	11.0	50.9	0.08	0.42	6.19	6.61	0.39	1.93	2.33	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.73	2.04	25.0	46.9	0.16	0.46	13.1	13.4	0.43	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	2.70	2.61	14.6	68.4	0.09	0.49	9.73	10.2	0.46	2.76	3.22	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	0.78	0.64	3.23	21.7	0.02	0.07	3.53	3.60	0.06	0.83	0.89	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.37	1.30	8.88	31.0	0.06	0.30	4.55	4.85	0.28	1.36	1.65	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	1.30	1.33	7.63	32.0	0.05	0.28	4.27	4.55	0.26	1.32	1.58	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.02	0.01	0.07	0.48	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.25	0.24	1.62	5.65	0.01	0.05	0.83	0.88	0.05	0.25	0.30	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.24	0.24	1.39	5.83	0.01	0.05	0.78	0.83	0.05	0.24	0.29	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.01	0.09	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824

Mit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Mit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Mit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792
Mit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	871	871	0.06	0.01	—	874
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.30	0.27	2.37	9.89	0.02	0.07	—	0.07	0.07	—	0.07	—	1,863	1,863	0.08	0.02	—	1,869
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.14	0.60	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.11	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.2. Linear, Grading & Excavation (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.30	0.27	2.37	9.89	0.02	0.07	—	0.07	0.07	—	0.07	—	1,863	1,863	0.08	0.02	—	1,869

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.14	0.60	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.11	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.3. Linear, Grading & Excavation (2027) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.30	0.27	2.31	9.90	0.02	0.07	—	0.07	0.06	—	0.06	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.21	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.4. Linear, Grading & Excavation (2027) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.30	0.27	2.31	9.90	0.02	0.07	—	0.07	0.06	—	0.06	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.21	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.5. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.6. Demolition (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—

Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.7. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	1.13	8.28	32.0	0.06	0.42	—	0.42	0.39	—	0.39	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	1.13	8.28	32.0	0.06	0.42	—	0.42	0.39	—	0.39	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.78	0.70	5.12	19.8	0.04	0.26	—	0.26	0.24	—	0.24	—	3,798	3,798	0.15	0.03	—	3,811
Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.13	0.93	3.62	0.01	0.05	—	0.05	0.04	—	0.04	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—

Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.8. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	1.13	8.28	32.0	0.06	0.42	—	0.42	0.39	—	0.39	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	1.13	8.28	32.0	0.06	0.42	—	0.42	0.39	—	0.39	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.78	0.70	5.12	19.8	0.04	0.26	—	0.26	0.24	—	0.24	—	3,798	3,798	0.15	0.03	—	3,811

Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.13	0.93	3.62	0.01	0.05	—	0.05	0.04	—	0.04	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—
Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.9. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.20	1.08	7.75	32.0	0.06	0.38	—	0.38	0.36	—	0.36	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.20	1.08	7.75	32.0	0.06	0.38	—	0.38	0.36	—	0.36	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.79	0.71	5.08	21.0	0.04	0.25	—	0.25	0.23	—	0.23	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.13	0.93	3.83	0.01	0.05	—	0.05	0.04	—	0.04	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

3.10. Building Construction (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.20	1.08	7.75	32.0	0.06	0.38	—	0.38	0.36	—	0.36	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.20	1.08	7.75	32.0	0.06	0.38	—	0.38	0.36	—	0.36	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.79	0.71	5.08	21.0	0.04	0.25	—	0.25	0.23	—	0.23	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.13	0.93	3.83	0.01	0.05	—	0.05	0.04	—	0.04	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehou	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape Equipme	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	12/1/2026	1/11/2027	5.00	30.0	Pipeline Installation
Demolition	Demolition	1/1/2025	1/29/2025	5.00	20.0	—
Building Construction	Building Construction	2/19/2025	12/1/2026	5.00	465	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Tier 4 Final	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Tier 4 Final	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Tier 4 Final	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Tier 4 Final	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Tier 4 Final	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Tier 4 Final	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43

Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT
Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT

Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Building Construction	0.00	0.00	60,000	20,000	7,684

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	—	0.14	0.00	—

Demolition	—	1,350	0.14	3,000	—
Building Construction	—	8,000	581	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-Rail	0.00	0%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%
User Defined Linear	0.14	100%
Other Asphalt Surfaces	0.44	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005
2027	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	60,000	20,000	7,684

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	3,800,000	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00
Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	0.00	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00

Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	5.00	0.73
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73
Fire Pump	Diesel	1.00	24.0	8,760	15.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.

Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A

Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6

Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582

Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8

Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Based on Client Provided data and construction schedule
Construction: Off-Road Equipment	Client Provided construction equipment list When using construction equipment greater than 150 horsepower (>150 hp), the Construction Contractor shall ensure that off-road diesel construction equipment complies with the Environmental Protection Agency (EPA)/California Air Resources Board (CARB) Tier 4 emissions standards or equivalent and shall ensure that all construction equipment is tuned and maintained in accordance with the manufacturer's specifications
Construction: Trips and VMT	Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.

Operations: Vehicle Data	No trips data available
Operations: Architectural Coatings	SCAQMD Rule 1113
Construction: Dust From Material Movement	Export expected per Project data
Construction: Architectural Coatings	SCAQMD Rule 1113
Operations: Energy Use	Electricity adjusted based on client provided data
Operations: Water and Waste Water	Taken from 2022 Lake Analysis report

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APPENDIX 3.7:

CALEEMOD REPLENISH BIG BEAR COMPONENT 2 MITIGATED EMISSIONS MODEL OUTPUTS

15309-Lake Pipeline (Mitigated) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Lake Pipeline (Mitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	3.78	Mile	2.06	0.00	—	—	—	—
Other Non-Asphalt Surfaces	1.00	Acre	1.00	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.07	1.09	26.1	30.8	0.15	0.42	8.51	8.93	0.41	2.05	2.46	—	22,975	22,975	1.96	3.22	47.5	24,031
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.38	1.05	19.2	31.2	0.11	0.36	5.63	5.99	0.35	1.45	1.80	—	17,145	17,145	1.26	2.04	0.86	17,776
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.13	0.40	10.1	11.5	0.06	0.16	2.89	3.05	0.15	0.73	0.88	—	8,713	8,713	0.74	1.21	7.77	9,099
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.21	0.07	1.85	2.10	0.01	0.03	0.53	0.56	0.03	0.13	0.16	—	1,443	1,443	0.12	0.20	1.29	1,506

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.07	1.09	26.1	30.8	0.15	0.42	8.51	8.93	0.41	2.05	2.46	—	22,975	22,975	1.96	3.22	47.5	24,031
2026	0.59	0.49	3.12	12.9	0.01	0.11	1.24	1.34	0.10	0.29	0.39	—	2,467	2,467	0.09	0.05	4.47	2,489
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.89	0.66	16.7	20.5	0.10	0.26	4.40	4.66	0.26	1.16	1.42	—	15,029	15,029	1.26	2.04	0.80	15,670
2026	2.38	1.05	19.2	31.2	0.11	0.36	5.63	5.99	0.35	1.45	1.80	—	17,145	17,145	1.20	2.01	0.86	17,776
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.13	0.40	10.1	11.5	0.06	0.16	2.89	3.05	0.15	0.73	0.88	—	8,713	8,713	0.74	1.21	7.77	9,099
2026	0.38	0.28	2.33	6.76	0.01	0.07	0.82	0.89	0.06	0.20	0.26	—	1,845	1,845	0.07	0.11	1.51	1,880
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.21	0.07	1.85	2.10	0.01	0.03	0.53	0.56	0.03	0.13	0.16	—	1,443	1,443	0.12	0.20	1.29	1,506
2026	0.07	0.05	0.43	1.23	< 0.005	0.01	0.15	0.16	0.01	0.04	0.05	—	305	305	0.01	0.02	0.25	311

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.36	2.84	9.69	0.02	0.10	—	0.10	0.10	—	0.10	—	1,799	1,799	0.07	0.01	—	1,805

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.36	2.84	9.69	0.02	0.10	—	0.10	0.10	—	0.10	—	1,799	1,799	0.07	0.01	—	1,805
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.36	4.64	0.01	0.05	—	0.05	0.05	—	0.05	—	862	862	0.03	0.01	—	865
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.25	0.85	< 0.005	0.01	—	0.01	0.01	—	0.01	—	143	143	0.01	< 0.005	—	143
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.16	0.12	0.31	5.78	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,131	1,131	0.04	0.03	4.24	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.0	6.69	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,194	12,194	1.15	1.99	26.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.12	0.34	4.11	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,036	1,036	0.04	0.03	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.5	6.70	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,195	12,195	1.15	2.00	0.69	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.07	0.06	0.18	2.10	0.00	0.00	0.51	0.51	0.00	0.12	0.12	—	504	504	0.02	0.02	0.88	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.64	0.09	6.59	3.21	0.04	0.08	1.60	1.67	0.08	0.44	0.51	—	5,846	5,846	0.55	0.96	5.50	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.03	0.38	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	83.4	83.4	< 0.005	< 0.005	0.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.12	0.02	1.20	0.59	0.01	0.01	0.29	0.31	0.01	0.08	0.09	—	968	968	0.09	0.16	0.91	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.35	2.76	9.69	0.02	0.09	—	0.09	0.09	—	0.09	—	1,800	1,800	0.07	0.01	—	1,806
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.11	0.40	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	74.0	74.0	< 0.005	< 0.005	—	74.2
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	12.2	12.2	< 0.005	< 0.005	—	12.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.11	0.31	3.81	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,015	1,015	< 0.005	0.03	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.25	0.10	13.0	6.54	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	11,972	11,972	1.07	1.92	0.64	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.17	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	42.3	42.3	< 0.005	< 0.005	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.05	< 0.005	0.54	0.27	< 0.005	0.01	0.14	0.14	0.01	0.04	0.04	—	492	492	0.04	0.08	0.44	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.00	7.00	< 0.005	< 0.005	0.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.01	< 0.005	0.10	0.05	< 0.005	< 0.005	0.03	0.03	< 0.005	0.01	0.01	—	81.5	81.5	0.01	0.01	0.07	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.35	2.80	6.68	0.01	0.11	—	0.11	0.10	—	0.10	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.35	2.80	6.68	0.01	0.11	—	0.11	0.10	—	0.10	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	1.46	3.48	0.01	0.06	—	0.06	0.05	—	0.05	—	612	612	0.02	< 0.005	—	614
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.27	0.63	< 0.005	0.01	—	0.01	0.01	—	0.01	—	101	101	< 0.005	< 0.005	—	102
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.14	0.32	6.23	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,292	1,292	0.04	0.04	4.47	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.17	0.13	0.36	4.44	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,184	1,184	< 0.005	0.04	0.12	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.07	0.21	2.45	0.00	0.00	0.64	0.64	0.00	0.15	0.15	—	625	625	< 0.005	0.02	1.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.45	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	103	103	< 0.005	< 0.005	0.17	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.81	1.81	—	0.27	0.27	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.44	0.53	< 0.005	0.01	—	0.01	0.01	—	0.01	—	70.3	70.3	< 0.005	< 0.005	—	70.5
Demolition	—	—	—	—	—	—	0.35	0.35	—	0.05	0.05	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.6	11.6	< 0.005	< 0.005	—	11.7
Demolition	—	—	—	—	—	—	0.06	0.06	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.78	0.11	7.55	3.90	0.05	0.09	1.95	2.04	0.09	0.53	0.63	—	7,108	7,108	0.67	1.16	15.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.15	0.02	1.54	0.75	0.01	0.02	0.37	0.39	0.02	0.10	0.12	—	1,363	1,363	0.13	0.22	1.28	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	226	226	0.02	0.04	0.21	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—
Demolition	Demolition	5/1/2025	8/7/2025	5.00	70.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82

Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	15.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	36.0	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	17.5	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT

Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	21.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	19,940	5.00	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	5.00	0.00	—
Demolition	0.00	0.00	0.00	5,875	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction

Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	5.00	100%
Other Non-Asphalt Surfaces	66.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	172,498

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list When using construction equipment greater than 150 horsepower (>150 hp), the Construction Contractor shall ensure that off-road diesel construction equipment complies with the Environmental Protection Agency (EPA)/California Air Resources Board (CARB) Tier 4 emissions standards or equivalent and shall ensure that all construction equipment is tuned and maintained in accordance with the manufacturer's specifications

Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase in addition to default CalEEMod hauling trucks. Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.

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APPENDIX 3.8:

CALEEMOD REPLENISH BIG BEAR COMPONENT 3 MITIGATED EMISSIONS MODEL OUTPUTS

15309-Shay Ponds (Mitigation) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Shay Ponds (Mitigation)
Construction Start Date	5/1/2025
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.30
Precipitation (days)	1.80
Location	34.253674, -116.80784
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
User Defined Linear	1.20	Mile	0.65	0.00	—	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.04	0.60	8.71	13.8	0.06	0.22	1.66	1.88	0.21	0.45	0.66	—	7,464	7,464	0.47	0.85	15.0	7,744
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.36	0.86	10.9	19.6	0.07	0.29	1.66	1.96	0.28	0.45	0.73	—	8,444	8,444	0.47	0.85	0.39	8,710
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.50	0.29	4.33	6.53	0.03	0.11	0.80	0.90	0.10	0.22	0.32	—	3,573	3,573	0.22	0.41	3.12	3,704
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.09	0.05	0.79	1.19	< 0.005	0.02	0.15	0.16	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2025	1.04	0.60	8.71	13.8	0.06	0.22	1.66	1.88	0.21	0.45	0.66	—	7,464	7,464	0.47	0.85	15.0	7,744
2026	0.36	0.31	2.36	6.11	0.01	0.09	0.00	0.09	0.08	0.00	0.08	—	1,087	1,087	0.04	0.01	0.00	1,091
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.03	0.60	8.93	13.6	0.06	0.22	1.66	1.88	0.21	0.45	0.66	—	7,451	7,451	0.47	0.85	0.39	7,717
2026	1.36	0.86	10.9	19.6	0.07	0.29	1.66	1.96	0.28	0.45	0.73	—	8,444	8,444	0.47	0.85	0.36	8,710
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.29	4.33	6.53	0.03	0.11	0.80	0.90	0.10	0.22	0.32	—	3,573	3,573	0.22	0.41	3.12	3,704
2026	0.23	0.18	1.58	3.74	0.01	0.05	0.07	0.12	0.05	0.02	0.07	—	868	868	0.04	0.04	0.25	881
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.09	0.05	0.79	1.19	< 0.005	0.02	0.15	0.16	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613
2026	0.04	0.03	0.29	0.68	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.01	—	144	144	0.01	0.01	0.04	146

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.57	0.50	3.73	10.7	0.02	0.14	—	0.14	0.13	—	0.13	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.57	0.50	3.73	10.7	0.02	0.14	—	0.14	0.13	—	0.13	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.27	0.24	1.79	5.12	0.01	0.07	—	0.07	0.06	—	0.06	—	930	930	0.04	0.01	—	933
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.33	0.93	< 0.005	0.01	—	0.01	0.01	—	0.01	—	154	154	0.01	< 0.005	—	155
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.77	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	151	151	< 0.005	< 0.005	0.56	—
Vendor	0.27	0.06	3.28	1.53	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,807	3,807	0.24	0.58	11.1	—
Hauling	0.17	0.02	1.66	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	3.39	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.55	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.06	3.42	1.50	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,808	3,808	0.24	0.58	0.29	—
Hauling	0.17	0.02	1.74	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	0.09	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—
Vendor	0.13	0.03	1.67	0.72	0.01	0.03	0.52	0.55	0.03	0.14	0.17	—	1,826	1,826	0.11	0.28	2.30	—
Hauling	0.08	0.01	0.85	0.41	< 0.005	0.01	0.21	0.21	0.01	0.06	0.07	—	750	750	0.07	0.12	0.71	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.02	0.01	0.30	0.13	< 0.005	0.01	0.10	0.10	0.01	0.03	0.03	—	302	302	0.02	0.05	0.38	—
Hauling	0.01	< 0.005	0.15	0.08	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	124	124	0.01	0.02	0.12	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.55	0.49	3.63	10.7	0.02	0.13	—	0.13	0.12	—	0.12	—	1,942	1,942	0.08	0.02	—	1,948
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.15	0.44	< 0.005	0.01	—	0.01	0.01	—	0.01	—	79.8	79.8	< 0.005	< 0.005	—	80.1
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.2	13.2	< 0.005	< 0.005	—	13.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.51	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	135	135	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.03	3.22	1.44	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,743	3,743	0.21	0.58	0.26	—
Hauling	0.16	0.01	1.66	0.84	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,537	1,537	0.14	0.25	0.08	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.64	5.64	< 0.005	< 0.005	0.01	—
Vendor	0.01	< 0.005	0.13	0.06	< 0.005	< 0.005	0.04	0.05	< 0.005	0.01	0.01	—	154	154	0.01	0.02	0.18	—
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	63.1	63.1	0.01	0.01	0.06	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.93	0.93	< 0.005	< 0.005	< 0.005	—
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	25.5	25.5	< 0.005	< 0.005	0.03	—
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	10.5	10.5	< 0.005	< 0.005	0.01	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.36	0.31	2.36	6.11	0.01	0.09	—	0.09	0.08	—	0.08	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.36	0.31	2.36	6.11	0.01	0.09	—	0.09	0.08	—	0.08	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.23	3.18	0.01	0.04	—	0.04	0.04	—	0.04	—	566	566	0.02	< 0.005	—	568
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.22	0.58	< 0.005	0.01	—	0.01	0.01	—	0.01	—	93.7	93.7	< 0.005	< 0.005	—	94.0
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

4. Operations Emissions Details

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38

Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	4.00	376	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	2.00	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	13.0	100	HHDT,MHDT
Linear, Grading & Excavation	Hauling	4.62	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	0.00	18.5	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,020	0.65	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.65	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.65	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	39.3	annual days of extreme heat
Extreme Precipitation	4.40	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	31.0	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list When using construction equipment greater than 150 horsepower (>150 hp), the Construction Contractor shall ensure that off-road diesel construction equipment complies with the Environmental Protection Agency (EPA)/California Air Resources Board (CARB) Tier 4 emissions standards or equivalent and shall ensure that all construction equipment is tuned and maintained in accordance with the manufacturer's specifications
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase.

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APPENDIX 3.9:

CALEEMOD REPLENISH BIG BEAR COMPONENT 4 MITIGATED EMISSIONS MODEL OUTPUTS

15309-Evaporation Ponds (Mitigated) Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Evaporation Ponds (Mitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.270764, -116.820355
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Other Non-Asphalt Surfaces	57.0	Acre	57.0	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	19.6	19.1	15.4	124	0.20	0.75	7.07	7.82	0.67	2.41	3.08	—	23,481	23,481	1.15	0.79	10.9	23,755
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	19.6	19.0	15.6	123	0.20	0.75	7.07	7.82	0.67	2.41	3.08	—	23,418	23,418	1.15	0.79	0.28	23,681
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	11.0	10.7	8.69	68.8	0.11	0.42	3.97	4.39	0.37	1.35	1.73	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.00	1.95	1.59	12.6	0.02	0.08	0.72	0.80	0.07	0.25	0.31	—	2,171	2,171	0.10	0.07	0.41	2,195

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	19.6	19.1	15.4	124	0.20	0.75	7.07	7.82	0.67	2.41	3.08	—	23,481	23,481	1.15	0.79	10.9	23,755
2026	19.5	19.0	15.2	123	0.20	0.74	7.07	7.81	0.67	2.41	3.07	—	23,400	23,400	1.12	0.76	10.1	23,665
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	19.6	19.0	15.6	123	0.20	0.75	7.07	7.82	0.67	2.41	3.08	—	23,418	23,418	1.15	0.79	0.28	23,681
2026	19.5	19.0	15.4	122	0.20	0.74	7.07	7.81	0.67	2.41	3.07	—	23,338	23,338	1.10	0.76	0.26	23,593
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	9.38	9.13	7.53	58.9	0.10	0.36	3.39	3.75	0.32	1.15	1.47	—	11,232	11,232	0.55	0.38	2.26	11,361
2026	11.0	10.7	8.69	68.8	0.11	0.42	3.97	4.39	0.37	1.35	1.73	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.71	1.67	1.38	10.7	0.02	0.07	0.62	0.68	0.06	0.21	0.27	—	1,860	1,860	0.09	0.06	0.37	1,881
2026	2.00	1.95	1.59	12.6	0.02	0.08	0.72	0.80	0.07	0.25	0.31	—	2,171	2,171	0.10	0.07	0.41	2,195

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10
Area	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	19.1	18.9	11.3	118	0.18	0.70	—	0.70	0.62	—	0.62	—	19,001	19,001	0.77	0.15	—	19,066

Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	19.1	18.9	11.3	118	0.18	0.70	—	0.70	0.62	—	0.62	—	19,001	19,001	0.77	0.15	—	19,066
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	9.13	9.07	5.40	56.5	0.08	0.33	—	0.33	0.30	—	0.30	—	9,110	9,110	0.37	0.07	—	9,141
Dust From Material Movement	—	—	—	—	—	—	2.56	2.56	—	0.94	0.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.67	1.65	0.99	10.3	0.02	0.06	—	0.06	0.05	—	0.05	—	1,508	1,508	0.06	0.01	—	1,513
Dust From Material Movement	—	—	—	—	—	—	0.47	0.47	—	0.17	0.17	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	3.85	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	754	754	0.02	0.02	2.82	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.41	0.06	3.96	2.04	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	8.08	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.23	2.74	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	690	690	0.02	0.02	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.41	0.05	4.13	2.05	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	0.21	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.12	1.40	0.00	0.00	0.34	0.34	0.00	0.08	0.08	—	336	336	0.01	0.01	0.58	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.20	0.03	2.01	0.98	0.01	0.02	0.49	0.51	0.02	0.13	0.16	—	1,786	1,786	0.17	0.29	1.68	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.26	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	55.6	55.6	< 0.005	< 0.005	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.04	< 0.005	0.37	0.18	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	296	296	0.03	0.05	0.28	—

3.3. Site Preparation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	19.0	18.9	11.2	118	0.18	0.69	—	0.69	0.62	—	0.62	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	19.0	18.9	11.2	118	0.18	0.69	—	0.69	0.62	—	0.62	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	10.7	10.6	6.31	66.2	0.10	0.39	—	0.39	0.35	—	0.35	—	10,673	10,673	0.43	0.09	—	10,710
Dust From Material Movement	—	—	—	—	—	—	3.00	3.00	—	1.10	1.10	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.95	1.94	1.15	12.1	0.02	0.07	—	0.07	0.06	—	0.06	—	1,767	1,767	0.07	0.01	—	1,773
Dust From Material Movement	—	—	—	—	—	—	0.55	0.55	—	0.20	0.20	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.18	3.56	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	738	738	0.02	0.02	2.55	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.38	0.03	3.81	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	7.59	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	2.54	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	677	677	< 0.005	0.02	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.38	0.03	3.96	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	0.20	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.13	1.51	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	385	385	< 0.005	0.01	0.62	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.21	0.02	2.25	1.12	0.01	0.03	0.57	0.60	0.03	0.16	0.18	—	2,054	2,054	0.18	0.33	1.84	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	63.8	63.8	< 0.005	< 0.005	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.04	< 0.005	0.41	0.20	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	340	340	0.03	0.05	0.30	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	5/1/2025	10/14/2026	5.00	380	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Tier 4 Final	2.00	8.00	367	0.40
Site Preparation	Crushing/Proc. Equipment	Gasoline	Average	2.00	2.00	12.0	0.85
Site Preparation	Off-Highway Trucks	Diesel	Tier 4 Final	2.00	8.00	376	0.38
Site Preparation	Scrapers	Diesel	Tier 4 Final	7.00	8.00	423	0.48
Site Preparation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	10.0	100	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	11.0	100	HHDT
Site Preparation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	175,000	3,040	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Other Non-Asphalt Surfaces	57.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	3.00	0.00	0.00	0.00	300

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	148,975

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A

Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1

Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506

Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—

Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided schedule
Construction: Off-Road Equipment	Client provided equipment list
Construction: Trips and VMT	Client provided total worker trips and hauling trips which equals 8,000 round trips.

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APPENDIX 3.10:

CALEEMOD REPLENISH BIG BEAR COMPONENT 5 MITIGATED EMISSIONS MODEL OUTPUTS

15309-Sand Canyon (Mitigated) Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Sand Canyon (Mitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.224799, -116.85662
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5157
EDFZ	10
Electric Utility	Southern California Edison
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	1.37	Mile	0.74	0.00	—	—	—	Pipeline
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump/Monitoring Wells
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.82	1.41	22.1	32.3	0.11	0.52	6.86	7.39	0.50	1.60	2.10	—	16,984	16,984	1.34	2.11	34.1	17,682
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.75	1.75	20.3	42.3	0.10	0.58	5.42	6.00	0.54	1.35	1.89	—	15,465	15,465	0.86	1.36	0.74	15,893
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.04	0.60	8.47	13.4	0.04	0.23	2.04	2.27	0.21	0.51	0.72	—	6,132	6,132	0.43	0.68	5.38	6,350
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.19	0.11	1.55	2.45	0.01	0.04	0.37	0.41	0.04	0.09	0.13	—	1,015	1,015	0.07	0.11	0.89	1,051

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.82	1.41	22.1	32.3	0.11	0.52	6.86	7.39	0.50	1.60	2.10	—	16,984	16,984	1.34	2.11	34.1	17,682
2026	1.11	0.84	7.50	23.5	0.04	0.22	2.27	2.49	0.21	0.55	0.76	—	5,995	5,995	0.25	0.34	11.1	6,114
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.13	1.25	17.1	27.8	0.08	0.47	4.01	4.48	0.45	1.02	1.46	—	12,475	12,475	0.86	1.34	0.66	12,898
2026	2.75	1.75	20.3	42.3	0.10	0.58	5.42	6.00	0.54	1.35	1.89	—	15,465	15,465	0.83	1.36	0.74	15,893
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.04	0.60	8.47	13.4	0.04	0.23	2.04	2.27	0.21	0.51	0.72	—	6,132	6,132	0.43	0.68	5.38	6,350
2026	0.52	0.40	3.42	10.2	0.02	0.11	1.05	1.15	0.10	0.25	0.35	—	2,633	2,633	0.09	0.13	2.01	2,678
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.19	0.11	1.55	2.45	0.01	0.04	0.37	0.41	0.04	0.09	0.13	—	1,015	1,015	0.07	0.11	0.89	1,051
2026	0.10	0.07	0.62	1.86	< 0.005	0.02	0.19	0.21	0.02	0.05	0.06	—	436	436	0.02	0.02	0.33	443

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Stationar	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.86	0.74	6.04	13.0	0.02	0.30	—	0.30	0.28	—	0.28	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.86	0.74	6.04	13.0	0.02	0.30	—	0.30	0.28	—	0.28	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.35	2.89	6.22	0.01	0.14	—	0.14	0.13	—	0.13	—	1,091	1,091	0.04	0.01	—	1,095
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.53	1.14	< 0.005	0.03	—	0.03	0.02	—	0.02	—	181	181	0.01	< 0.005	—	181

Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.21	0.16	0.41	7.70	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,508	1,508	0.05	0.05	5.65	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.67	0.09	6.48	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	13.2	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.46	5.49	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,381	1,381	0.05	0.05	0.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.67	0.09	6.76	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	0.34	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.07	0.24	2.79	0.00	0.00	0.67	0.67	0.00	0.16	0.16	—	669	669	0.02	0.02	1.17	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.32	0.04	3.28	1.60	0.02	0.04	0.80	0.83	0.04	0.22	0.26	—	2,911	2,911	0.27	0.48	2.74	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.19	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.06	0.01	0.60	0.29	< 0.005	0.01	0.15	0.15	0.01	0.04	0.05	—	482	482	0.05	0.08	0.45	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.83	0.71	5.83	13.0	0.02	0.27	—	0.27	0.25	—	0.25	—	2,286	2,286	0.09	0.02	—	2,294
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.25	0.56	< 0.005	0.01	—	0.01	0.01	—	0.01	—	98.4	98.4	< 0.005	< 0.005	—	98.8
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.3	16.3	< 0.005	< 0.005	—	16.4
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.63	0.05	6.48	3.27	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	5,986	5,986	0.53	0.96	0.32	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.23	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	59.1	59.1	< 0.005	< 0.005	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.08	< 0.005	0.02	0.02	—	258	258	0.02	0.04	0.23	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	< 0.005	< 0.005	0.05	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.04	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.52	0.45	3.58	10.1	0.02	0.14	—	0.14	0.13	—	0.13	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.52	0.45	3.58	10.1	0.02	0.14	—	0.14	0.13	—	0.13	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.27	0.24	1.86	5.24	0.01	0.07	—	0.07	0.07	—	0.07	—	942	942	0.04	0.01	—	945
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.34	0.96	< 0.005	0.01	—	0.01	0.01	—	0.01	—	156	156	0.01	< 0.005	—	157
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.37	7.12	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,477	1,477	0.05	0.05	5.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.24	2.80	0.00	0.00	0.73	0.73	0.00	0.17	0.17	—	714	714	< 0.005	0.02	1.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.13	0.13	0.00	0.03	0.03	—	118	118	< 0.005	< 0.005	0.19	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.62	1.62	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.1	20.1	< 0.005	< 0.005	—	20.1
Demolition	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.32	3.32	< 0.005	< 0.005	—	3.34
Demolition	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Hauling	0.69	0.09	6.75	3.49	0.04	0.08	1.74	1.82	0.08	0.48	0.56	—	6,351	6,351	0.60	1.04	13.8	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.08	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	19.2	19.2	< 0.005	< 0.005	0.03	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.04	0.01	0.39	0.19	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	348	348	0.03	0.06	0.33	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.18	3.18	< 0.005	< 0.005	0.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	57.6	57.6	0.01	0.01	0.05	—

3.9. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.08	0.86	1.53	< 0.005	0.03	—	0.03	0.03	—	0.03	—	241	241	0.01	< 0.005	—	242
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.16	0.28	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	39.9	39.9	< 0.005	< 0.005	—	40.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.13	0.03	1.51	0.71	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	5.11	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.11	1.37	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	345	345	0.01	0.01	0.04	—
Vendor	0.13	0.03	1.58	0.69	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	0.13	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.58	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.24	—
Vendor	0.05	0.01	0.63	0.27	0.01	0.01	0.20	0.21	0.01	0.05	0.07	—	695	695	0.04	0.10	0.87	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	0.01	0.11	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	22.9	22.9	< 0.005	< 0.005	0.04	—
Vendor	0.01	< 0.005	0.12	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	115	115	0.01	0.02	0.14	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.11. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.43	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	128
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.2

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.09	1.78	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	369	369	0.01	0.01	1.28	—
Vendor	0.13	0.02	1.43	0.66	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	4.71	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.27	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	338	338	< 0.005	0.01	0.03	—
Vendor	0.12	0.02	1.49	0.67	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	0.12	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	71.8	71.8	< 0.005	< 0.005	0.12	—
Vendor	0.03	< 0.005	0.32	0.14	< 0.005	0.01	0.11	0.11	0.01	0.03	0.03	—	362	362	0.02	0.06	0.42	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.9	11.9	< 0.005	< 0.005	0.02	—
Vendor	< 0.005	< 0.005	0.06	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	59.9	59.9	< 0.005	0.01	0.07	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Total	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	167

Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/2/2025	1/22/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/22/2026	10/14/2026	5.00	190	—
Demolition	Demolition	5/1/2025	5/29/2025	5.00	20.0	—
Building Construction	Building Construction	6/13/2025	4/17/2026	5.00	220	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Linear, Grading & Excavation	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	8.00	376	0.38

Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Drainage, Utilities, & Sub-Grade	Cranes	Diesel	Tier 4 Final	1.00	4.00	367	0.29
Linear, Drainage, Utilities, & Sub-Grade	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Tier 4 Final	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73
Building Construction	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Building Construction	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2

Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	18.8	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	18.0	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	5.00	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.00	100	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,210	0.74	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.74	0.00	—
Demolition	0.00	0.00	0.00	1,500	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.74	100%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	349	0.03	< 0.005
2026	29.4	346	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	6,534

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	532	0.0330	0.0040	0.00

Parking Lot	19,079	532	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.1	annual days of extreme heat
Extreme Precipitation	8.60	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	32.4	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A

Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	98.7
AQ-PM	4.43
AQ-DPM	1.14
Drinking Water	70.5
Lead Risk Housing	65.1
Pesticides	4.55
Toxic Releases	18.1
Traffic	3.04
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	1.80
Impaired Water Bodies	90.1
Solid Waste	75.7
Sensitive Population	—
Asthma	26.6
Cardio-vascular	44.6
Low Birth Weights	67.2
Socioeconomic Factor Indicators	—
Education	9.73
Housing	12.8
Linguistic	0.26
Poverty	55.9

Unemployment	35.0

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	53.62504812
Employed	15.8475555
Median HI	38.16245348
Education	—
Bachelor's or higher	57.65430515
High school enrollment	0.372128834
Preschool enrollment	1.873476197
Transportation	—
Auto Access	44.50147568
Active commuting	57.28217631
Social	—
2-parent households	49.63428718
Voting	87.82240472
Neighborhood	—
Alcohol availability	85.88476838
Park access	61.54240985
Retail density	2.078788656
Supermarket access	11.39484152
Tree canopy	94.22558707
Housing	—
Homeownership	62.4534839

Housing habitability	66.86770178
Low-inc homeowner severe housing cost burden	47.83780316
Low-inc renter severe housing cost burden	50.78916977
Uncrowded housing	77.4541255
Health Outcomes	—
Insured adults	70.78147055
Arthritis	0.0
Asthma ER Admissions	68.5
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	87.1
Cognitively Disabled	32.0
Physically Disabled	7.5
Heart Attack ER Admissions	26.6
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	97.6
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0

No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	72.7
SLR Inundation Area	0.0
Children	75.0
Elderly	8.4
English Speaking	75.9
Foreign-born	3.5
Outdoor Workers	55.8
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.3
Traffic Density	2.9
Traffic Access	23.0
Other Indices	—
Hardship	33.2
Other Decision Support	—
2016 Voting	97.1

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	24.0
Healthy Places Index Score for Project Location (b)	21.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Characteristics: Project Details	Rural Big Bear
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client provided schedule When using construction equipment greater than 150 horsepower (>150 hp), the Construction Contractor shall ensure that off-road diesel construction equipment complies with the Environmental Protection Agency (EPA)/California Air Resources Board (CARB) Tier 4 emissions standards or equivalent and shall ensure that all construction equipment is tuned and maintained in accordance with the manufacturer’s specifications
Construction: Trips and VMT	Client provided pump station trips

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Biological Resources & Jurisdictional Waters Assessment

Jacobs

Big Bear Valley Partner Agencies
Replenish Big Bear Project

Biological Resources And
Jurisdictional Waters Assessment

Final

September 2023

Tom Dodson & Associates

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Appendix A. CNDDB Species and Habitats Documented Within the *Big Bear Lake, Big Bear City, Fawnskin* and *Moonridge* USGS 7.5-Minute Quadrangles

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1. Introduction

The Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), and Big Bear Municipal Water District (BBMWD), henceforth referred to jointly as the Project Proponents, are proposing to implement the Replenish Big Bear Program. The Project includes upgrades and additions to BBARWA's wastewater treatment plant (WWTP) to produce purified water through full advanced treatment to protect the receiving waters and their beneficial uses. The goal of the Project is to produce full advanced treated water that would be retained within the Big Bear Valley watershed to be used to increase the sustainability of local water supplies. BBARWA will be the lead agency for compliance with the California Environmental Quality Act (CEQA) on behalf of this Project. The Project would involve both state and federal grant funds. Therefore, this Biological Resources Assessment and Jurisdictional Waters Assessment report was prepared in accordance with the standards required by the National Environmental Policy Act (NEPA) and CEQA review processes.

On behalf of Tom Dodson and Associates (TDA), Jacobs Engineering Group, Inc. (Jacobs) has prepared this Biological Resources Assessment (BRA) report for the proposed Replenish Big Bear Program (Project). The BRA fieldwork was conducted by Jacobs's biologist Daniel Smith in June and July of 2022, as well as July of 2023. The purpose of the BRA survey was to address potential effects of the Project on designated Critical Habitats and/or any species currently listed or formally proposed for listing as endangered or threatened under the federal Endangered Species Act (ESA) and/or the California Endangered Species Act (CESA), as well as any species otherwise designated as sensitive by the California Department of Fish and Wildlife (CDFW [formerly California Department of Fish and Game]) and/or the California Native Plant Society (CNPS).

The Project Area was assessed for special status species known to occur locally. Attention was focused on those state and/or federally listed as threatened or endangered species and California Fully Protected species that have been documented in the vicinity of the Project Area, whose habitat requirements are present within or adjacent to the Project Area. Results of the habitat assessment are intended to provide sufficient baseline information to the Project Proponents and, if required, to City, County, or other local government planning officials and federal and state regulatory agencies, including the U.S. Forest Service (Forest Service), U.S. Fish and Wildlife Service (USFWS) and CDFW, respectively, to determine if the Project is likely to affect any special status biological resources and to identify mitigation measures to offset those effects.

In addition to the BRA field survey, Jacobs assessed the Project Area for the presence of state and/or federal jurisdictional waters potentially subject to regulation by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA), Regional Water Quality Control Board (RWQCB) under Section 401 of the CWA and Porter-Cologne Water Quality Control Act, and CDFW under Section 1600 of the California Fish and Game Code (FGC), respectively.

1.1 Project Location

The overall Project Area consists of the Big Bear Valley, which is situated in the San Bernardino Mountains of San Bernardino County, California (Figures 1-3, Pages 4-6). The proposed Project is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are in the middle of this Basin. The Project will span just east of Big Bear Lake to the WWTP at Baldwin Lake and then south to Shay Pond, and southeast of Big Bear Lake to the Ski Resort Pond and Sand Canyon Recharge Area. The Project is located within several U. S. Geological Survey (USGS) 7.5 Minute Series Quadrangle maps, including the following: *Big Bear City, Big Bear Lake, Moonridge*. The central point for the proposed Project is the BBARWA WWTP, for which the geographic coordinates of the proposed Project are latitude: 34.268906, longitude: -116.815575. The BBARWA WWTP is in Section 7 of Township 2 North, Range 2 East, San Bernardino Base Meridian (SBBM).

Jacobs

SOURCE: Google Earth

FIGURE 1

Jacobs

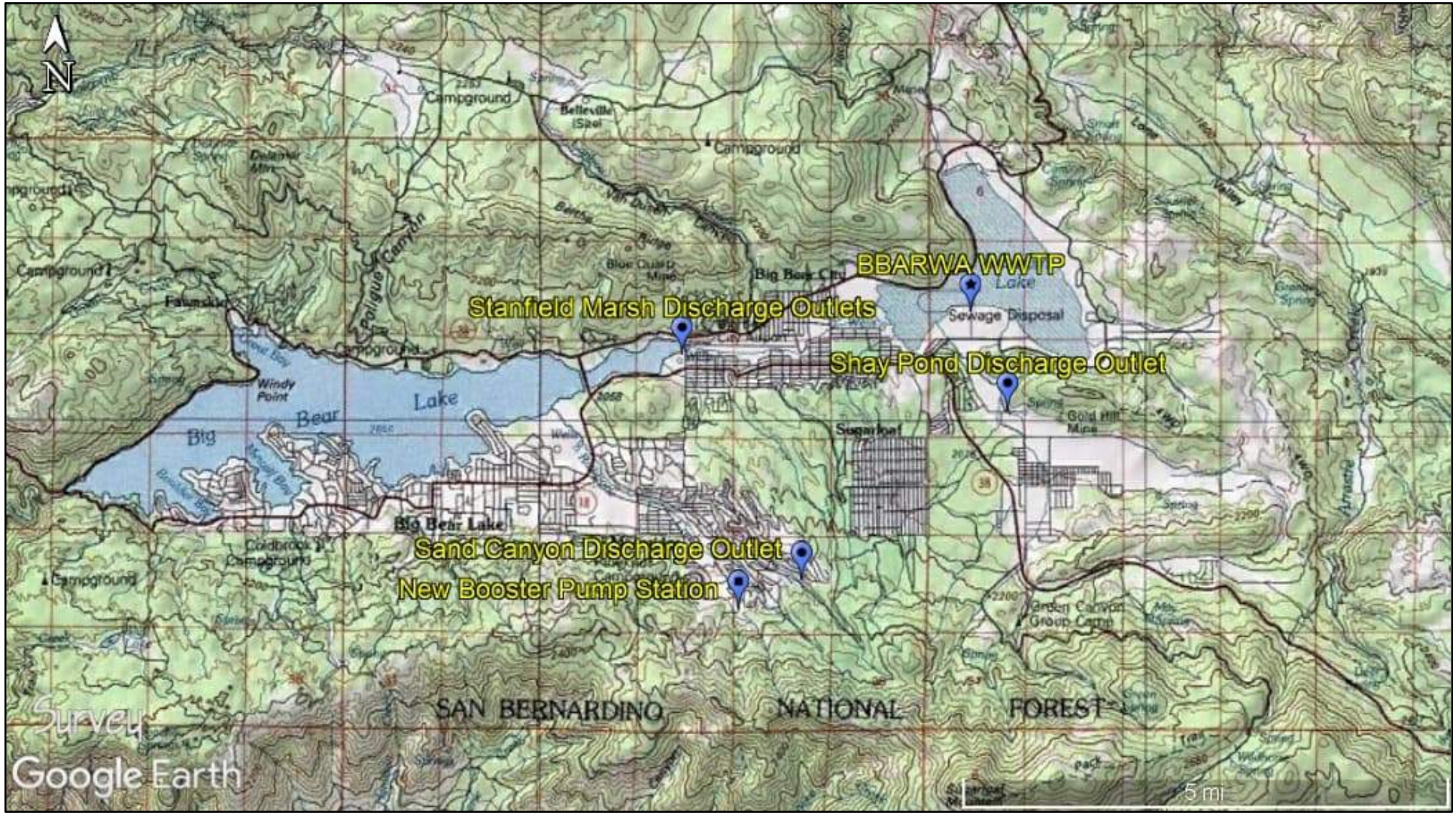
Regional Location
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 2

Project Vicinity Aerial
Replenish Big Bear Project

Jacobs



SOURCE: Google Earth

FIGURE 3

Jacobs

Project Vicinity Topo
Replenish Big Bear Project

1.2 Project Description

BBARWA owns and operates a 4.89 million gallon per day (MGD) capacity WWTP located just south of Baldwin Lake on the east side of the Big Bear Valley. In 2021, the WWTP treated approximately 1.85 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake, and County of San Bernardino Service Area (CSA) 53 in Fawnskin. The existing treatment process includes the following:

- Preliminary treatment consisting of a mechanical coarse screen and an aerated grit chamber.
- Secondary treatment consisting of extended aeration oxidation ditches and secondary clarifiers.
- Solids handling through a dewatering belt filter press.

Treated effluent is temporarily stored on-site prior to discharge to Lucerne Valley. Dewatered solids are hauled off-site. The influent flows to BBARWA's WWTP are comprised of three components:

- Flow from full-time residential homes.
- Flows due to tourism, commercial activities, and part-time residential homes.
- Flows from Infiltration and Inflow (I/I) due to precipitation.

These components create a seasonal variation in the wastewater flows treated at the plant. BBARWA's 2010 Sewer Master Plan (2010 SMP) estimated that the full-time residential rate is 38 percent (%) of the overall customer population within the area. The tourism season is largely concentrated in the months of December through April due the local ski resorts; additionally, the months of June and July also see a slight rise in tourism due to Lake recreation activities. The average daily flow is presently approximately 2.0 MGD and the maximum month flow is 5.4 MGD.

BBARWA's WWTP is located on a 93.5-acre property. The WWTP process components occupy 11.2 acres, and the remaining 82.3 acres include storage ponds and evaporation ponds. Influent flows are conveyed through three BBARWA operated sewer mains and lift stations to the plant. The WWTP currently provides preliminary and secondary treatment.

Treated secondary effluent is discharged to a 480-acre site in Lucerne Valley (LV Site) – about 20 miles north of the Big Bear Valley – for irrigation of fodder and fiber crops that are used as feed for livestock. Use of recycled water for crop irrigation at the LV Site began in 1980 and 100% of the WWTP effluent is currently discharged to the LV Site. Discharge to the LV Site must meet the Colorado River Basin RWQCB Waste Discharge Requirement (WDR), which has an effluent limit for TDS of 550 mg/L over a 12-month period.

1.2.1 Project Purpose and Objectives

Natural precipitation is the only source of recharge and water supply to the Big Bear Valley. Drought conditions and a long-term decline in precipitation trends have led the local water management agencies to investigate opportunities for supplemental water supplies, which are extremely limited due to its isolated location at the top of the Santa Ana River watershed (Figures 1-3, Pages 4-6). As such, the Replenish Big Bear Program has been designed to retain local water in the Valley to increase the sustainability of water supplies. To this end, the Project Proponents intend to implement the Replenish Big Bear Program, which would include the following uses and benefits:

- Purified water would be discharged to Shay Pond to sustain habitat for the state and federally listed as endangered unarmored threespine stickleback fish (*Gasterosteus aculeatus williamsoni*), which is currently sustained using potable groundwater.

- Purified water would be discharged to the Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), providing a consistent water source to sustain habitat and increase education opportunities for the community and visitors.

- Purified water would flow through Stanfield Marsh and provide new inflow to Big Bear Lake to increase inflows and Lake level, enhance recreational opportunities and aquatic habitat, and support water quality improvements.

- When needed, purified water stored in Big Bear Lake would be pumped to Sand Canyon to recharge the groundwater basin to strengthen the sustainability of the groundwater basin.

- Purified water stored in Big Bear Lake could also be used for golf course irrigation and dust control by the Big Bear Mountain Resorts (Resorts) in the summer.

- During wet periods, excess purified water stored in Big Bear Lake could be stored locally as snow, providing flexibility to further enhance winter recreation, reduce spills from Big Bear Lake, augment spring runoff, and increase groundwater recharge. This activity is not currently planned to be implemented as part of the Program, but the Program provides the flexibility to adapt if more extreme hydrologic conditions occur in the future.

- Additional inflow may enable BBMWD to modify their current Big Bear Lake management strategy to minimize spills and optimize releases to enable additional water to be captured downstream for recharge of the San Bernardino Basin, rather than discharged to the ocean.

For redundancy purposes, BBARWA is also seeking to maintain its current discharge location in Lucerne Valley, where undisinfected secondary effluent is currently conveyed to irrigate crops used for livestock feed.

1.2.1.1 Stanfield Marsh and Big Bear Lake

Stanfield Marsh is a 145-acre wildlife preserve that is home to rare and diverse species of birds, fish, amphibians, and mammals. Stanfield marsh is situated immediately east (upstream) of Big Bear Lake and is hydrologically connected to the Lake through a set of culverts under Stanfield Cutoff. Currently, rainfall and snowmelt are the only sources of water for Stanfield Marsh, so the water level varies from season to season and throughout longer hydrologic cycles. During wet periods, Stanfield Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, sometimes drying up completely, and the wildlife become scarce. In the last 15 years, Stanfield Marsh has been less than half full nearly 40 percent of the time. Full advanced treated water would provide a new, drought proof source of inflow to stabilize the water levels and sustain habitat in Stanfield Marsh even during dry periods. Additionally, overflow from Stanfield Marsh would provide new inflow into the Big Bear Lake and increase Lake levels relative to no Project conditions. The proposed outlets into the Lake at Stanfield Marsh would occur at one of two points just west of the Big Bear Airport (Figure 4, Page 10).

Big Bear Lake is managed by BBMWD, which has rights to the lake bottom, Bear Valley Dam, and the right to utilize and manage the surface of Big Bear Lake from Bear Valley Mutual (BVM). BVM maintains a storage right and ownership of all water inflow into the Lake. BVM has the right to request Lake releases commensurate with what may be reasonably necessary to meet the requirements of BVM's stockholders, not exceeding 65,000 acre-

feet (AF) in any ten (10) year period. BBMWD can maintain a higher water level in the lake by delivering water to BVM from an alternate source of water. This alternate source of water (In-Lieu Water) comes mainly from the State Water Project through a contract executed in 1996 with San Bernardino Valley Municipal Water District (Valley District).

BBMWD's current Lake Release Policy was adopted in 2006 provides guidance on how BVM demands will be met depending on the Lake level.

- When the Lake is in the top 4 feet, Mutual's demands will be met with Lake releases.
- When the Lake is between 4 and 6 feet below full, Lake releases will be made in the months of November through April and In-Lieu Water will be obtained from May to October.
- When the Lake is more than 6 feet below full, In-Lieu Water will be obtained.

Snowmaking Withdrawals

BBMWD currently has a contract with the Big Bear Mountain Resorts, allowing the withdrawal of an allocated amount of water from the Lake to use for snowmaking purposes. Currently, Big Bear Mountain Resort is authorized to withdraw a maximum of 11,000 AF of water from the Lake over a 10-year rolling period, not exceeding 1,300 AF in any single year. It is calculated that about half of the water withdrawn from the lake for this purpose is returned as runoff.

Fish Protection Releases

In 1995, the State Water Resources Control Board (SWRCB) issued Order No. 95-4, which requires BBMWD and Mutual to release water from the Lake for fishery protection in Bear Creek. Sufficient water must be released from the Lake to maintain specific flow standards, which vary by month and by hydrologic year type (normal, above normal, or below normal precipitation).

SOURCE: Google Earth

FIGURE 4

Stanfield Marsh Discharge Outlets
Replenish Big Bear Project

1.2.1.2 Unarmored Threespine Stickleback Habitat

One of the projected uses of the recycled water generated by the Replenish Big Bear Program would be to provide a continuous water supply to Shay Pond to enhance and maintain habitat for the state and federally listed as endangered unarmored threespine stickleback fish (UTS). The UTS is listed as endangered under both the federal ESA and CESA, as well as a CDFW Fully Protected species. There is a long history of study and group effort regarding the UTS population in the Shay Creek area. The main stakeholders include the USFWS, CDFW, the San Bernardino National Forest (SBNF), BBCCSD, BBLDWP, and BBARWA. The Shay Creek Working Group, which includes representatives from the USFWS, CDFW, SBNF, BBCCSD, BBLDWP, and BBARWA, was formed during the process of preparing the USFWS' 2002 Biological Opinion (BO) for the area. The requirements of the 2002 BO state that BBCCSD will continue to provide water to Shay Pond to maintain a minimum 20-gallon per minute (gpm) outflow from Shay Pond. To meet this outflow requirement, BBCCSD discharges 50 gpm of potable water into the pond. Based on the average volumes of discharges between 2012 and 2020, BBCCSD discharges approximately 50 acre-feet per year (AFY) of potable water into Shay Pond to maintain the UTS population.

The 2002 BO also states that, should a suitable alternative supply of water be found to be appropriate for the stickleback in the future, BBCCSD may use an 'in-lieu' water supply, which could include the use of tertiary-treated water. The proposed Project would provide an in-lieu water supply (i.e., full advanced treated water, which exceeds tertiary treated water) for Shay Pond to meet the requirements of the 2002 BO, which would enable BBCCSD to recover this potable supply to serve their customers. The proposed Project would replace potable water currently discharged to the pond with tertiary-treated water to maintain the water flow through the pond. The objective is to maintain a minimum pond water level that will support suitable habitat conditions for UTS. Up to 80 AFY of purified water would be sent to Shay Pond, and any remaining purified water will be sent to the Stanfield Marsh, which is tributary to Big Bear Lake.

1.2.1.3 Groundwater Recharge at Sand Canyon

The Sand Canyon groundwater recharge project involves extracting Project water stored in Big Bear Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water would then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline, as shown in Figures 5-6, Pages 13-14. The objective of the Sand Canyon recharge project is to recharge the groundwater basin. The following are operation strategies for the Sand Canyon recharge project:

- Recharge will occur within the defined Sand Canyon recharge area.
- Recharge will not occur during periods where natural surface flows occur in the channel.
- Recharge will occur over a 6-month dry weather period (April-October).
- Flows will be reduced or stopped if Project water does not fully percolate within the defined recharged area.

BBLDWP would monitor the discharge and percolation performance as needed to comply with permit requirements for the Sand Canyon recharge operation.

The hatched area along the Sand Canyon channel depicted on Figure 6, Page 14, is where surface water can percolate and still meet the travel time required to the nearest downstream well. The Project water stored in the Lake would have approximately 2,900 linear feet to percolate into the groundwater basin. The Project water is expected to fully percolate before reaching the end of the recharge area. If the Project water does not fully percolate within the defined recharge area, the surface application discharge rate will be reduced using a variable

frequency drive (VFD) on the Sand Canyon Booster Station until the water does percolate within the defined recharge area.

No channel modifications to the channel bottom are anticipated.

When water is needed for recharge in Sand Canyon, it is assumed that the existing Lake pump station owned by Big Bear Mountain Resort (Ski Resort) could be used to transfer water through an existing pipeline into the existing storage pond located at Bear Mountain Ski Resort. These facilities are used primarily for snowmaking in the winter and are expected to be available for the proposed recharge operation, which would only occur from April through October when the resorts are not making snow.

No new infrastructure is needed to extract the Sand Canyon recharge water from the groundwater basin. The Sand Canyon recharge water would become potable groundwater and would be extracted using BBLDWP's existing potable wells located downstream of the recharge area. The wells are located at least six months of travel time from the recharge area, as required by groundwater recharge regulations.

Once pumped out by BBLDWP, the water would be distributed to BBLDWP customers through the existing water distribution system. A portion (approximately 1/3) of the water will be delivered to BBCCSD using existing interconnections between BBCCSD and BBLDWP that are intended for transferring water between the two agencies.

SOURCE: Google Earth

FIGURE 5

Sand Canyon Recharge Facilities
Replenish Big Bear Project

Jacobs

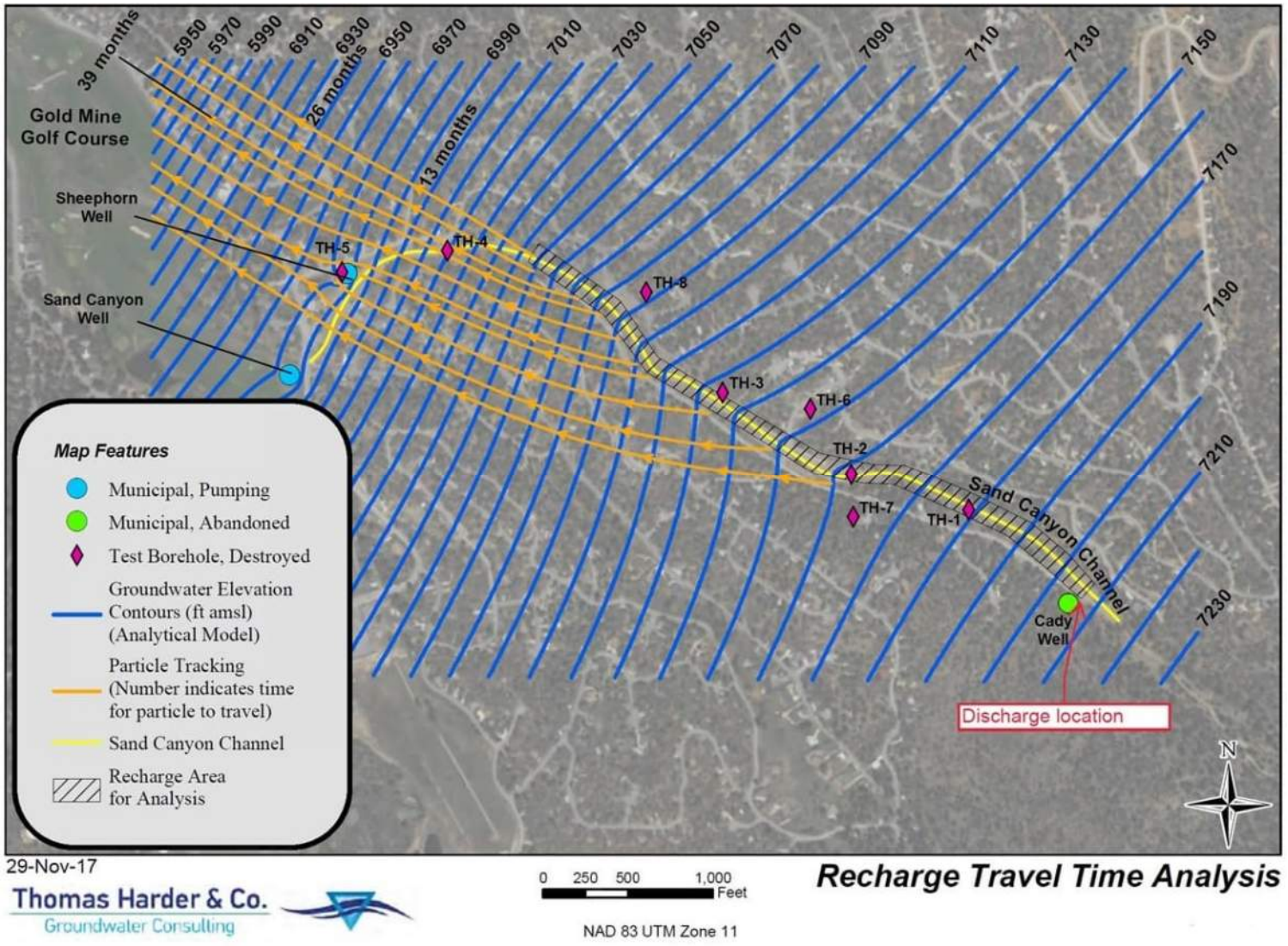


FIGURE 6

Jacobs

Sand Canyon Recharge Analysis
Replenish Big Bear Project

1.2.1.4 Other Uses

During wet periods, excess water could be stored as snow at the Resorts using their existing snowmaking infrastructure. This would reduce spills from the Lake, keep more of the water in the Valley, and enhance winter recreation by providing additional snowmaking water to the Resorts beyond their current allotment from the Lake. When the snow melts in the spring, runoff would be augmented, which is expected to increase natural groundwater recharge and may improve fish spawning habitat in streams tributary to the Lake.

A new proposed use under the proposed Program is to pump purified water stored in Big Bear Lake from the Bear Mountain intake pump (also owned by the Ski Resort) for landscape irrigation of the Bear Mountain Golf Course located at 43092 Goldmine Drive, Big Bear Lake, CA 92315. Golf course irrigation would keep additional water in the Valley, and the existing snowmaking facilities could also be used to deliver irrigation water to the Bear Mountain Golf Course in the summer, if desired.

Purified water stored in Big Bear Lake could also be used to provide dust control for a bike park at the Snow Summit Ski Resort. Each spring, the Snow Summit Ski resort is transformed into a bike park. Purified water stored in the Lake could be used from April to October for this purpose. It is estimated that about 120 AFY of purified water stored in the Lake could be utilized in support of this use under the proposed Program.

Additional inflows into Big Bear Lake will also provide BBMWD with more flexibility in managing Lake releases, while still maintaining high Lake levels. During wet periods, additional flood control releases are anticipated to flow down the Santa Ana River to the Seven Oaks Dam, which is upstream of the San Bernardino Groundwater Basin area. BBMWD intends to coordinate with San Bernardino Valley Municipal Water District (Valley District) to optimize the volume of releases from Big Bear Lake that can be captured for recharge of the Bunker Hill Basin, rather than flow past to the ocean.

1.2.2 Project Components

The Replenish Big Bear Program would consist of the following six general Project components:

1) Conveyance Pipelines
2) Ancillary Facilities including Monitoring Wells and Pump Stations
3) Evaporation Pond(s)
4) BBARWA WWTP Upgrades
5) Sand Canyon Outlet
6) Solar Energy Facilities

1.2.2.1 Project Component 1: Conveyance Pipelines

The Replenish Big Bear Program could ultimately install a total of about 6.59 miles or 34,810 LF of various types of pipelines, depending on which proposed alignments are selected. Potential alignments include the following:

- Installation of a pipeline to Big Bear Lake (Stanfield Marsh) utilizing one of three proposed alternatives from the WWTP to Stanfield Marsh in the maximum amount of approximately 19,940 LF sized at 12 inches in diameter (Figure 7, Page 17).

- Installation of approximately 710 LF of 4-inch pipeline to reach Shay Pond (UTS Habitat) from either an existing pipeline or a new 6-inch replacement pipeline that would be about 5,600 LF (Figures 8a-8b, Pages 18-19).

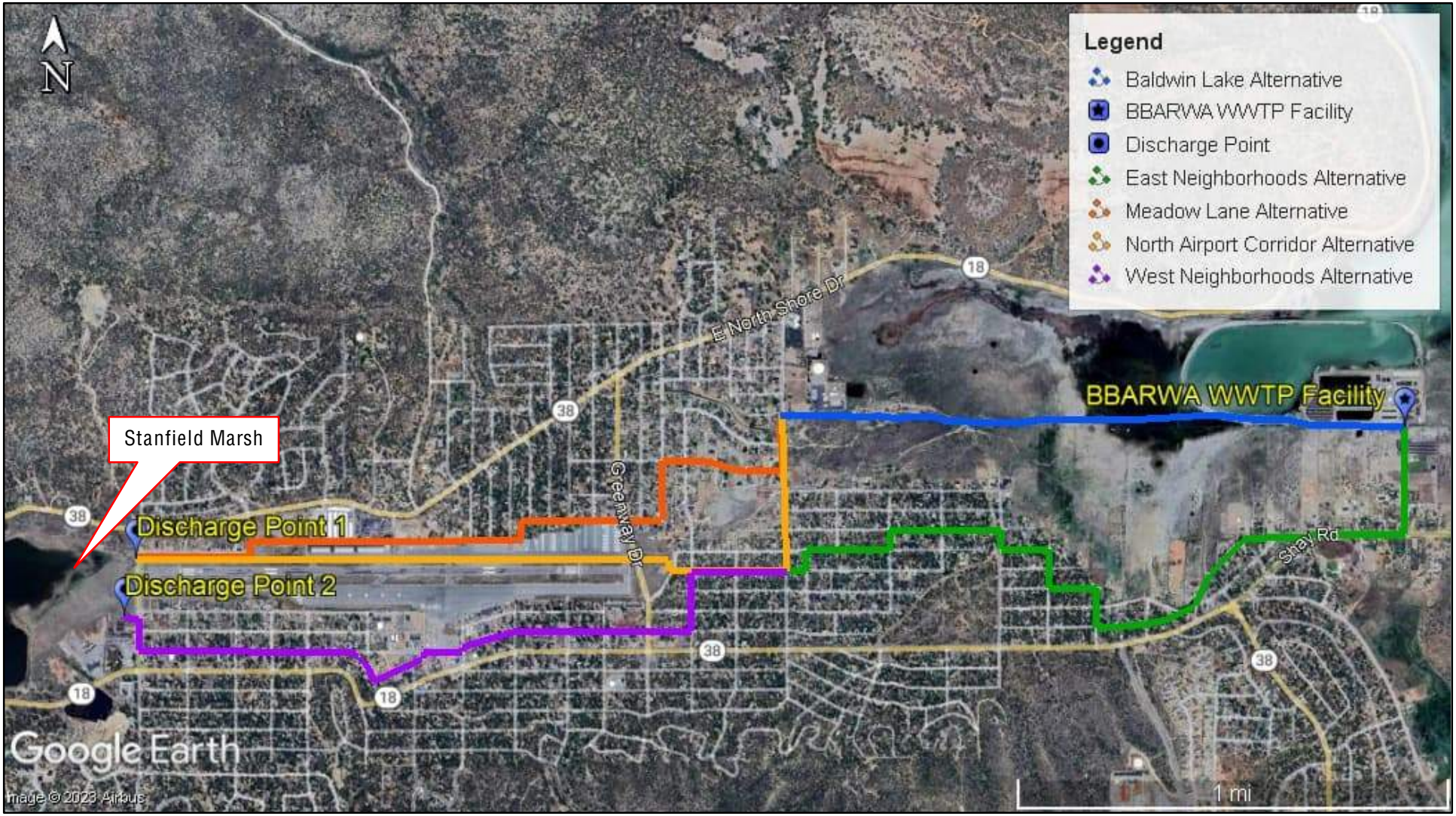
- Installation of approximately 7,210 LF of 8-inch pipeline that would convey stored water from an existing snowmaking storage pond to a discharge outlet into Sand Canyon (Figure 5, Page 13).

- Installation of approximately 1,350 LF of 8- to 10-inch brine pipeline from the WWTP pellet reactor to the solar evaporation ponds, all within the BBARWA WWTP property (Figure 9, Page 20).

The WWTP to Big Bear Lake (Stanfield Marsh) conveyance pipeline alternatives depicted on Figure 7, Page 17 as "East Neighborhoods Alternative," West Neighborhoods Alternative," and "Meadow Lane Alternative" would be constructed entirely within existing road right-of-way (ROW). For the pipelines in roadways, the total construction width would be up to 15 feet wide, including area for the trench, spoils pile, and pavement repair area. It should be noted that although the "North Airport Corridor Alternative" was included in this assessment, the Project Proponent is not likely to implement this alternative due to potential conflicts with airport operations.

The approximately 710-foot-long Shay Pond conveyance pipeline is expected to connect to an existing pipeline from the BBARWA WWTP. This new line would be constructed entirely within an existing unpaved road (Cascade Street). Figures 8a-8b on Pages 18-19 show a possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline as well. The Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. However, the replacement pipeline alternative ("Possible Replacement Pipeline Alignment") could be implemented should the existing pipeline be required to be replaced.

The Sand Canyon conveyance pipeline (Figure 5, Page 13) would mostly be constructed in existing road right-of-way, except for approximately 350 feet that would be constructed between two houses, which would require an easement.



SOURCE: Google Earth

FIGURE 7

Stanfield Marsh Conveyance Pipeline Alternatives
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 8a

Shay Pond Conveyance Pipeline
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 8b

Shay Pond Conveyance Pipeline
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 9

BBARWA WWTP
Replenish Big Bear Project

1.2.2.2 Project Component 2: Ancillary Facilities including Monitoring Wells and Pump Stations

The Replenish Big Bear Program anticipates the installation of up to four new monitoring wells:

- Installation of one or more monitoring wells at the evaporation pond on the WWTP Site to monitor groundwater quality, as required by the future discharge permit.

- Installation of two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.

The depths of a new wells are anticipated to range between 250 and 750 feet below ground surface, or as directed by the hydrogeologist. The average area of disturbance required to drill and construct each new well is anticipated to be half an acre or less. Drilling of up to four new wells during a given year, with flexibility to construct the four wells over a period of two or more years, will require the delivery and set up of the drilling rig at each site. It is anticipated these wells may be drilled concurrently, or at different times and the drilling equipment will be transported to and from the sites on separate occasions.

Additionally, the Project would require the installation of three pump stations to convey the water or brine generated by the proposed BBARWA WWTP Upgrades:

- Installation of a 50-gpm brine pump station.

- Installation of an anticipated 1,500 to 1,600 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

- Installation of a new 600 gpm pump station at the snowmaking pond to convey water to Sand Canyon (Figure 5, Page 13).

It is forecasted that, at each site, no more than 0.5 acre will be actively graded on a given day for site preparation of each pump station. Construction of the pump stations would involve site preparation and grading, construction of structural foundations, installation of piping and electrical equipment, pump, and motor installation, and final sitework, as well as the delivery of equipment and materials.

1.2.2.3 Project Component 3: Evaporation Ponds

The Replenish Big Bear Program would include the development of up to 57 acres of solar evaporation ponds, depending on the total system recovery rate achieved, at BBARWA's WWTP site to accommodate 22,000 gpd to 55,000 gpd of brine concentrate (Figure 9, Page 20). Each new pond is anticipated to be 8 to 10 feet deep with berms built up from the existing grade to create pond areas. Single basin dimensions would range from about 400 to 800 feet long and 400 to 800 feet wide, or about 3.75 to 7.5 acres to provide 6 to 10 ponds to accommodate the brine discharged from the treatment process. The berms would be built up so that the top of the berms would be level with the existing grade of the WWTP. This would provide protection from flooding in that area without requiring excavation much below the existing grade in that area.

The evaporation ponds would be constructed using large construction equipment; earthen berms would be installed; and the basins would be lined with an impermeable liner to prevent percolation of the brine into the underlying soil. Construction of the new evaporation ponds will require the delivery and installation of equipment and materials. It is not known whether each site will require import or export of soil, as the new evaporation ponds will require some excavation of the existing area to provide fill dirt for the earthen berms to create the pond areas. Given the size of the proposed 6 to 10 ponds (400 feet to 800 feet wide by 400 feet to 800 feet long

by 10 feet in depth), it is anticipated that a cut amount from 1 to 2-feet of the existing grade will provide enough fill dirt to create the earthen berms of the ponds. Periodically, the residual solids (primarily consisting of salts left after evaporation) would be collected and disposed of at an appropriately licensed disposal facility.

1.2.2.4 Project Component 4: BBARWA WWTP Upgrades

The Replenish Big Bear Program will require significant upgrades to the treatment process at the WWTP to meet stringent discharge requirements for the Big Bear Lake discharge and the Sand Canyon recharge portion. The existing BBARWA WWTP would be upgraded to produce full advanced treated water to serve the objectives outlined in the previous subsections (Figure 9, Page 20). These upgrades would treat wastewater to full advanced treatment at a capacity of 2.2 MGD, or approximately 2,210 AFY. Upgrades that would occur within the BBARWA WWTP are as follows:

- Upgrade the existing oxidation ditches to biological nutrient removal process.
- Tertiary filtration and nutrient removal via denitrification filters.
- Ultrafiltration (UF) and reverse osmosis (RO) membrane filtration.
- Brine pellet reactor for brine minimization.
- Ultraviolet disinfection and advanced oxidation process (UV/AOP).

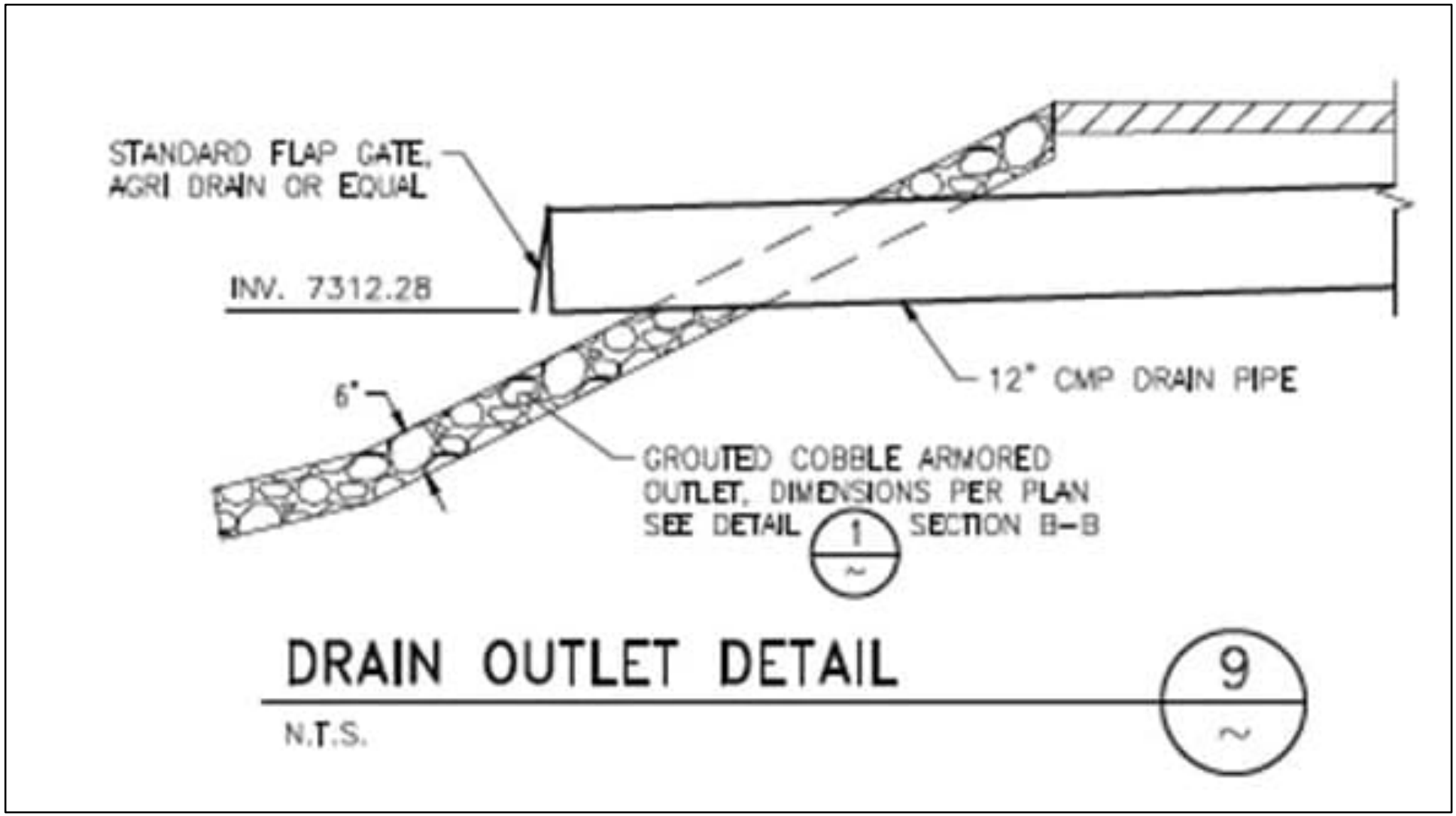
The construction activities to install upgrades at the BBARWA WWTP consists of the following range of activities: demolition of existing concrete basins, grading activities to prepare site for new construction, construction of concrete foundations and supports, installation of piping, equipment, and instrumentation, connection to existing electrical equipment and onsite utility water system construction of building foundations and building structures, and installation of treatment equipment. Civil and site work for the proposed BBARWA WWTP Upgrades would include demolition, grading, drainage, and site improvements. The area around new structures and processes would be backfilled to match existing finished surfaces. All disturbed areas would be paved, covered with crushed stone, or landscaped with ground cover. Areas that require routine vehicle access would be bituminous concrete roadways, consisting of a 12-inch gravel base course, a 2.5-inch bituminous concrete binder course and a 1.5-inch bituminous concrete top course. Areas that require routine pedestrian access would have concrete sidewalks. The sidewalk would consist of 4 inches of reinforced concrete on an 8-inch gravel base course. Painted steel bollards (approximately 4 inches in diameter and 42 inches high) would be provided as needed to protect equipment or structures that are near roadways.

1.2.2.5 Project Component 5: Sand Canyon Outlet

The discharge outlet to Sand Canyon would consist of a pipe outlet at the top of the channel bank that discharges down the side slope of the channel into the channel bottom. The channel slope will be protected from erosion using rip rap or similar erosion control methods, similar to the detail on Figure 10, Page 23.

1.2.2.6 Project Component 6: Solar Energy Facilities

The Project would include the installation of approximately 2.9 acres of new solar facilities (solar panels) within and adjacent the existing BBARWA WWTP (shown in green on Figure 9, Page 20). These new solar facilities would be constructed in previously disturbed areas and would likely require minimal grading and site preparation. Additionally, rooftop solar would be installed on the existing BBARWA Operations and Control building and Administration building.



SOURCE: BBARWA

FIGURE 10

Sand Canyon Discharge Detail
Replenish Big Bear Project

1.3 Environmental Setting

The Project Area is situated east/southeast of Big Bear Lake, in the Big Bear Valley area of the San Bernardino Mountains. The Big Bear Valley area is subject to both seasonal and annual variations in temperature and precipitation. Average annual maximum temperatures peak at 80.8 degrees Fahrenheit (° F) in July and fall to an average annual minimum temperature of 20.3° F in January. Average annual precipitation is greatest from November through April and reaches a peak in January (4.49 inches). Precipitation is lowest in the month of June (0.14 inches). Annual total precipitation averages 21.84 inches and annual total snowfall averages 62.6 inches.

The topography of the proposed Project footprint is flat, being mostly within existing paved roadways, WWTP facilities, and disturbed/graded areas. Much of the proposed Project is within and around Big Bear City, which has an elevation of approximately 6,770 feet above mean sea level (amsl). However, the Sand Canyon Recharge Facilities are within the unincorporated community of Moonridge, which is south of Big Bear City. The Moonridge residential area is a mountain community built on moderate to steep slopes. The elevation of the proposed Sand Canyon Recharge components of the Project ranges from approximately 7,275 feet amsl at the Sand Canyon discharge outlet, to 7,350 feet amsl at the highest point of the proposed conveyance pipeline.

Hydrologically, the Project Area is situated within the Bear Valley and Baldwin Hydrologic Sub-Areas (HSA 801.71 and 801.73). The Bear Valley HSA comprises a 34,333-acre drainage area, within the larger Santa Ana Watershed (HUC 18070203). The Baldwin HSA comprises a 22,789-acre drainage, also within the Santa Ana Watershed. The Santa Ana River is the major hydrogeomorphic feature within the Santa Ana Watershed. One of several tributaries to the Santa Ana River is Bear Creek, which outflows from Big Bear Lake from the Bear Valley Dam located at the westernmost (downstream) end of Big Bear Lake. Big Bear Lake is one of the head waters of the Santa Ana River Watershed.

Soils within the Project Area are comprised of the following:

- *Aquents-Grunney complex, 0 to 4 percent slopes*: Aquents family soils consist of sandy loam and stratified coarse sand, to sand, to sandy loam, to loam horizons comprised of mixed alluvium. This soil type is poorly drained and has been identified as a hydric soil. Grunney family soils consist of muck, mucky loam, and stratified loamy sand, to sandy loam, to silt loam horizons comprised of mixed alluvium. This soil type is also poorly drained and has been identified as a hydric soil. Aquents-Grunney complex, 0 to 4 percent slopes soils are present within the Baldwin Lake and Shay Pond portions of the proposed Project.

- *Moonridge-Shayroad-Caribou creek complex, 0 to 4 percent slopes*: Moonridge family soils consist of loam comprised of alluvium derived from granitoid. This soil type is well drained and has not been identified as a hydric soil. Shayroad family soils consist of sandy loam comprised of alluvium derived from granitoid. This soil type is also well drained and has not been identified as a hydric soil. Caribou creek family soils consist of loam and clay loam horizons comprised of mixed alluvium. Like Moonridge and Shayroad families, Caribou creek soils are well drained and do not have a hydric soil rating. Moonridge-Shayroad-Caribou creek complex, 0 to 4 percent slopes soils are present within the Baldwin Lake portion of the proposed Project.

- *Moonridge-Caribou creek-Urban land complex, 0 to 4 percent slopes*: See preceding description. This soil type is present within the Big Bear Lake (Stanfield Marsh) conveyance pipeline alternatives, except for the "Baldwin Lake Alternative" (Figure 7, Page 17).

- *Garloaf-Caribou creek-Urban land complex, 15 to 30 percent slopes*: See preceding description for Caribou creek family soils. Garloaf family soils consist of very cobbly loam and very cobbly clay loam

horizons comprised of alluvium derived from granitoid. This soil type is well drained and has not been identified as a hydric soil. Garloaf-Caribou creek-Urban land complex, 15 to 30 percent slopes soils are present within the Sand Canyon groundwater recharge portion of the Project, in Moonridge area.

- *Aquents-Riverwash complex, 0 to 4 percent slopes*: See top description for Aquents family soils. This soil type is present within the Sand Canyon groundwater recharge portion of the Project, in Moonridge area.

Please refer to Appendix E for a soil map of the Project Area and surrounding vicinity.

The Big Bear Valley area is comprised of small mountain communities in the SBNF that consist of a mix of residential and commercial development surrounded by undeveloped montane conifer forest (Figures 1-3, Pages 4-6). Existing land use surrounding the proposed Project footprint consists of residential neighborhoods, WWTP facilities, municipal airport, lake (Stanfield Marsh and Baldwin Lake), and open space. Adjacent undeveloped National Forest land supports a mix of montane conifer forests, shrublands, and montane meadow, and ruderal plant communities.

2. Assessment Methodology

2.1 Biological Resources Assessment

Data regarding biological resources in the Project Area were obtained through literature review and field investigation. Prior to performing the surveys, available databases, and documentation relevant to the Project Area were reviewed for documented occurrences of special status species in the Project vicinity (within approximately 3 miles). The USFWS threatened and endangered species occurrence data overlay, USFWS Information for Planning and Consultation System (IPaC), and the most recent versions of the California Natural Diversity Database (CNDDB; *Rarefind 5*) and California Native Plant Society Electronic Inventory (CNPSEI) databases were searched for special status species data in the *Big Bear Lake, Big Bear City, Fawnskin* and *Moonridge* USGS 7.5-Minute Series Quadrangles (Appendix F). These databases contain records of reported occurrences of state and federally listed species or otherwise sensitive species and habitats that may occur within the vicinity of the proposed Project footprint (within approximately 3 miles). Other available technical information on the biological resources of the area was also reviewed including previous surveys and recent findings.

2.1.1 Biological Resources Assessment Field Survey

Jacobs's biologist Daniel Smith conducted a biological resources assessment of the Project Area in June and July of 2022 and made a follow-up survey visit in July of 2023. Much of the Project is expected to be restricted to existing paved roadways and developed WWTP site. However, several Project components would impact areas that have not previously been developed including:

- The "Baldwin Lake Alternative" of the Stanfield Marsh conveyance pipeline from the BBARWA WWTP.
- The "North Airport Corridor Alternative" of the Stanfield Marsh conveyance pipeline from the BBARWA WWTP.
- Approximately 350 LF of the Sand Canyon conveyance pipeline from the existing Ski Resort storage pond.
- The Sand Canyon discharge outlet.
- The Shay Pond discharge outlet.
- The new solar evaporation ponds at the BBARWA WWTP.
- Approximately 2.9 acres of new solar facilities within and adjacent the WWTP.

Therefore, the reconnaissance-level field survey consisted of a pedestrian survey that encompassed 100% visual coverage of the undeveloped aspects of the Project, as well as the road shoulder along the proposed conveyance pipeline alignments, within the developed neighborhoods. No adjacent private properties were accessed during the survey. The purpose of the survey was to assess the Project Area for its potential to support special status species. Wildlife species were detected during field surveys by sight, calls, tracks, scat, and/or other sign. In addition to species observed, expected wildlife usage of the Project Area was determined based on known habitat preferences of regional wildlife species and knowledge of their relative distribution in the area. The focus of the faunal species survey was to identify potential habitat within and adjacent the proposed Project footprint for special status wildlife that may occur in the Project vicinity.

Floristic Botanical Field Survey

A floristic botanical field survey was also conducted by Jacobs's biologist Daniel Smith in June and July of 2022, a follow-up survey in July of 2023. In accordance with the CDFW's March 20, 2018, *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities*, the survey was conducted during the appropriate time of year, when the target species were both evident and identifiable. The target species consisted of those state and/or federally listed plant species that have been documented in the Project vicinity (within approximately 3 miles), whose environmental requirements may be present within the Project Area. Target species included:

- Ash-gray paintbrush (*Castilleja cinerea*)
- Big Bear Valley sandwort (*Eremogone ursina*)
- Southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanum*)
- Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*)
- San Bernardino Mountains bladderpod (*Physaria kingii* ssp. *bernardina*)
- San Bernardino blue grass (*Poa atropurpurea*)
- Bird-foot checkerbloom (*Sidalcea pedata*)
- California dandelion (*Taraxacum californicum*)
- Slender-petaled thelypodium (*Thelypodium stenopetalum*)

Prior to conducting the survey, Mr. Smith visited multiple reference sites within the Big Bear Valley area, where the target species are known to occur, to determine whether the target species were identifiable at the time of the survey and to obtain a visual image of the target species, associated habitat, and associated natural communities. The reference sites that were visited prior to survey included previously documented occurrences within the Big Bear Valley area, near the Aspen Glen Picnic Area (Big Bear Valley sandwort); the Eagle Point Rare Plant Preserve (ash-gray paintbrush, southern mountain buckwheat, bird-foot checkerbloom, California dandelion, and slender-petaled thelypodium); North Baldwin Meadow (San Bernardino blue grass); SBNF land northwest of the North Shore Drive/Division Drive intersection (Cushenbury buckwheat); and SBNF land in the vicinity of Holcomb Valley/Caribou Creek (San Bernardino Mountains bladderpod). All target species were evident and identifiable at the reference sites prior to the 2022 and 2023 survey visits. During the surveys, 100% visual coverage of the of the undeveloped aspects of the Project, as well as the road shoulder along the proposed conveyance pipeline alignments, was achieved by walking the proposed Project footprint and road shoulders, within and adjacent where Project related ground disturbance is expected to occur.

2.1.2 Survey Limitations

No private properties were accessed without landowner permission. No focused faunal surveys were conducted, and no small mammal trapping was performed. Approximately 350 LF of the Sand Canyon conveyance pipeline (Figure 5, Page 13) would be constructed between two houses, which would require an easement. Permission from the property owners of these two private residences was not obtained at the time of survey. Therefore, this section of the San Canyon conveyance pipeline alignment was not surveyed. Additionally, the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline (Figures 8a-8b, Pages 18-19) was not surveyed because the Project Proponent does not currently anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. Additional surveys should be conducted prior to implementation of Project activities within either of these two potential alignments, to assess potential Project related impacts to special status species and habitats that may occur in these areas.

2.2 Jurisdictional Waters Assessment

In June of 2022, Mr. Smith also evaluated the Project Area for the presence of riverine/riparian/wetland habitat and jurisdictional waters, i.e., Waters of the U.S. (WOTUS), as regulated by the USACE and RWQCB, and/or jurisdictional streambed and associated riparian habitat as regulated by the CDFW. Prior to the field visits, aerial photographs of the Project Area were viewed and compared with the surrounding USGS 7.5-Minute Topographic Quadrangle maps to identify drainage features within the survey area as indicated from topographic changes, blue-line features, or visible drainage patterns. The USFWS National Wetland Inventory and Environmental Protection Agency (EPA) Water Program "My Waters" Google Earth Pro data layer were also reviewed to determine whether any hydrologic features and wetland areas had been documented within the vicinity of the site. Similarly, the United States Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS) Web Soil Survey was reviewed for soil types found within the Project Area to identify the soil series in the area and to check these soils to determine whether they are regionally identified as hydric soils. Upstream and downstream connectivity of surface waters (if present) were reviewed on Google Earth Pro aerial photographs and topographic maps to determine jurisdictional status. The lateral extent of potential USACE jurisdiction was measured at the Ordinary High Watermark (OHWM) in accordance with regulations set forth in 33CFR part 328 and the USACE guidance documents listed below:

- *USACE Wetlands Research Program Technical Report Y-87-1 (on-line edition), Wetlands Delineation Manual, Environmental Laboratory, 1987 (Wetland Delineation Manual).*
- *USACE Minimum Standards for Acceptance of Preliminary Wetlands Delineations, November 30, 2001 (Minimum Standards).*
- *USACE Jurisdictional Determination Form Instructional Guidebook, May 30, 2007 (JD Form Guidebook).*
- *USACE Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0), May 2010.*
- *USACE A Guide to Ordinary High-Water Mark (OHWM) Delineation for Non-Perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States, August 2014 (Delineation Manual).*

To be considered a *jurisdictional wetland* under the federal CWA, Section 404, an area must possess three (3) wetland characteristics: hydrophytic *vegetation*, hydric *soils*, and wetland *hydrology*.

- *Hydrophytic vegetation*: Hydrophytic vegetation is plant life that grows, and is typically adapted for life, in permanently or periodically saturated soils. The hydrophytic vegetation criterion is met if more than 50 % of the dominant plant species from all strata (tree, shrub, and herb layers) is considered hydrophytic. Hydrophytic species are those included on the 2018 National Wetland Plant Lists for the Arid West Region (USACE 2018). Each species on the lists is rated with a wetland indicator category, as shown in Table 1 (below). To be considered hydrophytic, the species must have *wetland indicator status*, i.e., be rated as OBL, FACW or FAC.

Table 1. Wetland Indicator Vegetation Categories

Category	Probability
Obligate Wetland (OBL)	Almost always occur in wetlands (estimated probability >99%)
Facultative Wetland (FACW)	Usually occur in wetlands (estimated probability 67 to 99%)
Facultative (FAC)	Equally likely to occur in wetlands and non-wetlands (estimated probability 34 to 66%)
Facultative Upland (FACU)	Usually occur in non-wetlands (estimated probability 67 to 99%)
Obligate Upland (UPL)	Almost always occur in non-wetlands (estimated probability >99%)

- *Hydric Soil*: Soil maps from the USDA-NRCS Web Soil Survey (USDA 2021) were reviewed for soil types found within the Project Area. Hydric soils are saturated or inundated long enough during the growing season to develop anaerobic conditions that favor growth and regeneration of hydrophytic vegetation. There are several indirect indicators that may signify the presence of hydric soils including hydrogen sulfide generation, the presence of iron and manganese concretions, certain soil colors, gleying, and the presence of mottling. Generally, hydric soils are dark in color or may be gleyed (bluish, greenish, or grayish), resulting from soil development under anoxic (without oxygen) conditions. Bright mottles within an otherwise dark soil matrix indicate periodic saturation with intervening periods of soil aeration. Hydric indicators are particularly difficult to observe in sandy soils, which are often recently deposited soils of flood plains (entisols) and usually lack sufficient fines (clay and silt) and organic material to allow use of soil color as a reliable indicator of hydric conditions. Hydric soil indicators in sandy soils include accumulations of organic matter in the surface horizon, vertical streaking of subsurface horizons by organic matter, and organic pans.

  The hydric soil criterion is satisfied at a location if soils in the area can be inferred or observed to have a high groundwater table, if there is evidence of prolonged soil saturation, or if there are any indicators suggesting a long-term reducing environment in the upper part of the soil profile. Reducing conditions are most easily assessed using soil color. Soil colors were evaluated using the Munsell Soil Color Charts (Munsell 2000). Soil pits are dug (when necessary) to an approximate depth of 16-20 inches to evaluate soil profiles for indications of anaerobic and redoximorphic (hydric) conditions in the subsurface.

- *Wetland Hydrology*: The wetland hydrology criterion is satisfied at a location based upon conclusions inferred from field observations that indicate an area has a high probability of being inundated or saturated (flooded, ponded, or tidally influenced) long enough during the growing season to develop anaerobic conditions in the surface soil environment, especially the root zone (USACE 1987 and USACE 2008).

Evaluation of CDFW jurisdiction followed guidance in the FGC. Specifically, CDFW jurisdiction would occur where a stream has a definite course with a distinguishable bed and bank showing evidence of where waters rise to their highest level and to the extent of associated riparian vegetation.

3. Results

3.1 Existing Biological and Physical Conditions

The proposed Project footprint is within both urban and natural/semi-natural environments. The East Neighborhoods, Meadow Lane, and West Neighborhoods conveyance pipeline alternatives and associated discharge outlets, as well as the Sand Canyon recharge conveyance pipeline and associated discharge outlet, Sand Canyon monitoring wells, and new 600 gpm pump station at the existing Ski Resort snowmaking pond are all situated in a residential development setting (Figure 5, Page 14; Figure 7, Page 18). These conveyance pipeline alignments are entirely within existing disturbed/developed areas including paved roadways. The North Airport Corridor conveyance pipeline alternative is within a public airport setting, surrounded by residential development (Figure 7, Page 18). The remaining monitoring wells, pump stations, and WWTP upgrades are situated within existing developed WWTP facilities (Figure 9, Page 21). The proposed solar energy facilities would be constructed on existing rooftops and adjacent previously disturbed/graded areas around the BBARWA WWTP (Figure 9, Page 21).

The Baldwin Lake conveyance pipeline alternative follows an existing unpaved trail alignment (West Baldwin Lake Trail) within montane meadow, shrubland, and temporarily to seasonally flooded lacustrine habitats (Figure 7, Page 18). The Shay Pond conveyance pipeline would be constructed within an existing unpaved road (Cascade Street) surrounded by rural residential development and montane meadow habitat (Figure 8b, Page 19). The proposed evaporation ponds would be constructed on BBARWA WWTP property, within a previously disturbed/graded section of Baldwin Lake consisting of temporarily to seasonally flooded lacustrine habitat (Figure 9, Page 21).

Disturbances in the Project Area consist mostly of vehicular traffic and pedestrian use associated with the existing roads and residential developments, as well as existing utility infrastructure (i.e., the BBARWA WWTP) and associated WWTP operations. Other disturbances include feral livestock grazing in the vicinity of Shay Pond, domestic livestock grazing on the BBARWA WWTP property, disturbances associated with ongoing airport maintenance and operations at the Big Bear City Airport, vegetation removal/weed abatement, and illegal dumping.

3.1.1 Habitat

Habitats present within and/or adjacent the Project Area include:

- *Pinus jeffreyi* Forest & Woodland Alliance (Jeffrey pine forest and woodland)
- *Juniperus grandis* Woodland Alliance (mountain juniper woodland)
- *Artemisia tridentata* Shrubland Alliance (big sagebrush)
- *Schoenoplectus acutus* Herbaceous Alliance (hardstem bulrush marsh)
- wet montane meadow habitat
- temporarily to seasonally flooded lake (Baldwin Lake)

Sand Canyon Recharge

The undeveloped SBNF adjacent the Sand Canyon recharge conveyance pipeline and associated discharge outlet, Sand Canyon monitoring wells, and new 600 gpm pump station at the existing Ski Resort snowmaking pond supports mixed Jeffrey pine forest and woodland and mountain juniper woodland habitats. The Jeffrey pine forest and woodland habitat is characterized by an open to continuous tree canopy, with a sparse to intermittent shrub layer and varied herbaceous layer (Sawyer et al. 2009). The mountain juniper woodland habitat is characterized by an open to intermittent tree canopy, with a sparse to intermittent shrub layer and sparse or

grassy herbaceous layer (Sawyer et al. 2009). Dominant or otherwise conspicuous species in these plant communities include Jeffrey pine (*Pinus jeffreyi*), Sierra juniper (*Juniperus grandis*), California black oak (*Quercus kelloggii*), white fir (*Abies concolor*), manzanita (*Arctostaphylos* spp.), common sagebrush (*Artemisia tridentata*), and desert mountain mahogany (*Cercocarpus ledifolius*).

Shay Pond

The habitat surrounding the Shay Pond conveyance pipeline alignment (Cascade Street) and discharge outlet consists of a mosaic of ruderal vegetation, big sagebrush, and wet montane meadow habitat. The big sagebrush habitat within this area is characterized by an open canopy, with a sparse to intermittent shrub layer dominated by common sagebrush (*Artemisia tridentata*) and an intermittent grassy herbaceous layer (Sawyer et al. 2009). The wet montane meadow habitat in this area is dominated by sedge (*Carex* spp.), rush (*Juncus* spp.), and beardless wild rye (*Elymus triticoides*). Non-native and ruderal vegetation within this area consists mostly of brome grasses (*Bromus* spp.), Russian thistle (*Salsola tragus*), and tumble mustard (*Sisymbrium altissimum*).

Baldwin Lake

The habitat surrounding the Baldwin Lake conveyance pipeline alternative consists of temporarily to seasonally flooded lake at the eastern end of the proposed alignment, transitioning to wet montane meadow habitat toward the middle of the alignment, and big sagebrush habitat near the western end of the alignment. Dominant species within these plant communities include fox tail barley (*Hordeum jubatum*), summer cypress (*Kochia scoparia*), prickly lettuce (*Lactuca serriola*), *Carex* spp., *Juncus* spp., beardless wild rye, and common sagebrush, respectively.

The proposed solar evaporation ponds would be constructed within a previously disturbed/graded section of Baldwin Lake consisting of temporarily to seasonally flooded lacustrine habitat. Plant communities in this area consist of hardstem bulrush marsh dominated by tule (*Schoenoplectus acutus*), wet montane meadow habitat dominated by *Carex* spp. and *Juncus* spp., and ruderal vegetation dominated by goosefoot (*Chenopodium chenopodioides*), fox tail barley, summer cypress, and prickly lettuce.

The proposed solar energy facilities would be constructed on existing rooftops and adjacent previously disturbed/graded areas around the BBARWA WWTP consisting of bare ground and ruderal vegetation dominated by *Bromus* spp., Coastal heron's bill (*Erodium cicutarium*), summer cypress, prickly lettuce, and tumble mustard.

Please refer to Appendix C for a complete list of all plant species observed on site during surveys.

3.1.2 Wildlife

The proposed Project footprint is mostly within existing residential and commercial developments and the only species expected to occur within these areas are those adapted to an urban environment. During the survey, special attention was focused on those Project components that are within or immediately adjacent undeveloped areas, where special status species are more likely to occur, including the Baldwin Lake conveyance pipeline alternative, the proposed evaporation ponds and solar energy facilities sites, the Shay Pond conveyance pipeline and discharge outlet site, and the Sand Canyon discharge outlet site.

Amphibians and Reptiles

The only amphibian species observed or otherwise detected within the Project Area during the reconnaissance level survey was the California toad (*Anaxyrus boreas halophilus*). Reptile species observed within the Project Area during survey included Skilton's skink (*Plestiodon skiltonianus skiltonianus*) and southern sagebrush lizard

(*Sceloporus graciosus vandenburgianus*). Other common herp species expected to occur within the Project Area include southern Pacific rattlesnake (*Crotalus oreganus helleri*), San Diego alligator lizard (*Elgaria multicarinata webbii*), San Diego gophersnake (*Pituophis catenifer annectens*), Great Basin fence lizard (*Sceloporus occidentalis longipes*), and mountain gartersnake (*Thamnophis elegans elegans*).

Birds

Birds were the most observed wildlife group during survey and species observed or otherwise detected in the Project Area during the reconnaissance level survey included:

- Red-winged Blackbird (*Agelaius phoeniceus*)
- Mallard (*Anas platyrhynchos*)
- Bufflehead (*Bucephala albeola*)
- Killdeer (*Charadrius vociferus*)
- Northern Flicker (*Colaptes auratus*)
- Common Raven (*Corvus corax*)
- Steller's Jay (*Cyanocitta stelleri*)
- Horned Lark (*Eremophila alpestris*)
- Brewer's Blackbird (*Euphagus cyanocephalus*)
- American Coot (*Fulica americana*)
- House Finch (*Haemorhous mexicanus*)
- Dark-eyed Junco (*Junco hyemalis*)
- American Wigeon (*Mareca americana*)
- Acorn Woodpecker (*Melanerpes formicivorus*)
- Brown-headed Cowbird (*Molothrus ater*)
- Ruddy Duck (*Oxyura jamaicensis*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Cliff Swallow (*Petrochelidon pyrrhonota*)
- Eared Grebe (*Podiceps nigricollis*)
- Pied-billed Grebe (*Podilymbus Podiceps*)
- Mountain Chickadee (*Poecile gambeli*)
- Western Bluebird (*Sialia mexicana*)
- Pygmy Nuthatch (*Sitta pygmaea*)
- Violet-green Swallow (*Tachycineta thalassina*)
- American Robin (*Turdus migratorius*)

Mammals

Mammal species observed or otherwise detected within the Project Area during the reconnaissance level survey included coyote (*Canis latrans*), California ground squirrel (*Otospermophilus beecheyi*), western gray squirrel (*Sciurus griseus*), Botta's pocket gopher (*Thomomys bottae*). Other common mammal species expected to occur within the Project Area include bobcat (Lynx rufus), Merriam's chipmunk (*Neotamias merriami*), mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), and American black bear (*Ursus americanus*). Additionally, numerous feral donkeys (*Equus asinus*) were observed during survey in the vicinity of Shay Pond and several domestic cattle were observed on Baldwin Lake at the BBARWA WWTP.

3.2 Special Status Species and Habitats

According to the CNDDB, 102 special status species (73 plant species, 29 animal species) and two sensitive habitats have been documented in the *Big Bear Lake, Big Bear City, Fawnskin* and *Moonridge* USGS 7.5-Minute Series Quadrangles. This list of special status species and habitats includes any state and/or federally listed threatened or endangered species, California Fully Protected species, CDFW designated Species of Special Concern (SSC), and otherwise Special Animals. "Special Animals" is a general term that refers to all the taxa the CNDDB is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special status species." The CDFW considers the taxa on this list to be those of greatest conservation need.

The USFWS IPaC search identified three additional special status species as potentially occurring in the regional vicinity of the proposed Project. Of the 105 special status species identified by the CNDDB and IPaC queries, 21 are state and/or federally listed or proposed for listing as threatened or endangered species. Table 2 (below) provides a list of all state and/or federally listed or proposed threatened and endangered species identified by the CNDDB and IPaC queries, where they are found (locally, adjacent to the proposed Project footprint, or within the proposed Project footprint), if suitable habitat for that species exists within the Project Area and whether the Project may affect that species.

Table 2. Listed Species Documented in the Project Vicinity

Common Name	Scientific Name	Status	Found Locally	Found Adjacent	Found Within	Suitable Habitat	Project Affect
Plants:							
Cushenbury oxytheca	*Acanthoscyphus parishii* var. *goodmaniana*	FE	No	No	No	None	No effect
Cushenbury milk-vetch	*Astragalus albens*	FE	No	No	No	None	No effect
ash-gray paintbrush	*Castilleja cinerea*	FT	Yes	Yes	No	Yes	No effect
Big Bear Valley sandwort	*Eremogone ursina*	FT	Yes	No	No	None	No effect
Parish's daisy	*Erigeron parishii*	FT	No	No	No	None	No effect
southern mountain buckwheat	*Eriogonum kennedyi* var. *austromontanum*	FT	Yes	No	No	None	No effect
Cushenbury buckwheat	*Eriogonum ovalifolium* var. *vineum*	FE	Yes	No	No	None	No effect
San Bernardino Mountains bladderpod	*Physaria kingii* ssp. *bernardina*	FE	No	No	No	None	No effect

Common Name	Scientific Name	Status	Found Locally	Found Adjacent	Found Within	Suitable Habitat	Project Affect
San Bernardino blue grass	*Poa atropurpurea*	FE	Yes	Yes	No	Yes	No effect
bird-foot checkerbloom	*Sidalcea pedata*	FE/SE	Yes	Yes	Yes	Yes	May affect, and is likely to adversely affect
California dandelion	*Taraxacum californicum*	FE	Yes	Yes	No	Yes	No effect
slender-petaled thelypodium	*Thelypodium stenopetalum*	FE/SE	Yes	Yes	No	Yes	No effect
Insects:							
quino checkerspot butterfly	*Euphydryas editha quino*	FE	No	No	No	None	No effect
Amphibians:							
southern mountain yellow-legged frog	*Rana muscosa*	FE/SE	No	No	No	None	No effect
Fish:							
unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	FE/SE	Yes	Yes	No	Adjacent	May affect, but not likely to adversely affect
steelhead - southern California DPS	*Oncorhynchus mykiss irideus* pop. 10	FE	No	No	No	None	No effect
Birds:							
southwestern willow flycatcher	*Empidonax traillii extimus*	FE/SE	No	No	No	None	No effect
bald eagle	*Haliaeetus leucocephalus*	FD/SE	Yes	Yes	No	Adjacent	May affect, but not likely to adversely affect
California spotted owl	*Strix occidentalis occidentalis*	FPE	No	No	No	None	No effect
Reptiles:							
southern rubber boa	*Charina umbratica*	ST	Yes	No	No	Yes	May affect, but not likely to adversely affect
Mojave desert tortoise	*Gopherus agassizii*	FT/ST	No	No	No	None	No effect

Notes:
FE = Federally Endangered
FT = Federally Threatened
SE = State Endangered
ST = State Threatened

FD = Federally Delisted
FPE = Federally Proposed Endangered

The aquatic habitats required by southern mountain yellow-legged frog are absent from the Project Area and this species is considered extirpated from the Big Bear Valley (USFWS 2019). Likewise, the Project Area is outside the current range of the southern California steelhead (NMFS 2023). Additionally, the habitats required by southwestern willow flycatcher (i.e., riparian) and Mojave desert tortoise (i.e., desert scrub/desert woodland) are absent from the Project Area and these species have not been documented in the Project vicinity (within approximately 3 miles). Therefore, no further discussion of these species is warranted.

Although not a state or federally listed species, the San Bernardino flying squirrel (*Glaucomys sabrinus californicus*) is a CDFW SSC and is considered a particularly sensitive species within the region. Furthermore, this species has been documented in the Project vicinity (within approximately 3 miles). Therefore, San Bernardino flying squirrel will be included in the discussion below, along with the state and/or federally listed species that have been documented in the Project vicinity.

An analysis of the likelihood for occurrence of all CNDDB special status species documented in the *Big Bear Lake, Big Bear City, Fawnskin,* and *Moonridge* quads is provided in Appendix A. This analysis considers species' range as well as documentation within the vicinity of the Project Area and includes the habitat requirements for each species and the potential for their occurrence on site, based on required habitat elements and range relative to the current site conditions. A complete list of all special status species identified by the IPaC, CNDDB, and CNPSEI databases as potentially occurring in the Project vicinity is provided in Appendix F.

3.2.1 Special Status Species

The only state and/or federally listed threatened or endangered species observed in the Project Area during survey was the state and federally listed as endangered bird-foot checkerbloom (see discussion below). However, there is habitat within the Project Area that is suitable to support several other listed species that have been documented in the Project vicinity.

3.2.1.1 Special Status Plants

Cushenbury Milk-vetch – Endangered (Federal)

The federally listed as endangered Cushenbury milk-vetch is a silvery-white (pubescent), short-lived perennial herb in the pea family (Fabaceae). The stems form loose, prostrate mats, up 30 centimeters (11.8 inches) wide. The leaves are pinnately compound with 5 to 9 leaflets. The spreading or reflexed inflorescences (flower clusters) support 5 to 14 pink-purple bilateral flowers that develop crescent shaped fruit pods (Wojciechowski Spellenberg 2012). This species is typically found in rocky, carbonate substrates along washes and slopes within pinyon woodland, pinyon-juniper woodland, Joshua tree woodland, and blackbush scrub habitats on the northern (desert) slopes of the San Bernardino Mountains at elevations between 1,185 and 1,950 meters (3,888 to 6,397 feet). Cushenbury milk-vetch is typically found on soils derived directly from decomposing limestone rock (USFWS 2009a). This species typically blooms from March through June (Calflora 2023).

> *Findings*: According to the CNDDB, the nearest documented Cushenbury milk-vetch occurrence (2021) is approximately 2.4 miles northeast of the BBARWA WWTP site. This occurrence is located along a ridge between Nelson ridge and Arrastre Creek, on soils derived from carbonate and quartz monzonite in open pinyon woodland habitat (CNDDB 2023). There are no documented Cushenbury milk-vetch occurrences in the Big Bear Valley.

The USFWS lists the primary constituent elements (PCEs) for Cushenbury milk-vetch designated Critical Habitat as:

1. soils derived primarily from the upper and middle members of the Bird Spring Formation and Undivided Cambrian parent materials that occur on dry flats and slopes or along rocky washes with limestone outwash/deposits at elevations between 1,171 and 2,013 meters (3,864 and 6,604 feet).

2. soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment).

3. associated plant communities that have areas with an open canopy cover and little accumulation of organic material (e.g., leaf litter) on the surface of the soil.

The associated plant communities (PCE 3) and carbonate or limestone substrates (PCE 1) Cushenbury milk-vetch requires do not occur within the proposed Project footprint. Furthermore, most of the proposed Project footprint has been previously disturbed and the soils on site are no longer intact, natural surfaces (PCE 2). Additionally, the Project Area is outside the known elevation range for this species, which has not been documented in the Big Bear Valley. Therefore, Cushenbury milk-vetch is presumed absent from the proposed Project footprint and the Project will not affect this species.

Ash-gray Paintbrush – Threatened (Federal)

The federally listed as threatened ash-gray paintbrush is a hemiparasitic, perennial herb in the broomrape family (Orobanchaceae), with several ascending to decumbent (trailing) grayish stems sprouting from the root crown. The stems are 1 to 2 decimeters (4 to 8 inches) tall (Munz 1974, p. 795). Ash-gray paintbrush is distinguished from other species of *Castilleja* within its range by its perennial nature, ashy-puberulent (covered with short hairs) stems and leaves, yellowish or reddish flowers, with calyx lobes of equal length (Wetherwax et al. 2012, p. 957). Host plants include *Eriogonum kennedyi* var. *austromontanum*, *Eriogonum kennedyi* var. *kennedyi*, *Eriogonum wrightii* var. *subscaposum*, *Artemisia tridentata* ssp. *tridentata*, *Artemisia nova*, and other *Artemisia* taxa (USFWS 2013a). However, because this species also possesses photosynthetic green leaves that can produce sugars, it is termed hemiparasitic and does not require a host plant species for its survival (USFWS 2013a). This species typically occupies the meadow/forest ecotone (transitional area of vegetation between two different plant communities) of the San Bernardino Mountains at elevations between 1,800 and 3,300 meters (5,905 to 10,827 feet.) and has been recorded in the following ecological communities: pebble plains, dry and wet forest meadows, mixed conifer forests, open pine forests, and pinyon-juniper woodlands (USFWS 2013a). However, the primary habitat for this species is pebble plains, supporting one or more of the host plant species for ash-gray paintbrush (USFWS 2013a). This species typically blooms from June through August (Calflora 2023).

Findings: According to the CNDDB, the nearest documented ash-gray paintbrush occurrences are adjacent the southeast corner of the BBARWA WWTP (1999) and approximately 400 feet north of the Baldwin Lake conveyance pipeline alternative (2016), within big sagebrush habitat near the western end of this proposed alignment alternative (West Baldwin Lake Trail). There is suitable habitat for this species within the proposed Project footprint near the western end of the Baldwin Lake conveyance pipeline alternative and potential hostplant species (*Artemisia* spp.) are present in this area as well. However, ash-gray paintbrush was not observed within the proposed Project footprint during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, ash-gray paintbrush is considered absent from the proposed Project footprint at the time of survey and the Project will not affect this species.

Suitable Habitat Locations in Program Area:

- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative

Big Bear Valley Sandwort – Threatened (Federal)

The federally listed as threatened Big Bear Valley sandwort is a low, tufted perennial herb in the pink family (Caryophyllaceae). Individual plants are green, with stems from 10 to 18 centimeters (3.9 to 7.1 inches) long. The leaves are opposite and 0.5 to 1 centimeter (0.2 to 0.39 inches) long. The flowers are white, five-petaled, and arranged in open cymes (clusters). The petals are 0.2 to 0.45 centimeters (0.1 to 0.18 inches) long (USFWS 2015a). This species is typically found in pebble plain habitat in the northeastern San Bernardino Mountains of southwest San Bernardino County at elevations between 1,950 and 2,100 meters (6,393 to 6,885 feet.) (USFWS 2015a). Pebble plains are a rare plant community that occur in treeless, open patches within pine forests and pinyon-juniper woodlands that are comprised of clay soil mixed with quartzite pebbles and gravel that are continually pushed to the surface through frost action (USFS 2002, pp. 12, 15). Big Bear Valley sandwort is typically found within pebble plain habitat and is one of three indicator plant species, along with *Eriogonum kennedyi* var. *austromontanum*, and *Ivesia argyrocoma* var. *argyrocoma* defining a pebble plain (USFWS 2015a). This species typically blooms from May through August (Calflora 2023).

Findings: According to the CNDDB, the nearest documented Big Bear Valley sandwort occurrences are approximately 0.3 mile west (2021) and 0.5 mile north (1981) of the proposed Shay Pond conveyance pipeline alignment, within the Sawmill Pebble Plain Complex. However, there is no pebble plain or pebble plain-like habitat suitable for Big Bear Valley sandwort within the proposed Project footprint and this species was not detected during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, Big Bear Valley sandwort is considered absent from the proposed Project footprint at the time of survey and the Project will not affect this species.

Parish's Daisy – Threatened (Federal)

The federally listed as endangered Parish's daisy is a small perennial herb (subshrub) in the aster family (Asteraceae). The vertically oriented stems are few-branched near the mid-stem, silvery-hairy, especially distally, and grow to 10 to 35 centimeters (3.9 13.8 inches) in height (Keil and Nesom 2012). The cauline leaves (sometimes absent by flowering) are linear and silvery-strigose. The composite flowers typically include 30 to 50 pink or white ray flowers (Keil and Nesom 2012). Parish's daisy typically occurs on rocky slopes, active washes, and outwash plains, in pinyon woodland, pinyon-juniper woodland, and blackbush scrub habitats along the northern (desert) slopes of the San Bernardino Mountains and Little San Bernardino Mountains at elevations between 1,050 and 2,245 meters (3,445 to 7,365 feet). This species is typically found on soils derived directly from decomposing limestone or dolomite (USFWS 2009b). Parish's daisy typically blooms from May through August (Calflora 2023).

Findings: According to the CNDDB, the nearest documented Parish's daisy occurrence (1988) is approximately 1.8 miles northeast of the BBARWA WWTP site. This occurrence is located within a drainage along Nelson ridge, on soils derived from dolomite on carbonaceous rock in open pinyon and Joshua tree dominated woodland habitat (CNDDB 2023). There are no documented Parish's daisy occurrences in the Big Bear Valley.

The USFWS lists the primary constituent elements (PCEs) for Parish's daisy designated Critical Habitat as:

1. soils derived primarily from upstream or upslope limestone, dolomite, or quartz monzonite parent materials that occur on dry, rocky hillsides, shallow drainages, or outwash plains at elevations between 1,171 and 1,950 meters (3,842 and 6,400 feet).

2. soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment).

3. associated plant communities that have areas with an open canopy cover.

The associated plant communities (PCE 3) and limestone, dolomite, or quartz monzonite substrates (PCE 1) Parish's daisy requires do not occur within the proposed Project footprint. Furthermore, most of the proposed Project footprint has been previously disturbed and the soils on site are no longer intact, natural surfaces (PCE 2). Additionally, this species has not been documented in the Big Bear Valley. Therefore, Parish's daisy is presumed absent from the proposed Project footprint and the Project will not affect this species.

Southern Mountain Buckwheat – Threatened (Federal)

The federally listed as threatened southern mountain buckwheat is a woody-based, cushion-like, perennial plant in the buckwheat family (Polygonaceae). Individual plants are 8 to 15 centimeters (3.1 to 5.9 inches) tall, with stems forming loose, leafy mats, 14 to 36 centimeters (5.5 to 14.1 inches) wide. The leaves are oblanceolate (broadest above the middle and tapering toward the base) and 0.5 to 1 centimeter (0.2 to 0.4 inches) long, with dense white hair. The inflorescences (flower clusters) are 8 to 15 centimeters (3.2 to 5.9 inches) high, bearing head-like inflorescences. The perianth is white to rose and composed of inner and outer lobes that are similar in appearance (USFWS 2015b). This species is typically found in pebble plain habitat in the northeastern San Bernardino Mountains of southwest San Bernardino County at elevations between 2,000 and 2,200 meters (6,557 to 7,213 feet.) (USFWS 2015b). Southern mountain buckwheat is typically found within pebble plain habitat and is one of three indicator plant species, along with *Eremogone ursina*, and *Ivesia argyrocoma* var. *argyrocoma* defining a pebble plain (USFWS 2015b). This species typically blooms from June through September (Calflora 2023).

Findings: According to the CNDDB, the nearest documented southern mountain buckwheat occurrences are approximately 0.3 mile west (2021) and 0.5 mile north (1981) of the proposed Shay Pond conveyance pipeline alignment, within the Sawmill Pebble Plain Complex. However, there is no pebble plain or pebble plain-like habitat suitable for southern mountain buckwheat within the proposed Project footprint and this species was not detected during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, southern mountain buckwheat is considered absent from the proposed Project footprint at the time of survey and the Project will not affect this species.

Cushenbury Buckwheat – Endangered (Federal)

The federally listed as endangered Cushenbury buckwheat is a low, densely matted perennial in the buckwheat family (Polygonaceae) that reaches approximately 10 centimeters (4 inches) in height and forms a mat up to 51 centimeters (20 inches) in diameter (USFWS 2009c). This species is typically found within pinyon woodland, pinyon-juniper woodland, Joshua tree woodland, and blackbush scrub habitats on limestone or other carbonate soils at elevations between 1,400 and 2,400 meters (4,600 and 7,900 feet) in the San Bernardino Mountains (USFWS 2009c). This species typically blooms from May to August (Calflora 2023).

Findings: According to the CNDDB, the nearest documented Cushenbury buckwheat occurrence (2021) is approximately 0.5 mile northwest of the Stanfield Marsh conveyance pipeline discharge outlet (Option 1) site, north of Stanfield Marsh, on limestone marble and dolomitic limestone soils (CNDDB 2023).

The USFWS lists the primary constituent elements (PCEs) for Cushenbury buckwheat designated Critical Habitat as:

1. Soils derived primarily from the upper and middle members of the Bird Spring Formation and Bonanza King Formation parent materials that occur on hillsides at elevations between 4,600 to 7,900 feet (1,400 to 2,400 meters).

2. Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment).

3. Associated plant communities that have areas with an open canopy cover (generally less than 15 % cover) and little accumulation of organic material (e.g., leaf litter) on the surface of the soil (USFWS 1994).

The associated plant communities (PCE 3) and carbonate or limestone substrates (PCE 1) Cushenbury buckwheat requires do not occur within the proposed Project footprint. Furthermore, most of the proposed Project footprint has been previously disturbed and the soils on site are no longer intact, natural surfaces (PCE 2). Therefore, Cushenbury buckwheat is presumed absent from the proposed Project footprint and the Project will not affect this species.

San Bernardino Mountains bladderpod – Endangered (Federal)

The federally listed as endangered San Bernardino Mountains bladderpod is a silvery, short-lived perennial in the mustard family (Brassicaceae), that reaches approximately 5 to 15 centimeters (2 to 6 inches) in height (USFWS 2009d). The outer basal leaves are diamond-shaped to round, and the inner leaves are elliptic with petioles 2 to 5 centimeters (0.8 to 2 inches) long. The flower petals are yellow, and the fruits are spherical, pubescent, two-chambered, and contain 2 to 4 seeds per chamber (USFWS 2009d). This species is typically found within single leaf pinyon-mountain juniper and white fir forest on limestone and dolomite soils and gentle to moderate slopes at elevations between 2,098 and 2,700 meters (6,883 and 8,800 feet) in the San Bernardino Mountains (USFWS 2009d). This species typically blooms from May to June (Calflora 2023).

Findings: According to the CNDDB, the nearest documented San Bernardino Mountains bladderpod occurrence (2019) is approximately 1,000 feet north of the Stanfield Marsh conveyance pipeline discharge outlet (Option 1) site. This occurrence is located in mixed single leaf pinyon, mountain juniper, and white fir forest habitat, on several carbonate hills situated just north of Big Bear Lake and Stanfield Marsh (CNDDB 2023).

The USFWS lists the primary constituent elements (PCEs) for San Bernardino Mountains bladderpod designated Critical Habitat as:

1. Soils derived primarily from Bonanza King Formation and Undivided Cambrian parent materials that occur on hillsides or on large rock outcrops at elevations between 6,883 and 8,800 feet (2,098 and 2,700 meters).

2. Soils with intact, natural surfaces that have not been substantially altered by land use activities (e.g., graded, excavated, re-contoured, or otherwise altered by ground-disturbing equipment).

3. Associated plant communities that have areas with an open canopy cover and little accumulation of organic material (e.g., leaf litter) on the surface of the soil (USFWS 1994).

The associated plant communities (PCE 3) and limestone or dolomite soils (PCE 1) San Bernardino Mountains bladderpod requires do not occur within the proposed Project footprint. Furthermore, most of the proposed Project footprint has been previously disturbed and the soils on site are no longer intact, natural surfaces (PCE 2). Therefore, San Bernardino Mountains bladderpod is presumed absent from the proposed Project footprint and the Project will not affect this species.

San Bernardino Blue Grass – Endangered (Federal)

The federally listed as endangered San Bernardino blue grass is a rhizomatous, tufted, perennial herb in the grass family (Poaceae) that grows to approximately 10 to 55 centimeters (1.2 to 2.8 inches) tall. This species is dioecious and the unisexual flower inflorescences (flower clusters) are 3 to 7 centimeters (3.2 to 5.9 inches) long, with smooth, appressed branches and glabrous spikelets (Soreng 2012). San Bernardino blue grass occurs only in montane meadows at altitudes from 1,800 to 2,300 meters (5906 to 7546 feet) in San Bernardino and San Diego Counties (USFWS 2008). This species typically blooms from May through September (Calflora 2023).

Findings: San Bernardino blue grass has been documented within the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. According to the CNDDB, the next nearest documented San Bernardino blue grass occurrences (1981) are immediately adjacent the Shay Pond conveyance pipeline alignment and immediately adjacent the Stanfield Marsh conveyance pipeline discharge outlet (Option 2) site, respectively. There is also suitable montane meadow habitat for this species within the Baldwin Lake conveyance pipeline alternative, as well as the solar evaporation ponds components of the proposed Project. However, San Bernardino blue grass was not observed within the proposed Project footprint during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, San Bernardino blue grass is considered absent from the proposed Project footprint at the time of survey and the Project, as currently described, will not affect this species. Should replacement of the existing pipeline to the new Shay Pond conveyance pipeline be required, additional surveys would be necessary prior to implementation of Project activities, to assess potential Project related impacts to San Bernardino blue grass and other special status species that may occur in this area.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Shay Pond Conveyance Pipeline Alignment
- Stanfield Marsh Conveyance Pipeline Discharge Outlets
- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative

Bird-foot Checkerbloom – Endangered (Federal/State)

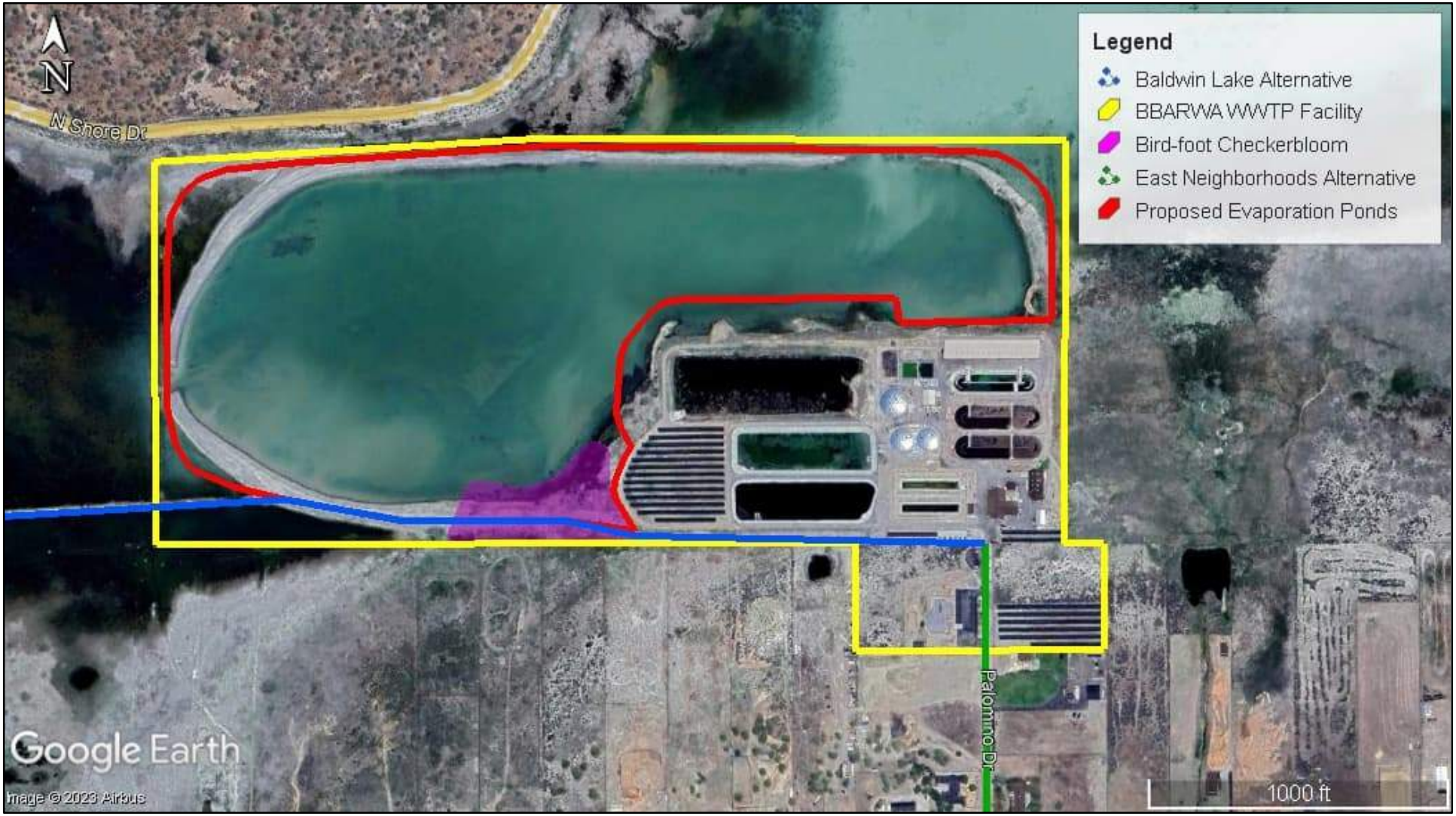
The state and federally listed as endangered bird-foot checkerbloom is a perennial herb in the mallow family (Malvaceae), with erect stems that grow to approximately 20 to 40 centimeters (7 to 16 inches) from a fleshy, nonrhizomatous taproot. This species is gynodioecious, with up to 25-centimeter-long, spike-like inflorescences that produce either bisexual or pistillate flowers that are rose-pink to magenta in color with dark veins (Hill 2012). The basal, cauline leaves are ternate-dissected, palmately five to seven parted into narrow, three lobe divisions, which are further dissected into linear to oblong segments (USFWS 2011a). Bird-foot checkerbloom

occurs only in vernally moist meadows and sparsely vegetated, drier meadow sites at elevations from 1,600 to 2,500 meters (5,250 to 8,200 feet) in the Big Bear Valley of the San Bernardino Mountains in San Bernardino County (USFWS 2011a). This species typically blooms from May through August (Calflora 2023).

Findings: Bird-foot checkerbloom was observed within and adjacent the proposed Project footprint during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Approximately 100+ individual bird-foot checkerbloom were observed within and adjacent the Baldwin Lake conveyance pipeline alternative alignment and the proposed evaporation ponds footprint at the BBARWA WWTP (Figure 11, Page 43). According to the CNDDB, bird-foot checkerbloom was also documented within the proposed Baldwin Lake conveyance pipeline alternative alignment in 2019, near the west end of the alignment, as well as near the southeast corner of the BBARWA WWTP (2009). There is also suitable montane meadow habitat for this species within the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline, as well as immediately adjacent the Shay Pond conveyance pipeline alignment and Stanfield Marsh conveyance pipeline discharge outlet components of the proposed Project. Given that bird-foot checkerbloom is present within the proposed Project footprint, the Project may affect this species and construction of the Baldwin Lake conveyance pipeline alternative and proposed evaporation ponds, as currently described, is likely to adversely affect this species.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Shay Pond Conveyance Pipeline Alignment
- Stanfield Marsh Conveyance Pipeline Discharge Outlets
- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative



SOURCE: Google Earth

FIGURE 11

Bird-foot Checkerbloom (*Sidalcea pedata*) Observations
Replenish Big Bear Project

California Dandelion – Endangered (Federal)

The federally listed as endangered California dandelion is a perennial herb in the aster family (Asteraceae) with 10 to 20 basal, oblanceolate, generally toothed, or occasionally shallowly lobed leaves, that grows to approximately 5 to 20 centimeters (2 to 8 inches) tall. This species produces yellow composite flowers with erect outer phyllaries that are lance-ovate to widely ovate with hornless tips and rounded, generally hornless main phyllaries (Brouillet 2012). California dandelion can be distinguished from the sympatric, nonnative, common dandelion (*Taraxacum officinale*) by the sharply cut or recurved-lobed leaves and reflexed outer phyllaries observed in the flowering plant of the latter species (USFWS 2013b). California dandelion occurs only in the relatively open edges or margins of moist meadow habitats at altitudes from 2,000 to 2,800 meters (6,700 to 9,000 feet) in the San Bernardino Mountains in San Bernardino County (USFWS 2013b). This species typically blooms from May through August (Calflora 2023).

Findings: California dandelion has been documented within the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. According to the CNDDB, the next nearest documented California dandelion occurrences are immediately adjacent the southeast corner of the BBARWA WWTP site (2000) and approximately 1,000 feet north of the Baldwin Lake conveyance pipeline alternative alignment (2008), near the west end of the alignment, respectively. There is suitable montane meadow habitat for this species within the Baldwin Lake conveyance pipeline alternative, as well as the proposed solar evaporation ponds, immediately adjacent the Shay Pond conveyance pipeline alignment, and adjacent the Stanfield Marsh conveyance pipeline discharge outlet components of the proposed Project. However, California dandelion was not observed within the proposed Project footprint during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, California dandelion is considered absent from the proposed Project footprint at the time of survey and the Project, as currently described, will not affect this species. Should replacement of the existing pipeline to the new Shay Pond conveyance pipeline be required, additional surveys would be necessary prior to implementation of Project activities, to assess potential Project related impacts to California dandelion and other special status species that may occur in this area.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Shay Pond Conveyance Pipeline Alignment
- Stanfield Marsh Conveyance Pipeline Discharge Outlets
- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative

Slender-petaled Thelypodium – Endangered (Federal)

The state and federally listed as endangered slender-petaled thelypodium is a glabrous (lacks hairs), biennial herb in the mustard family (Brassicaceae) with a rosette of wavy basal leaves and 30 to 90 centimeter (11.8 to 35.4 inch) tall, simple, or branched distally stems, which have mid-cauline sessile, sagittate to clasping, entire leaves. This species has small lavender or white flowers with narrow (0.3 to 0.5 millimeter wide) linear petals that are crinkled between the blade and claw (Al-Shehbaz 2012). Slender-petaled thelypodium produces narrow, linear fruits that are 3 to 5 centimeters (1.2 to 2 inches) long (USFWS 2011b). This species occurs on vernally moist alkaline meadows, alkaline flats, and lakeshores at altitudes from 1,600 to 2,500 meters (5,250 to 8,200 feet) in the Big Bear Valley of the San Bernardino Mountains in San Bernardino County (USFWS 2011b). All known populations of slender-petaled thelypodium are found on alkaline clay soils crossed by annually moist

seeps and streams, indicating that soil hydrology is an important factor in determining distribution (USFWS 2011b). This species is found towards the drier edges of moist meadows, or drier sparsely vegetated meadows, often growing up through sagebrush shrubs (USFWS 2011b). This species typically blooms from May through September (Calflora 2023).

Findings: Slender-petaled thelypodium has been documented within the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. According to the CNDDB, the next nearest documented slender-petaled thelypodium occurrence is immediately adjacent (to the north) the Baldwin Lake conveyance pipeline alternative (2019), within montane meadow and big sagebrush habitat near the western end of this proposed alignment alternative (West Baldwin Lake Trail). There is suitable montane meadow and big sagebrush habitat for this species within the Baldwin Lake conveyance pipeline alternative, as well as adjacent the Shay Pond conveyance pipeline components of the proposed Project. However, slender-petaled thelypodium was not observed within the proposed Project footprint during the floristic botanical field surveys conducted by Jacobs in June-July of 2022 and July of 2023. Therefore, slender-petaled thelypodium is considered absent from the proposed Project footprint at the time of survey and the Project, as currently described, will not affect this species. Should replacement of the existing pipeline to the new Shay Pond conveyance pipeline be required, additional surveys would be necessary prior to implementation of Project activities, to assess potential Project related impacts to slender-petaled thelypodium and other special status species that may occur in this area.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Shay Pond Conveyance Pipeline Alignment
- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative

3.2.1.2 Special Status Animals

Unarmored Threespine Stickleback – Endangered (Federal/State)

The state and federally listed as endangered UTS is a small (up to 6 centimeters [2.4 inches]) freshwater fish in the stickleback family (Gasterosteidae) that is distinguished from the other two threespine stickleback subspecies primarily in that it lacks any protective lateral plates (modified scales). UTS typically inhabit slow-moving streams or quiet-water microhabitats in swifter streams and rivers (USFWS 2009e). This species feeds on aquatic invertebrates and prefers aquatic refugia consisting of dense and abundant vegetation, algal mats, or barriers to swift water such as sand bars, floating vegetation, or low-flow road crossings. Although UTS reproduce year-round, breeding activity usually slows from October to January, and this species likely only lives for about 1 year (USFWS 2009e).

Historically, UTS occurred in many watersheds throughout southern California, including the headwaters of the Santa Clara River and low gradient parts of the Los Angeles River, San Gabriel River, and Santa Ana River in the Los Angeles Basin, the Santa Maria River drainage in San Luis Obispo County, and San Antonio Creek in Santa Barbara County (USFWS 2021). In 1970, the UTS was listed as endangered under the Endangered Species Preservation Act of 1966 as a result of population declines due to urbanization, eutrophication, stream channelization, water releases, groundwater removal, declining water quality, nonnative predators, disease, introgression, competition, and stochastic extinction. In the San Bernardino Mountains, UTS is currently considered extant at only three sites: Sugarloaf Meadow Pond, Juniper Springs Pond, the vicinity of Shay Creek

(USFWS 2021). The Shay Creek population at Shay Pond persists due to BBCCSD discharges of approximately 50 AFY of supplemental water into Shay Pond to prevent desiccation. The status of the remaining UTS population from the vicinity of Shay Creek, including those in Motorcycle Pond, Shay Creek, Weibe's Pond, and Baldwin Lake are considered intermittent or unknown (i.e., Weibe's Pond), primarily due to the ephemeral hydrologic regime within the Shay Creek system (USFWS 2021).

Findings: UTS have been documented within the Shay Creek system from Baldwin Lake at the downstream terminus of Shay Creek, to Shay Pond and Motorcycle Pond at the upstream extent of Shay Creek. The possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline extends through Shay Meadow, in the immediate vicinity of Shay Creek. Should replacement of the existing pipeline to the new Shay Pond conveyance pipeline be required, the Project could potentially result in adverse effects to UTS that intermittently inhabit this portion of Shay Creek. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline.

The goal of the Shay Pond conveyance pipeline and associated discharge outlet component of the proposed Project is to provide a more sustainable water source needed to maintain and enhance suitable UTS habitat conditions in Shay Pond. The Project would increase the amount of water supplied to Shay Pond from the current 50 ACY to an anticipated 80 ACY. The proposed Shay Pond conveyance pipeline would be constructed in an existing unpaved roadway and the discharge outlet would be constructed in an upland area immediately adjacent Shay Pond. Therefore, construction activities associated with the installation of the proposed conveyance pipeline and discharge outlet will not affect this species. The Project may affect UTS by causing a temporary change in water level and/or flow rate within Shay Pond, due to the increased discharge. However, the increased discharge would have a beneficial effect on UTS and UTS habitat at Shay Pond. Therefore, the Project may affect, but would not adversely affect this species.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Shay Pond Conveyance Pipeline Alignment

Quino Checkerspot Butterfly – Endangered (Federal)

The federally listed as endangered quino checkerspot butterfly is a butterfly in the checkerspot subfamily (Melitaeinae) of the brushfooted butterfly family (Nymphalidae) that occurs in Riverside and San Diego Counties and the northern areas of Baja California Norte, Mexico. This species occurs in patchy scrubland habitats characterized by mosaics of open areas and dense patches of shrubs (USFWS 2003). Host plants required by quino checkerspot larvae for food sources include *Plantago erecta*, *Plantago patagonica*, *Anterrhinum coulterianum,* and *Collinsia concolor* (USFWS 2003). Although quino checkerspot butterfly historically ranged throughout much of non-montane southern California, this species has been extirpated from more than 75 % of its former range (USFWS 2003). Due to dramatic declines resulting primarily from habitat loss, degradation, and fragmentation, the USFWS listed the quino checkerspot butterfly as endangered on January 16, 1997, and the USFWS issued an incidental take permit for this species to the Riverside County Habitat Conservation Agency under the MSHCP on June 22, 2004.

Findings: Although there is a single quino checkerspot butterfly historic collection (1969) from approximately 2.7 miles south/southeast of the Shay Pond conveyance pipeline Project component, the identity of this specimen is questionable (CNDDB 2023). Furthermore, there are no other occurrences of this species documented in the Big Bear Valley and this species is considered extirpated in San

Bernardino County. Therefore, quino checkerspot butterfly is not likely to occur in the Project Area and the Project will not affect this species.

Bald Eagle – Delisted (Federal) / Endangered (State)

The bald eagle (BAEA) was a federally listed species until 2007 when it was delisted because of the increase in population. However, it remains a state listed endangered species and is covered under the federal Migratory Bird Treaty Act (MBTA) of 1918, as well as the Bald and Golden Eagle Protection Act of 1940, as amended in 1962. BAEA are distinguished by a white head and white tail feathers, are powerful, brown birds that may weigh 14 pounds and have a wingspan of 8 feet. Male eagles are smaller, weighing as much as 10 pounds and have a wingspan of 6 feet. Sometimes confused with Golden Eagles, BAEA are mostly dark brown until they are four to five years old and acquire their characteristic coloring. They live near rivers, lakes, and marshes where they can find fish, their staple food. BAEA will also feed on waterfowl, turtles, rabbits, snakes, and other small animals and carrion. BAEA require a good food base, perching areas, and nesting sites. Their habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts (CDFW 2016). In winter, the birds congregate near open water in tall trees for spotting prey and night roosts for sheltering (CDFW 1999). They mate for life, choosing the tops of large trees to build nests, which they typically use and enlarge each year. In most of California, the breeding season lasts from about January through July or August (CDFW 2016). Nests may reach 10 feet across and weigh a half ton. They may also have one or more alternate nests within their breeding territory (CDFW 2016). The young eagles are flying within three months and are on their own about a month later.

Perches in the immediate vicinity of lakeshores form an essential habitat requirement for BAEA in the Big Bear Valley and the major threat to the continued existence of wintering BAEA in this area comes from development and modification of habitat near the shoreline (Walter and Garrett 1981).

Findings: The Forest Service conducts annual surveys for BAEA in the San Bernardino Mountains. Migrating BAEA have long been documented to overwinter at Big Bear Lake and Baldwin Lake. During a two-year study of the wintering BAEA population in the Big Bear Valley, it was estimated that about 30 individuals wintered in the Big Bear Valley. The wintering period for migrating BAEA in the Big Bear Valley area is generally December through March, with the first eagles arriving in mid-November and the last eagles leaving in early April (Walter and Garrett 1981). The highest numbers of wintering eagles in the area are in January and early February (Walter and Garrett 1981).

Since 2012, at least one resident pair has been documented in the Big Bear Valley, which first nested successfully in 2012 and 2015. These eagles typically nest to the west of Grout Bay in the Fawnskin area, approximately 5 miles west of the Stanfield Marsh conveyance pipeline discharge outlet locations.

Big Bear and Baldwin Lakes support overwintering migratory BAEA and the BBARWA WWTP site is within suitable BAEA foraging habitat and adjacent BAEA for perching habitat along the Baldwin Lake shoreline. However, this species is not known to nest in the Project Area and given the existing human disturbance adjacent the Project site, consisting mostly of residential development, BBARWA WWTP operations and maintenance, and Big Bear City Airport operations and maintenance, BAEA are not likely to nest within the Project Area. Furthermore, the proposed evaporation ponds and Baldwin Lake conveyance pipeline alternative would be constructed when those portions of Baldwin Lake are dry, and potential BAEA prey (i.e., fish, waterfowl.) are absent from the Project Area. Although BAEA may utilize lakeshore perches when Stanfield Marsh and Baldwin Lake are dry, the Project will not remove any of these trees and the only potential Project-related impacts to overwintering eagles would be if the construction disturbance alters their utilization of lakeshore perches for foraging on fish and waterfowl, which would not be the case when the lake are dry. Therefore, potential Project related effects due to construction disturbance

would likely be insignificant and although the Project may affect BAEA, it will not adversely affect this species.

Suitable Habitat Locations in Program Area:

- Stanfield Marsh Conveyance Pipeline Discharge Outlets
- BBARWA WWTP Upgrades
- Baldwin Lake Conveyance Pipeline Alternative

Southern Rubber Boa – Threatened (State)

The state listed as threatened southern rubber boa (rubber boa) is a small, rather stout-bodied snake with smooth scales and a blunt head and tail (Stewart et al. 2005). Adults grow to about 49.5-55.9 centimeters (19.5-22 inches) in length. Adult rubber boas are light brown or tan in dorsal color with an unmarked yellow venter; juveniles are pale without a distinct margin between dorsal and ventral coloration (Stewart et al. 2005). Rubber boas are primarily fossorial and are rarely encountered on the surface, except on days and nights of high humidity and overcast sky. During warm months, this snake is typically active at night and on overcast days. Rubber boas hibernate during the winter, usually in crevices in rocky outcrops. Other potential hibernacula for this species may include rotting stumps.

Typical southern rubber boa habitat is mixed conifer-oak forest or woodland dominated by two or more of the following species: Jeffrey pine (*Pinus jeffreyi*), yellow pine (*P. ponderosa*), sugar pine (*P. lambertiana*), incense cedar (*Calocedrus decurrens*), white fir (*Abies concolor*), and black oak (*Quercus kelloggii*) (Stewart et al., 2005). Rubber boas are usually found near streams or wet meadows or within or under surface objects with good moisture retaining properties such as rotting logs (CDFW 2014). Much of the literature suggests that the rubber boa prefers moist conifer-oak forests and woodlands between 5,000 and 8,000 feet in elevation, especially in canyons and on cool, north facing slopes (CDFW 1987). However, the factors of overriding importance seem to be access to hibernation sites below the frost line and access to damp soil (Keasler 1982). In all habitat types, rock outcrops and surface materials (i.e., rocks, logs, and a well-developed duff layer) are important habitat components because they provide cover and maintain soil moisture (Loe 1985, as cited in Stewart et al. 2005).

Findings: According to the CNDDB, the nearest documented rubber boa occurrence (2013) is approximately 0.5 mile north of the west end of the western end of the Baldwin Lake conveyance pipeline alternative, on the north side of East North Shore Drive (State Route 18 [SR 18]) (CDFW pers. comm.). There is some marginally suitable rubber boa habitat in the vicinity of the Baldwin Lake conveyance pipeline alternative consisting of mixed wet montane meadow and big sagebrush habitat, with scattered trees, large shrubs, and woody debris. Additionally, the Baldwin Lake conveyance pipeline alternative crosses an ephemeral stream (Caribou Creek) near the western end of the alignment. However, the mixed conifer-oak forest or woodland habitats that rubber boa typically occur in are absent from this area and there are no nearby rock outcrops, downed logs, or tree stumps that could provide potential rubber boa hibernacula.

There is suitable rubber boa habitat in the vicinity of the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline. Additionally, although the Sand Canyon discharge outlet and portions of the Sand Canyon conveyance pipeline are adjacent undeveloped areas of potentially suitable rubber boa habitat consisting of mixed Jeffrey pine forest and woodland and mountain juniper woodland habitats, there is no suitable rubber boa habitat within the proposed footprint of these Project components.

Due to the environmental conditions and existing disturbances within and adjacent the proposed Project footprint, as currently described, rubber boa is very unlikely to occur within the proposed Project footprint. Therefore, the proposed Project may affect, but is not likely to adversely affect this species.

Suitable Habitat Locations in Program Area:

- Possible Replacement Pipeline Alignment from the BBARWA WWTP
- Sand Canyon Conveyance Pipeline
- Sand Canyon Discharge Outlet

California Spotted Owl – SSC

The California spotted owl (SPOW) is considered an SSC by the CDFW and is listed as a Sensitive Species by the U.S. Forest Service. The SPOW breeds and roosts in forests and woodlands with large old trees and snags, high basal areas of trees and snags, dense canopies (≥70% canopy closure), multiple canopy layers, and downed woody debris (Verner et al. 1992a, as cited in Davis and Gould 2008). Large, old trees are the key component; they provide nest sites and cover from inclement weather and add structure to the forest canopy and woody debris to the forest floor. These characteristics typify old-growth or late-seral-stage habitats (Davis and Gould 2008). Because the SPOW selects stands that have higher structural diversity and significantly more large trees than those generally available, it is considered a habitat specialist (Moen and Gutiérrez 1997, as cited in Davis and Gould 2008). In southern California, SPOW principally occupy montane hardwood and montane hardwood-conifer forests, especially those with canyon live oak (*Quercus chrysolepis*) and bigcone Douglas-fir (*Pseudotsuga macrocarpa*), at mid to high elevations (Davis and Gould 2008).

SPOW prey on small mammals, particularly dusky-footed woodrats (*Neotoma fuscipes*) at lower elevations (oak woodlands and riparian forests) and throughout southern California (Verner et al. 1992a, as cited in Davis and Gould 2008). The SPOW breeding season occurs from early spring to late summer or fall. Breeding spotted owls begin pre-laying behaviors, such as preening and roosting together, in February or March and juvenile owl dispersal likely occurs in September and October (Meyer 2007). The SPOW does not build its own nest but depends on finding suitable, naturally occurring sites in tree cavities or on broken-topped trees or snags, on abandoned raptor or common raven (*Corvus corax*) nests, squirrel nests, dwarf mistletoe (*Arceuthobium* spp.) brooms, or debris accumulations in trees (Davis and Gould 2008). In the San Bernardino Mountains, platform nests predominate (59%) and were in trees with an average diameter at breast height (dbh) of 75 cm, whereas cavity nest trees and broken-top nest trees were significantly larger (mean dbh of 108.3 cm and 122.3 cm, respectively) (LaHaye et al. 1997, as cited in Davis and Gould 2008).

According to LaHaye and Gutierrez (2005), urbanization in the form of primary and vacation homes has degraded or consumed some forest in most mountain ranges. The results of spotted owl surveys conducted between 1987 and 1998 in the San Bernardino Mountains indicated that a large area of potentially suitable spotted owl habitat, enough to support 10-15 pairs, existed between Running Springs and Crestline (LaHaye and others 1999, as cited in LaHaye and Gutierrez 2005). However, only four pairs have been found in this area, and owls were found only in undeveloped sites. Thus, residential development within montane forests may preclude spotted owl occupancy, even when closed-canopy forest remains on developed sites (LaHaye and Gutierrez 2005).

Findings: According to the CNDDB Spotted Owl Observations Database (2023), the nearest documented SPOW observation is a SPOW activity center (e.g., a roosting or nesting site) located approximately 1 mile southeast of the Sand Canyon conveyance pipeline alignment. However, the Project Area is within an existing urban and rural residential setting that is subject to a high level of human disturbance. Additionally, the Project Area does not support the old growth montane hardwood and montane

hardwood-conifer forests that SPOW typically occupy in the region. Therefore, SPOW are not likely to occur in the Project Area and the Project will not affect this species.

San Bernardino Flying Squirrel – SSC

The San Bernardino flying squirrel (flying squirrel) is considered an SSC by the CDFW and is listed as a Sensitive Species by the U.S. Forest Service. The flying squirrel is a nocturnally active, arboreal squirrel that is distinguished by the furred membranes extending from wrist to ankle that allow squirrels to glide through the air between trees at distances up to 91 meters (300 feet) (Wolf 2010). The San Bernardino flying squirrel is the most southerly distributed subspecies of northern flying squirrel (*Glaucomys sabrinus*) and is paler in color and smaller than most other northern flying squirrel subspecies. It inhabits high-elevation mixed conifer forests comprised of white fir, Jeffrey pine, and black oak between ~4,000 to 8,500 feet. It has specific habitat requirements that include associations with mature forests, large trees, and snags, closed canopy, downed woody debris, and riparian areas, and it is sensitive to habitat fragmentation. It specializes in eating truffles (e.g. hypogeous mycorrhizal sporocarps) buried in the forest floor as well as arboreal lichens in winter when truffles are covered with snow and unavailable (Wolf 2010). This flying squirrel historically occurred as three isolated populations in the San Gabriel, San Bernardino, and San Jacinto Mountain forests.

Flying squirrel populations are adversely affected by habitat fragmentation. Rosenberg and Raphael (1984) found that in northwestern California, the abundance of squirrels increased with stand size, they were generally absent in stands smaller than 20 hectares (ha), and approximately 75% of stands over 100 ha had flying squirrels. An additional problem with fragmented habitats is the constraints that open spaces pose to the movements of individuals and the colonization of unoccupied habitat patches. Mowrey and Zasada (1982) reported an average gliding distance of about 20 meters in *sabrinus*, with a maximum of 48 meters, and concluded that movements are unimpeded in areas with average openings of 20 meters and occasional openings of 30 to 40 meters (Bolster 1998).

Findings: The Flying Squirrels of Southern California is a project of the San Diego Natural History Museum (SDNHM), in collaboration with the U.S. Forest Service and the USFWS, to try to determine the distribution and habitat use of the flying squirrel in southern California. According to the SDNHM database, flying squirrel have been documented in the vicinity of the Sand Canyon conveyance pipeline alignment, as well as north of West North Shore Drive (State Route 38 [SR 38]), approximately 0.4 mile north of the Meadow Lane conveyance pipeline alternative alignment. Although the Project Area is situated in an urban and rural residential setting that is subject to a high level of existing human disturbance, this species has been documented in residential areas in the Big Bear Valley and elsewhere. Thus, there is a moderate potential for flying squirrel to occur in the Project Area and species-specific impacts avoidance and minimization measures are recommended.

Suitable Habitat Locations in Program Area:

- Sand Canyon Conveyance Pipeline
- Sand Canyon Discharge Outlet
- East Neighborhoods Conveyance Pipeline Alternative
- West Neighborhoods Conveyance Pipeline Alternative
- North Airport Corridor Conveyance Pipeline Alternative
- Meadow Lane Conveyance Pipeline Alternative

3.2.2 Special Status Habitats

Several special status habitats have been documented in the Project vicinity (within approximately 3 miles) including pebble plains, southern California threespine stickleback stream, and USFWS designated Critical Habitat for several federally listed threatened or endangered species. There is no pebble plain or pebble plain-like habitat within the proposed Project footprint. There is southern California threespine stickleback stream habitat within the Shay Pond conveyance pipeline alignment and possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline and the proposed footprint of the Shay Pond conveyance pipeline is entirely within existing unpaved roadway and upland. Additionally, the Project would increase the amount of water supplied to Shay Pond from the current 50 ACY to an anticipated 80 ACY, which would likely enhance UTS habitat conditions in Shay Pond and potentially, the downstream portion of Shay Creek. Therefore, the Project would not result in any loss or adverse modification pebble plains or southern California threespine stickleback stream.

The nearest USFWS designated Critical Habitat units are adjacent the east side of the BBARWA WWTP and adjacent the north side of the proposed Baldwin Lake conveyance pipeline alternative alignment, respectively. The Critical Habitat unit adjacent the east side of the BBARWA WWTP site consists of the North Shay Meadow USFWS designated Critical Habitat unit (Unit 6) for the federally listed as endangered California dandelion. The Critical Habitat unit adjacent the north side of the proposed Baldwin Lake conveyance pipeline alternative consists of the Pan Hot Springs Meadow USFWS designated Critical Habitat unit (Unit 1) for the federally listed as endangered San Bernardino blue grass and California dandelion. However, no portion of the proposed Project footprint is within these Critical Habitat units, or any other Critical Habitat. Therefore, the Project will not result in the loss or adverse modification of USFWS designated Critical Habitat.

3.3 Jurisdictional Waters Assessment

The Project Area is within the Bear Valley and Baldwin Hydrologic Sub-Areas (HSA 801.71 and 801.73). The Bear Valley HSA comprises a 34,333-acre drainage area, within the larger Santa Ana Watershed (HUC 18070203). The Baldwin HSA comprises a 22,789-acre drainage, also within the Santa Ana Watershed. This watershed is primarily within San Bernardino County and includes portions of Riverside and Orange Counties with a small portion of Los Angeles County. The Santa Ana Watershed is bound on the north by the Mojave and Southern Mojave Watersheds, on the southeast by the Whitewater River and San Jacinto Watersheds, and on the west by the San Gabriel, Seal Beach, Newport Bay, and Aliso-San Onofre Watersheds. The Santa Ana Watershed encompasses a portion of the San Gabriel and San Bernardino Mountains in the north and is approximately 3,000 square miles in area. The Santa Ana River is the major hydrogeomorphic feature within the Santa Ana Watershed. One of several tributaries to the Santa Ana River is Bear Creek, which outflows from Big Bear Lake from the Bear Valley Dam located at the westernmost (downstream) end of Big Bear Lake. Big Bear Lake is one of the head waters of the Santa Ana River Watershed.

Waters of the U.S.

The USACE has authority to permit the discharge of dredged or fill material in WOTUS under Section 404 of the CWA. The Environmental Protection Agency (EPA) and USACE currently define WOTUS as:

1. Waters used either currently, previously, or susceptible to future use in interstate or foreign commerce, the territorial seas, and interstate waters.

2. Impoundments of waters otherwise defined as WOTUS, except for impoundments of those WOTUS that are identified in 5 (below).

3. Relatively permanent, standing, or continuously flowing tributaries to the WOTUS described in 1 and 2 (above).

4. Wetlands that are adjacent to waters described in 1 (above), or relatively permanent, standing or continuously flowing bodies of water identified in 2 or 3 (above) that have a continuous surface connection with those waters.

5. Intrastate lakes and ponds not identified in 1 through 4 (above) that are relatively permanent, standing, or continuously flowing bodies of water with a continuous surface connection to the waters identified in 1 or 3 (above).

Findings: Given that the Santa Ana River is a relatively permanent tributary to the Pacific Ocean (a territorial sea) and Big Bear Lake has a continuous surface connection to the Santa Ana River via Bear Creek, it is likely that the EPA and USACE would consider Stanfield Marsh a wetland WOTUS. Therefore, the Stanfield Marsh discharge outlet component of the Project may result in temporary and/or permanent impacts to jurisdictional waters subject to regulation by the USACE and RWQCB under Sections 404/401 of the CWA, respectively.

State Lake/Streambed

Under Sections 1600 through 1607 of the California FGC, the CDFW has jurisdiction over lakes, rivers, streams, or other aquatic resources, stream-dependent wildlife resources, and riparian habitats. This jurisdiction can include, but is not limited to intermittent and ephemeral streams, rivers, creeks, dry washes, sloughs, USGS blue-line streams, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance that support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (CDFG 1994).

Findings: Several aquatic features and habitats were identified in the Project Area that would likely be subject to regulation by the CDFW under Section 1602 of the FGC, as well as by the RWQCB under the Porter-Cologne Water Quality Control Act. Table 3 (below) provides a list of the aquatic features and habitats that were identified in the Project Area, as well as the Project component(s) that may impact those "waters of the State."

Table 3. Potential Impacts to Waters of the State

Waters of the State	Project Component
Stanfield Marsh	Conveyance Pipeline Discharge Outlet
Baldwin Lake	Baldwin Lake Conveyance Pipeline Alternative; BBARWA WWTP Evaporation Ponds
Caribou Creek	Baldwin Lake Conveyance Pipeline Alternative
Shay Pond/Shay Creek	Shay Pond Discharge Outlet; Possible Replacement Pipeline from the BBARWA WWTP to the Shay Pond Conveyance Pipeline (not expected)
Sand Canyon Channel	Sand Canyon Discharge Outlet

Given that the Project is likely to result in temporary and/or permanent impacts to waters of the State, it is likely that FGC Section 1602 and/or RWQCB Waste Discharge Requirements (WDRs) permitting will be required.

4. Effects Analysis

The proposed Project may affect several state and/or federally listed species known to occur in the Project vicinity. Construction of the Baldwin Lake conveyance pipeline alternative and proposed new evaporation ponds at the BBARWA WWTP may affect and is likely to adversely affect the state and federally listed as endangered bird-foot checkerbloom. Potential Project related effects on the state and federally listed as endangered UTS may result due temporary changes in water level and/or flow rate. However, the Project is expected to have a beneficial effect on this species. Therefore, the Project may affect, but is not likely to adversely affect UTS. Any Project related effects on the state listed as endangered BAEA resulting from the construction of the proposed Baldwin Lake conveyance pipeline alternative and proposed new evaporation ponds at the BBARWA WWTP would likely be insignificant. Therefore, the Project may affect, but is not likely to adversely affect BAEA. Likewise, Project related effects on the state listed as threatened rubber boa resulting from the Baldwin Lake conveyance pipeline and Sand Canyon recharge Project components are unlikely to occur. Therefore, the Project may affect, but is not likely to adversely affect rubber boa.

The proposed Project will not affect USFWS designated Critical Habitat. Furthermore, the proposed Project will not affect any resources protected under the Coastal Barriers Resources Act, Coastal Zone Management Act, Fish and Wildlife Conservation Act, Magnuson-Stevens Fishery Conservation and Management Act, the Protection of Wetlands – Executive Order 11990 or Wild and Scenic Rivers Act, respectively.

The proposed Project may impact state and/or federal jurisdictional waters potentially subject to regulation by the USACE under Section 404 of the CWA, the RWQCB under Section 401 of the CWA and Porter-Cologne Water Quality Control Act, or CDFW under Section 1602 of the California FGC, respectively. Figures 12a-12e on Pages 53-57 show the jurisdictional waters identified within the Project Area and their approximate extent in relation to the Project components that may affect them. Stanfield Marsh would likely be considered both a WOTUS and water of the State and any impacts to this jurisdictional water feature resulting from the construction of the Stanfield Marsh discharge outlet would likely require both CWA Section 404/401 and FGC Section 1602 permitting (Figure 12a, Page 53). Although not considered WOTUS, Baldwin Lake, Caribou Creek, Shay Pond/Shay Creek, and the Sand Canyon Channel are all waters of the State of California (Figures 12b-12e, Pages 54-57). Therefore, potential Project related impacts to these aquatic resources would likely require RWQCB issued WDRs, as well as CDFW issued Lake or Streambed Alteration Agreements (LSAs).

SOURCE: Google Earth

FIGURE 12a

Jurisdictional Waters Assessment – Stanfield Marsh
Replenish Big Bear Project

SOURCE: Google Earth

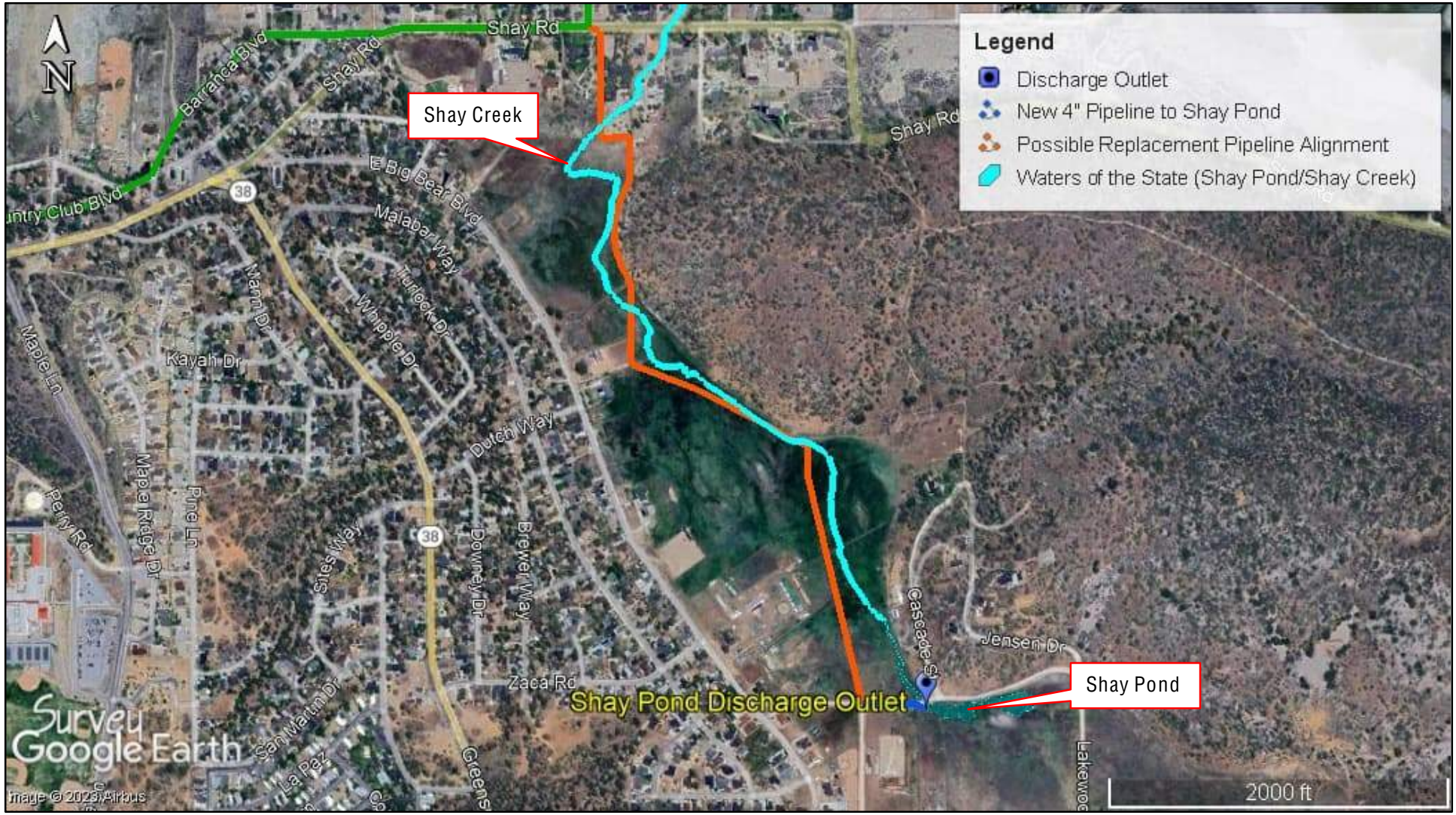
FIGURE 12b

Jurisdictional Waters Assessment – Baldwin Lake & Caribou Creek
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 12c

Jurisdictional Waters Assessment – Shay Pond/Shay Creek
Replenish Big Bear Project



SOURCE: Google Earth

FIGURE 12d

Jurisdictional Waters Assessment – Shay Creek
Replenish Big Bear Project

SOURCE: Google Earth

FIGURE 12e

Jurisdictional Waters Assessment – Sand Canyon Channel
Replenish Big Bear Project

Migratory Bird Treaty Act

There is vegetation, as well as man-made structures, within the Project Area that are suitable to support nesting birds, including shoreline nesting waterfowl and open ground nesters such as killdeer (*Charadrius vociferus*). Most native bird species and their active nests (i.e., with eggs or young) are protected from unlawful take by the federal Migratory Bird Treaty Act of 1918 (MBTA). Additionally, the State of California provides protection for native bird species and their nests in the FGC under Sections 3503, 3503.5, 3511, 3513, and 3800, respectively (Appendix D). Bird nesting protections in the FGC include the following (Sections 3503, 3503.5, 3511, 3513 and 3800):

- Section 3503 prohibits the take, possession, or needless destruction of the nest or eggs of any bird.
- Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (new world vultures, hawks, eagles, ospreys, and falcons, among others), and Strigiformes (owls).
- Section 3511 prohibits the take or possession of Fully Protected birds.
- Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the MBTA. To avoid violation of the take provisions, it is generally required that Project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle.
- Section 3800 prohibits the take of any any non-game bird (i.e., bird that is naturally occurring in California that is not a gamebird, migratory game bird, or fully protected bird).

5. Conclusions and Recommendations

5.1 Special Status Biological Resources

A BRA and floristic botanical field surveys, which included 100% visual coverage of the undeveloped aspects of the Project, as well as the road shoulder along the proposed conveyance pipeline alternatives in the developed neighborhoods, was conducted by Jacobs in June and July of 2022 and July of 2023 to identify potential habitat for special status plant and wildlife species within the Project Area. The result of the BRA and floristic botanical field surveys was that the state and federally listed as endangered bird-foot checkerbloom was observed within and adjacent the proposed footprints for the Baldwin Lake conveyance pipeline alternative and the proposed solar evaporation ponds, within Baldwin Lake. Several other state and/or federally listed plant species have been documented within or adjacent the proposed Project footprint including the federally listed as threatened ash-gray paintbrush, the federally listed as endangered San Bernardino blue grass and California dandelion, as well as the state and federally listed as endangered slender-petaled thelypodium. However, none of these species were observed within the proposed Project footprint during the surveys. As identified in Appendix A, the Big Bear Valley milk-vetch (*Astragalus lentiginosus* var. *sierrae*) was also observed within and adjacent the proposed footprints for the Baldwin Lake conveyance pipeline alternative and the proposed solar evaporation ponds, within Baldwin Lake. However, this CNPS rare plant species is not state or federally listed as threatened or endangered.

No protocol level focused surveys were conducted for state and/or federally listed wildlife species known to occur in the Project vicinity and none were observed during the reconnaissance level BRA survey or floristic botanical field surveys. However, there is some potentially suitable habitat for the state listed as threatened southern rubber boa within and adjacent the Baldwin Lake conveyance pipeline alternative and possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline, as well as adjacent the Sand Canyon discharge outlet and portions of the Sand Canyon conveyance pipeline. Although, Big Bear and Baldwin Lakes are known to support overwintering migratory populations of the state listed as endangered (federally delisted) BAEA, the Project Area is not suitable to support nesting BAEA and the Project is not likely to adversely affect this species. Shay Pond supports a known population of the state and federally listed as endangered UTS. However, the Project is expected to benefit UTS and is not likely to adversely affect this species either.

The Project Area does not contain any USFWS designated Critical Habitat for federally listed species, and the Project will not result in any loss or adverse modification of Critical Habitat. Furthermore, the proposed Project will not affect any resources protected under the Coastal Barriers Resources Act, Coastal Zone Management Act, Fish and Wildlife Conservation Act, Magnuson-Stevens Fishery Conservation and Management Act, the Protection of Wetlands – Executive Order 11990 or Wild and Scenic Rivers Act, respectively.

According to accepted protocols and standard practices, the results of the surveys will remain valid for the period of one year, or until July 2024, after which time, if the site has not been disturbed in the interim, additional surveys may be warranted to determine the persisting absence of special status flora and fauna on-site. Regardless of survey results and conclusions given herein, the special status species identified in this report are protected by applicable state and/or federal laws, including but not exclusive to the federal ESA and CESA. As such, if a listed species is found on site during preconstruction surveys or work activities, all activities likely to affect the species should cease immediately and regulatory agencies should be contacted to determine appropriate management actions. Additionally, it should be noted that listed species may be handled only by a qualified biologist who has been given authorization by the appropriate agencies (i.e., USFWS and CDFW).

Project components that may affect federally listed threatened or endangered species would require ESA Section 7 Consultation (informal and/or formal) with the USFWS prior to implementation. Unavoidable Project related

impacts to state listed species would require an incidental take permit from the CDFW, in accordance with Section 2081(b) of the CESA. Therefore, it is recommended that the Project Proponent incorporate alternatives and specific precautionary measures and Best Management Practices (BMPs) into the Project design that would ensure potential Project related impacts to state and/or federally listed species are avoided. Specific precautionary avoidance measures are provided below.

Special Status Plant Species

Several special status plant species have been documented in the vicinity of the possible replacement pipeline alignment from the BBARWA WWTP to the Shay Pond conveyance pipeline including the federally listed as endangered San Bernardino blue grass and California dandelion, and the state and federally listed as endangered slender-petaled thelypodium. However, the Project Proponent does not anticipate utilizing this alignment to convey water to the new Shay Pond conveyance pipeline and this alignment was not included in the floristic botanical field surveys. Should replacement of the existing pipeline to the new Shay Pond conveyance pipeline be required, additional surveys would be necessary prior to implementation of Project activities, to assess potential Project related effects on San Bernardino blue grass, California dandelion, slender-petaled thelypodium, and other special status species that may occur in this area. Additionally, the following precautionary measures are recommended to avoid any potential Project related effects on the state and federally listed as endangered bird-foot checkerbloom:

- It is recommended that the Project Proponent avoid implementing the Baldwin Lake conveyance pipeline alternative, if feasible. Additionally, the proposed solar evaporation ponds should be designed to avoid areas where bird-foot checkerbloom are known to occur (Figure 11, Page 43).

- The Project disturbance limits should be clearly marked and limited to previously disturbed areas (e.g., previously graded areas), where feasible.

- Preconstruction clearance surveys should be conducted by a qualified biologist who is familiar with the local flora, to determine if any special status plant species are present within the proposed disturbance area prior to construction. Botanical surveys should be conducted during the appropriate time of year, when target species are both evident and identifiable.

- If any listed plant species are found within the proposed disturbance area(s), then orange construction fencing, or similarly visible material should be installed around the area where they are located, and this area should be completely avoided.

Special Status Wildlife

The Project may affect but is not likely to adversely affect the state and federally listed as endangered UTS, the state listed (federally delisted) as endangered BAEA, and the state listed as threatened southern rubber boa. Additionally, there is a moderate potential for the California SSC San Bernardino flying squirrel to occur in the Project Area. Therefore, the following precautionary measures are recommended to avoid or minimize any potential Project related effects on UTS, BAEA, rubber boa, and flying squirrel:

- All construction activities associated with the Shay Pond conveyance pipeline and discharge outlet should be restricted to the existing unpaved access road (Cascade Street) and adjacent upland areas. All disturbance within the wetted portions of Shay Pond/Shay Creek should be avoided.

- Appropriate BMPs (e.g., silt fence) should be implemented during construction to ensure that no sediment or pollutants enter Shay Pond/Shay Creek and potentially impact UTS and/or their habitat.

- It is recommended that all construction activities associated with the proposed solar evaporation ponds be conducted when the portion of Baldwin Lake where this Project component will occur is dry, to avoid or minimize potential Project related disturbance to BAEA.

- A preconstruction rubber boa survey is recommended that would provide 100% visual coverage of any undeveloped areas within the proposed Project footprint and would consist of a systematic ground search that would focus on moveable surface materials such as rocks, logs, duff, and man-made debris that may provide shelter for rubber boa.

- It is recommended that rubber boa exclusion fence (e.g., silt fence) be installed around the perimeter of the Sand Canyon discharge outlet construction site prior to commencement of any Project related ground disturbing activities in this area. All construction activities should be restricted to within the fenced disturbance limits to avoid potential harm to rubber boa that may be present in nearby habitat.

- A qualified biologist who is familiar with southern rubber boa and their habits should be present on site during initial ground disturbing activities within or adjacent any potential rubber boa habitat to monitor the clearing/removal of any surface objects that could potentially provide rubber boa refugia or hibernacula (e.g., rotting logs/stumps, duff layer). The biological monitor should visually inspect under any surface cover objects prior to their removal to ensure no rubber boa are harmed or killed.

- All open trenches should be backfilled or covered at the end of the day and ramped to allow rubber boa and other wildlife to escape.

- If a rubber boa is found during preconstruction presence/absence surveys or during construction activities, all Project activities shall be halted, CDFW shall be contacted, and a CESA Incidental Take Permit shall be obtained from CDFW prior to reinitiating Project activities.

- To ensure the Project does not impact flying squirrel, it is recommended that a preconstruction survey be conducted to identify potentially suitable cavity nesting sites and foraging habitat, prior to the removal of any trees or downed woody debris.

- If suitable flying squirrel cavity nesting sites are detected within the proposed Project footprint, then coordination with the CDFW would be necessary to determine appropriate minimization and mitigation measures to offset Project related impacts to this species.

Nesting Birds

Although BAEA and SPOW are not likely to nest in the Project Area due to existing disturbances within and adjacent the proposed Project footprint, the Project Area is suitable to support other nesting bird species. Most native bird species are protected from unlawful take by the MBTA (Appendix D). Additionally, the State of California provides protection for native bird species and their nests in the FGC (Appendix D). In general, impacts to all bird species (common and special status) can be avoided by conducting work outside of the nesting season, which is generally February 1st through August 31st. However, if all work cannot be conducted outside of nesting season, the following precautionary measures are recommended to ensure MBTA compliance:

- Vegetation removal, including any tree removal or pruning, and structure demolition should be conducted outside the typical nesting season (i.e., between September 1st and January 31st).

- To avoid impacts to nesting birds (common and special status) during the nesting season, a qualified Avian Biologist should conduct preconstruction nesting bird surveys prior to Project related disturbance to suitable nesting areas to identify any active nests. The nesting bird surveys should consist of a minimum of five (5) consecutive survey days and should include an additional three (3) consecutive nights of survey for nocturnal species. Nocturnal surveys should be conducted between the hours of 9:00 pm. and midnight, during appropriate weather conditions (e.g., no rain or winds).

- If no active nests are found, no further action would be required. If an active nest is found, the biologist should set appropriate no-work buffers around the nest which would be based upon the nesting species, its sensitivity to disturbance, nesting stage and expected types, intensity, and duration of disturbance. The nest(s) and buffer zones should be field checked weekly by a qualified biological monitor. The approved no-work buffer zone should be clearly marked in the field, within which no disturbance activity should commence until the qualified biologist has determined the young birds have successfully fledged and the nest is inactive.

Lighting Impacts

To avoid potential impacts to nocturnal species such as SPOW and flying squirrel, due to light pollution, Project related night lighting (both temporary and permanent) should be directed away from adjacent areas to protect nocturnal species from direct night lighting. Shielding should be incorporated in Project designs to ensure ambient lighting in adjacent areas is not increased.

5.2 Jurisdictional Waters

In addition to the BRA field survey, Jacobs also assessed the proposed Project footprint for the presence of any state and/or federal jurisdictional waters. Stanfield Marsh is a jurisdictional wetland that is subject to the CWA and FGC under the jurisdictions of the USACE, RWQCB, and CDFW, respectively (Figure 12a, Page 53). Therefore, any proposed permanent or temporary impacts to Stanfield Marsh associated with the Stanfield Marsh conveyance pipeline discharge outlet may require CWA Sections 404/401 permits from the USACE and RWQCB, as well as a LSA Agreement from the CDFW. Baldwin Lake, Caribou Creek, Shay Pond/Shay Creek, and the Sand Canyon Channel are all waters of the State of California (Figures 12b-12e, Pages 54-57). Therefore, potential Project related impacts to these aquatic resources would likely require RWQCB issued WDRs, as well as a CDFW issued LSA. Prior to implementation of any Project components that may impact state and/or federal jurisdictional waters, a formal jurisdictional delineation should be conducted by a qualified delineation specialist to determine the extent of any potential Project related impacts to aquatic resources and the appropriate regulatory permitting (if any) required.

USACE 404 Permit

The two most common types of permits issued by USACE under Section 404 of the CWA to authorize the discharge of dredged or fill material into WOTUS are: a nation-wide permit (NWP) or an individual permit (IP). NWPs are general permits for specific categories of activities that result in minimal impacts to aquatic resources. The discharge must not cause the loss of greater than ½ acre to WOTUS, including the loss of no more than 300 linear feet of streambed. Projects that would exceed these limits would likely require an IP.

The projects under this Program that may require CWA Section 404 permitting through the USACE are the following:

- Stanfield Marsh Conveyance Pipeline Discharge Outlet(s)

Regional Water Quality Control Board 401 Certification

The Project Area is within the jurisdiction of the Santa Ana RWQCB (Regional Board 8). Under Section 401 of the CWA, the RWQCB must certify that the discharge of dredged or fill material into WOTUS does not violate state water quality standards. The RWQCB also regulates impacts to Waters of the State of California under the Porter Cologne Water Quality Control Act through issuance of a Construction General Permit, State General Waste Discharge Order, or WDRs, depending upon the level of impact and the waterway. In addition to the formal application materials and fee (based on area of impact), a copy of the appropriate CEQA documentation must be included with the application.

The projects under this Program that may require CWA Section 401 Water Quality Certification through the RWQCB are the following:

- Stanfield Marsh Conveyance Pipeline Discharge Outlet(s)

Additionally, the projects under this Program that may require WDRs issued by the RWQCB are the following:

- Baldwin Lake Conveyance Pipeline Alternative
- BBARWA WWTP Evaporation Ponds
- Sand Canyon Conveyance Pipeline Discharge Outlet
- Shay Pond Conveyance Pipeline Discharge Outlet
- Possible Replacement Pipeline from the BBARWA WWTP to the Shay Pond Conveyance Pipeline (not expected)

FGC Section 1602 Lake or Streambed Alteration Agreement

A FGC Section 1602 LSA Agreement is required for all activities that alter streams and lakes and their associated riparian habitat. In addition to the formal application materials and fee (based on cost of the Project), a copy of the appropriate CEQA documentation must be included with the application.

The projects under this Program that may require FGC Section 1602 LSA Agreement with the CDFW are the following:

- Stanfield Marsh Conveyance Pipeline Discharge Outlet(s)
- Baldwin Lake Conveyance Pipeline Alternative
- BBARWA WWTP Evaporation Ponds
- Sand Canyon Conveyance Pipeline Discharge Outlet
- Shay Pond Conveyance Pipeline Discharge Outlet
- Possible Replacement Pipeline from the BBARWA WWTP to the Shay Pond Conveyance Pipeline (not expected)

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Jacobs

Special Status Species Occurrence Potential Analysis

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Acanthoscyphus parishii var. *cienegensis*	Cienega Seca oxytheca	None/ None	G4?T2; S2; CNPS: 1B.3	Upper montane coniferous forest, pinyon and juniper woodland, Joshua tree woodland. Dry gravelly banks and granitic sand. 1920-2560 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley. Occurrence potential is low.
Acanthoscyphus parishii var. *goodmaniana*	Cushenbury oxytheca	Endangered/ None	G4?T1; S1; CNPS: 1B.1	Pinyon and juniper woodland. On limestone talus and rocky slopes. 1400-2350 m.	The pinyon-juniper woodland habitat this species is associated with is absent from the Project Area and the nearest documented occurrence for this species is approx. 4.1 miles NW of the site. Occurrence potential is low.
Accipiter cooperii	Cooper's hawk	None/ None	G5; S4; CDFW: WL	Woodland, chiefly of open, interrupted, or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river floodplains; also, live oaks.	The only documented occurrence for this species in the 4-quad CNDDB query is a historic collection (1886) from approx. 7.5 miles NW of the site. Occurrence potential is low.
Anniella stebbinsi	Southern California legless lizard	None/ None	G3; S3; CDFW: SSC	Generally, south of the Transverse Range, extending to northwestern Baja California. Occurs in sandy or loose loamy soils under sparse vegetation. Disjunct populations in the Tehachapi and Piute Mountains in Kern County. Variety of habitats; generally, in moist, loose soil. They prefer soils with a high moisture content.	This species has not been documented in the Big Bear Valley since 1966. Occurrence potential is low.
Antennaria marginata	white-margined everlasting	None/ None	G4G5; S1; CNPS: 2B.3	Lower montane coniferous forest, upper montane coniferous forest. Dry woods. 2070-3355 m.	The habitats this species is associated with are absent from the proposed Project footprint. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Aquila chrysaetos	golden eagle	None/ None	G5; S3; CDFW: FP	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	The site is situated in an urban/semi-urban setting and is subject to existing human disturbance. Furthermore, the nearest documented occurrence for this species is approx. 4.8 miles NW of the Project Area and this species has not been documented nesting in the Big Bear Valley area. Occurrence potential is low.
Arenaria lanuginosa var. *saxosa*	rock sandwort	None/ None	G5T5; S2; CNPS: 2B.3	Subalpine coniferous forest, upper montane coniferous forest. Mesic, sandy sites. 1920-2935 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley. Occurrence potential is low.
Astragalus albens	Cushenbury milk-vetch	Endangered/ None	G1; S1; CNPS: 1B.1	Joshua tree woodland, Mojavean desert scrub, pinyon and juniper woodland. Sandy or stony flats, rocky hillsides, canyon washes, and fans, on carbonate or mixed granitic-calcareous debris. 1185-1950 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.
Astragalus bernardinus	San Bernardino milk-vetch	None/ None	G3; S3; CNPS: 1B.2	Joshua tree woodland, pinyon and juniper woodland. Granitic or carbonate substrates. 290-2290 m.	The only documented occurrence for this species in the 4-quad CNDDB query is a historic collection (1924) from approx. 1.4 miles NW of the site. Occurrence potential is low.
Astragalus lentiginosus var. *sierrae*	Big Bear Valley milk-vetch	None/ None	G5T2; S2; CNPS: 1B.2	Mojavean desert scrub, meadows and seeps, pinyon and juniper woodland, upper montane coniferous forest. Stony meadows and open pinewoods; sandy and gravelly soils in a variety of habitats. 1710-3230 m.	This species is present within the proposed Baldwin Lake conveyance pipeline alternative and BBARWA WWTP solar evaporation ponds components.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Astragalus leucolobus	Big Bear Valley woollypod	None/ None	G2; S2; CNPS: 1B.2	Lower montane coniferous forest, pebble plain, pinyon and juniper woodland, upper montane coniferous forest. Dry pine woods, gravelly knolls among sagebrush, or stony lake shores in the pine belt. 1460-2895 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Astragalus tidestromii	Tidestrom's milk-vetch	None/ None	G4; S2; CNPS: 2B.2	Mojavean desert scrub. Washes, in sandy or gravelly soil. On limestone. 765-1575 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Atriplex parishii	Parish's brittlescale	None/ None	G1G2; S1; CNPS: 1B.1	Vernal pools, chenopod scrub, playas. Usually on drying alkali flats with fine soils. 4-1420 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Berberis fremontii	Fremont barberry	None/ None	G5; S3; CNPS: 2B.3	Pinyon and juniper woodland, Joshua tree woodland. Rocky, sometimes granitic. 1140-1770 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Boechera dispar	pinyon rockcress	None/ None	G3; S3; CNPS: 2B.3	Joshua tree woodland, pinyon and juniper woodland, Mojavean desert scrub. Granitic, gravelly slopes and mesas. Often under desert shrubs which support it as it grows. 1005-2805 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Boechera lincolnensis	Lincoln rockcress	None/ None	G4G5; S3; CNPS: 2B.3	Chenopod scrub, Mojavean desert scrub. On limestone. 880-2410 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Boechera parishii	Parish's rockcress	None/ None	G2; S2; CNPS: 1B.2	Pebble plain, pinyon and juniper woodland, upper montane coniferous forest. Generally found on pebble plains on clay soil with quartzite cobbles, sometimes on limestone. 1825-2805 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Boechera shockleyi	Shockley's rockcress	None/ None	G3; S2; CNPS: 2B.2	Pinyon and juniper woodland. On ridges, rocky outcrops and openings on limestone or quartzite. 875-2515 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Bombus caliginosus	obscure bumble bee	None/ None	G4?; S1S2	Coastal areas from Santa Barbara County to north to Washington state. Food plant genera include *Baccharis, Cirsium, Lupinus, Lotus, Grindelia* and *Phacelia*.	The Project Area is outside the current known range for this species and the food plants for this species are sparse within the Project Area. Occurrence potential is low.
Bombus crotchii	Crotch bumble bee	None/ Candidate Endangered	G3G4; S1S2	Coastal California east to the Sierra-Cascade crest and south into Mexico. Food plant genera include *Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia,* and *Eriogonum*.	The food plants for this species are sparse within the Project Area and the nearest documented occurrence for this species (1999) is approx. 5.6 miles NE of the Project Area. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Bombus morrisoni	Morrison bumble bee	None/ None	G4G5; S1S2	From the Sierra-Cascade ranges eastward across the intermountain west. Food plant genera include *Cirsium, Cleome, Helianthus, Lupinus, Chrysothamnus,* and *Melilotus*.	The food plants for this species are sparse within the Project Area and the nearest documented occurrence for this species (1999) is approx. 4.9 miles NW of the Project Area. Occurrence potential is low.
Botrychium crenulatum	scalloped moonwort	None/ None	G4; S3; CNPS: 2B.2	Bogs and fens, meadows and seeps, upper montane coniferous forest, lower montane coniferous forest, marshes, and swamps. Moist meadows, freshwater marsh, and near creeks. 1185-3110 m.	Some of the habitat this species is associated with is present in the Project vicinity, but the nearest documented occurrence is approx. 5.7 miles SE of the Project Area. Occurrence potential is low.
Calochortus palmeri var. *palmeri*	Palmer's mariposa-lily	None/ None	G3T2; S2; CNPS: 1B.2	Meadows and seeps, chaparral, lower montane coniferous forest. Vernally moist places in yellow-pine forest, chaparral. 195-2530 m.	Some of the habitat this species is associated with is present in the Project vicinity and the nearest documented occurrence is approx. 1.3 miles N of the Project Area. Occurrence potential is moderate.
Calochortus plummerae	Plummer's mariposa-lily	None/ None	G4; S4; CNPS: 4.2	Coastal scrub, chaparral, valley and foothill grassland, cismontane woodland, lower montane coniferous forest. Occurs on rocky and sandy sites, usually of granitic or alluvial material. Can be very common after fire. 60-2500 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley area. Occurrence potential is low.
Calochortus striatus	alkali mariposa-lily	None/ None	G3?; S2S3; CNPS: 1B.2	Chaparral, chenopod scrub, Mojavean desert scrub, meadows, and seeps. Alkaline meadows and ephemeral washes. 70-1600m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Calyptridium pygmaeum	pygmy pussypaws	None/ None	G1G2; S1S2; CNPS: 1B.2	Upper montane coniferous forest, subalpine coniferous forest. Sandy or gravelly sites. 2145-3415 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, the nearest documented occurrence for this species is approx. 2.8 miles N of the site. Occurrence potential is low.
Carex occidentalis	western sedge	None/ None	G4; S3; CNPS: 2B.3	Lower montane coniferous forest, meadows and seeps. 1645-2320 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Castilleja cinerea	ash-gray paintbrush	Threatened/ None	G1G2; S1S2; CNPS: 1B.2	Pebble plains, upper montane coniferous forest, Mojavean desert scrub, meadows and seeps, pinyon and juniper woodland. Endemic to the San Bernardino Mountains, in clay openings; often in meadow edges. 725-2860 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species was absent at the time of survey (June-July 2022; July 2023).
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	None/ None	G2?; S2?; CNPS: 1B.2	Meadows and seeps, pebble plain, upper montane coniferous forest, chaparral, riparian woodland. Mesic to drying soils in open areas of stream and meadow margins or in vernally wet areas. 1140-2320 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	None/ None	G5T34; S3S4; CDFW: SSC	Desert border areas in eastern San Diego County in desert wash, desert scrub, desert succulent scrub, pinyon-juniper, etc. Sandy, herbaceous areas, usually in association with rocks or coarse gravel.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Charina umbratica	southern rubber boa	None/ Threatened	G2G3; S2S3	Known from the San Bernardino and San Jacinto mtns; found in a variety of montane forest habitats. Snakes resembling *C. umbratica* reported from Mt. Pinos and Tehachapi mtns group with *C. bottae* based on mtDNA. Further research needed. Found in vicinity of streams or wet meadows; requires loose, moist soil for burrowing; seeks cover in rotting logs, rock outcrops, and under surface litter.	There is some marginally suitable rubber boa habitat in the Project Area and the nearest documented rubber boa occurrence (2013) is approx. 0.5 mile N of the site. Occurrence potential is low-moderate.
Claytonia peirsonii ssp. *bernardinus*	San Bernardino spring beauty	None/ None	G2G3T1; S1; CNPS: 1B.1	Pinyon and juniper woodland, upper montane coniferous forest. Rocky, talus slopes, carbonate, usually openings. 2360-2465 m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.
Claytonia peirsonii ssp. *californacis*	Furnace spring beauty	None/ None	G2G3T1; S1; CNPS: 1B.1	Pinyon and juniper woodland, upper montane coniferous forest. Rocky, talus slopes, carbonate, usually openings. 2300 m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.
Corynorhinus townsendii	Townsend's big-eared bat	None/ None	G3G4; S2; CDFW: SSC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	There are no suitable roosting sites for this species in the Project Area. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Cymopterus multinervatus	purple-nerve cymopterus	None/ None	G4G5; S2; CNPS: 2B.2	Mojavean desert scrub, pinyon and juniper woodland. Sandy or gravelly places. 765-2195 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Drymocallis cuneifolia var. *cuneifolia*	wedgeleaf woodbeauty	None/ None	G2T1; S1; CNPS: 1B.1	Upper montane coniferous forest, riparian scrub. Sometimes on carbonate. 1520-2220 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Dryopteris filix-mas	male fern	None/ None	G5; S2; CNPS: 2B.3	Upper montane coniferous forest. In granite crevices. 1855-3075 m.	The habitats this species is associated with are absent from the Project Area and the only documented occurrence for this species in the 4-quad CNDDB query is a historical collection (1882) and the site consists of graded/developed land. Therefore, this species is presumed absent from the proposed Project footprint.
Dudleya abramsii ssp. *affinis*	San Bernardino Mountains dudleya	None/ None	G4T2; S2; CNPS: 1B.2	Pebble (pavement) plain, upper montane coniferous forest, pinyon and juniper woodland. Outcrops, granite, or quartzite, rarely limestone. 1200-2425 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Empidonax traillii extimus	southwestern willow flycatcher	Endangered/ Endangered	G5T2; S1	Riparian woodlands in Southern California.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.
Ensatina eschscholtzii klauberi	large-blotched salamander	None/ None	G5T2?; S3; CDFW: WL	Found in conifer and woodland associations. Found in leaf litter, decaying logs and shrubs in heavily forested areas.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Eremogone ursina	Big Bear Valley sandwort	Threatened/ None	G1; S1; CNPS: 1B.2	Pebble plain, pinyon and juniper woodland, meadows and seeps. Mesic, rocky sites. 1795-2895 m.	The habitats this species is associated with are absent from the Project Area this species was absent at the time of survey (June-July 2022; July 2023).
Erigeron parishii	Parish's daisy	Threatened/ None	G2; S2; CNPS: 1B.1	Mojavean desert scrub, pinyon and juniper woodland. Often on carbonate; limestone mountain slopes; often associated with drainages. Sometimes on granite. 1050-2245 m.	The habitats this species is associated with are absent from the Project Area this species was absent at the time of survey (June-July 2022; July 2023).
Eriogonum evanidum	vanishing wild buckwheat	None/ None	G2; S1; CNPS: 1B.1	Chaparral, cismontane woodland, lower montane coniferous forest, pinyon and juniper woodland. Sandy sites. 975-2240 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, the nearest documented occurrence for this species is approx. 2.3 miles NW of the site. Occurrence potential is low.
Eriogonum kennedyi var. *alpigenum*	southern alpine buckwheat	None/ None	G4T3; S3; CNPS: 1B.3	Alpine boulder and rock fields, subalpine coniferous forest. Dry granitic gravel. 2500-3415 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Eriogonum kennedyi var. *austromontanum*	southern mountain buckwheat	Threatened/ None	G4T2; S2; CNPS: 1B.2	Pebble (pavement) plain, lower montane coniferous forest. Usually found in pebble plain habitats. 1765-3020 m.	The habitats this species is associated with are absent from the Project Area this species was absent at the time of survey (June-July 2022; July 2023).
Eriogonum microthecum var. *johnstonii*	Johnston's buckwheat	None/ None	G5T2; S2; CNPS: 1B.3	Subalpine coniferous forest, upper montane coniferous forest. Slopes and ridges on granite or limestone. 1795-2865 m	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Eriogonum microthecum var. *lacus-ursi*	Bear Lake buckwheat	None/ None	G5T1; S1; CNPS: 1B.1	Lower montane coniferous forest, Great Basin scrub. Clay outcrops. 2000-2100 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, there is only one documented occurrence for this species (2003) in the 4-quad CNDDB query and it is approx. 2.6 miles SW of the site. Occurrence potential is low.
Eriogonum ovalifolium var. *vineum*	Cushenbury buckwheat	Endangered/ None	G5T1; S1; CNPS: 1B.1	Mojavean desert scrub, pinyon and juniper woodland, Joshua tree woodland. Limestone mountain slopes. Dry, usually rocky places. 1430-2440 m.	The habitats this species is associated with are absent from the Project Area this species was absent at the time of survey (June-July 2022; July 2023).
Erythranthe exigua	San Bernardino Mountains monkeyflower	None/ None	G2; S2; CNPS: 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. Seeps and sandy sometimes disturbed soil in moist drainages of annual streams; clay soils. 2060-2630 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Erythranthe purpurea	little purple monkeyflower	None/ None	G2; S2; CNPS: 1B.2	Meadows and seeps, pebble plain, upper montane coniferous forest. Dry clay or gravelly soils under Jeffrey pines, along annual streams or vernal springs and seeps. 2045-2290 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Euchloe hyantis andrewsi	Andrew's marble butterfly	None/ None	G3G4T1; S1	Inhabits yellow pine forest near Lake Arrowhead and Big Bear Lake, San Bernardino Mtns, San Bernardino Co, 5,000-6,000 ft. Hostplants are *Streptanthus bernardinus* and *Arabis holboellii* var. *pinetorum*; larval foodplant is *Descurainia richardsonii*.	The host and food plant species for this species are absent from the proposed Project footprint. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Euphydryas editha quino	quino checkerspot butterfly	Endangered/ None	G5T1T2; S1S2	Sunny openings within chaparral and coastal sage shrublands in parts of Riverside and San Diego counties. Hills and mesas near the coast. Need high densities of food plants *Plantago erecta, P. insularis,* and *Orthocarpus purpurescens*.	The Project Area is outside the current known range of this species and there is no suitable habitat for this species within the Project Area. Occurrence potential is low.
Gasterosteus aculeatus williamsoni	unarmored threespine stickleback	Endangered/ Endangered	G5T1; S1; CDFW: FP	Weedy pools, backwaters, and among emergent vegetation at the stream edge in small Southern California streams. Cool (<24 C), clear water with abundant vegetation.	This species is presumed present within Shay Pond.
Gentiana fremontii	Fremont's gentian	None/ None	G4; S2; CNPS: 2B.3	Meadows and seeps, upper montane coniferous forest. Wet mountain meadows. 2400-2700 m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.
Gilia leptantha ssp. *leptantha*	San Bernardino gilia	None/ None	G4T2; S2; CNPS: 1B.3	Lower montane coniferous forest. Sandy or gravelly sites. 1520-2595 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species has not been documented in the Project vicinity since 1926. Occurrence potential is low.
Glaucomys oregonensis californicus	San Bernardino flying squirrel	None/ None	G5T1T2; S1S2; CDFW: SSC	Known from black oak or white fir dominated woodlands between 5,200 – 8,500 ft in the San Bernardino and San Jacinto ranges. May be extirpated from San Jacinto range. Needs cavities in trees/snags for nests and cover. Needs nearby water.	Although the site is situated in an urban/semi-urban setting and is subject to a high level of existing human disturbance, this species has been documented in residential areas and the nearest documented occurrence (2015) is approx. 0.4 miles N of the proposed Project footprint. Occurrence potential is moderate.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Haliaeetus leucocephalus	bald eagle	Delisted/ Endangered	G5; S3; CDFW: FP	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mile of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter.	There is some shoreline habitat suitable to support wintering BAEA within the Project Area. Occurrence potential is moderate.
Heuchera parishii	Parish's alumroot	None/ None	G3; S3; CNPS: 1B.3	Lower montane coniferous forest, subalpine coniferous forest, upper montane coniferous forest, alpine boulder and rock field. Rocky places. Sometimes on carbonate. 1340-3505 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Horkelia wilderae	Barton Flats horkelia	None/ None	G1; S1; CNPS: 1B.1	Lower montane coniferous forest, upper montane coniferous forest, chaparral. On rocky, north aspects in openings that hold persistent snowdrifts. 1980-2895 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species has not been documented in the Big Bear Valley area. Occurrence potential is low.
Hulsea vestita ssp. pygmaea	pygmy hulsea	None/ None	G5T1; S1; CNPS: 1B.3	Alpine boulder and rock field, subalpine coniferous forest. Gravelly sites; on granite. 2860-3502 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Hydroporus simplex	simple hydroporus diving beetle	None/ None	G1?; S1?	Known from aquatic habitats in Tuolumne and San Bernardino counties.	The aquatic habitats required by this species are present in the Project Area but the only documented occurrence for this species in the 4-quad CNDDB query is from approx. 2.9 miles N of the site. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Icteria virens	yellow-breasted chat	None/ None	G5; S3; CDFW: SSC	Summer resident; inhabits riparian thickets of willow and other brushy tangles near watercourses. Nests in low, dense riparian, consisting of willow, blackberry, wild grape; forages and nests within 10 ft of ground.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.
Ivesia argyrocoma var. *argyrocoma*	silver-haired ivesia	None/ None	G2T2; S2; CNPS: 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. In pebble plains and meadows with other rare plants. 1490-2960 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Lewisia brachycalyx	short-sepaled lewisia	None/ None	G4; S2; CNPS: 2B.2	Lower montane coniferous forest, meadows and seeps. Dry to moist meadows in rich loam. 1400-2290 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Lilium parryi	lemon lily	None/ None	G3; S3; CNPS: 1B.2	Lower montane coniferous forest, meadows and seeps, riparian forest, upper montane coniferous forest. Wet, mountainous terrain; generally, in forested areas; on shady edges of streams, in open boggy meadows and seeps. 625-2930 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Linanthus killipii	Baldwin Lake linanthus	None/ None	G1; S1; CNPS: 1B.2	Alkaline meadows, pebble plain, pinyon and juniper woodland, Joshua tree woodland. Usually on pebble plains with other rare species. 1645-2645 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Malaxis monophyllos var. *brachypoda*	white bog adder's-mouth	None/ None	G4?T4; S1; CNPS: 2B.1	Meadows and seeps, bogs and fens, upper montane coniferous forest. Hillside bogs and mesic meadows. 2375-2560 m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.
Myotis evotis	long-eared myotis	None/ None	G5; S3	Found in all brush, woodland, and forest habitats from sea level to about 9,000 ft. Prefers coniferous woodlands and forests. Nursery colonies in buildings, crevices, spaces under bark, and snags. Caves used primarily as night roosts.	Some suitable habitat for this species exists in the Project vicinity. Occurrence potential is moderate.
Myotis thysanodes	fringed myotis	None/ None	G4; S3	In a wide variety of habitats, optimal habitats are pinyon-juniper, valley foothill hardwood and hardwood-conifer. Uses caves, mines, buildings or crevices for maternity colonies and roosts.	Some suitable habitat for this species exists in the Project vicinity. Occurrence potential is moderate.
Myotis volans	long-legged myotis	None/ None	G5; S3	Most common in woodland and forest habitats above 4,000 ft. Trees are important day roosts; caves and mines are night roosts. Nursery colonies usually under bark or in hollow trees, but occasionally in crevices or buildings.	Some suitable habitat for this species exists in the Project vicinity. Occurrence potential is moderate.
Myotis yumanensis	Yuma myotis	None/ None	G5; S4	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution is closely tied to bodies of water. Maternity colonies in caves, mines, buildings or crevices.	Some suitable habitat for this species exists in the Project vicinity. Occurrence potential is moderate.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Navarretia peninsularis	Baja navarretia	None/ None	G3; S2; CNPS: 1B.2	Lower montane coniferous forest, chaparral, meadows and seeps, pinyon and juniper woodland. Wet areas in open forest. 1150-2365 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Neotamias speciosus speciosus	lodgepole chipmunk	None/ None	G4T2T3; S2S3	Summits of isolated Piute, San Bernardino, and San Jacinto mountains. Usually found in open-canopy forests. Habitat is usually lodgepole pine forests in the San Bernardino Mts and chinquapin slopes in the San Jacinto Mts.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.
Oncorhynchus mykiss irideus pop. 10	Steelhead – southern California DPS	Endangered/ None	G5T1Q; S1	Federal listing refers to populations from Santa Maria River south to southern extent of range (San Mateo Creek in San Diego County). Southern steelhead likely have greater physiological tolerances to warmer water and more variable conditions.	The aquatic habitats required by this species are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.
Oreonana vestita	woolly mountain-parsley	None/ None	G3; S3; CNPS: 1B.3	Subalpine coniferous forest, upper montane coniferous forest, lower montane coniferous forest. High ridges; on scree, talus, or gravel. 800-3370 m.	The habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Oxytropis oreophila var. *oreophila*	rock-loving oxytrope	None/ None	G5T4T5; S2; CNPS: 2B.3	Alpine boulder and rock field, subalpine coniferous forest. Gravelly or rocky sites. 2615-3505 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Packera bernardina	San Bernardino ragwort	None/ None	G2; S2; CNPS: 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. Mesic, sometimes alkaline meadows, and dry rocky slopes. 1615-2470 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
	Pebble Plains	None/ None	G1; S1.1		There is no pebble plain or pebble plain-like habitat within the proposed Project footprint and pebble plain indicator species are absent from the proposed Project footprint.
Perideridia parishii ssp. *parishii*	Parish's yampah	None/ None	G4T3T4; S2; CNPS: 2B.2	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest. Damp meadows or along streambeds-prefers an open pine canopy. 1470-2530 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Phlox dolichantha	Big Bear Valley phlox	None/ None	G2; S2; CNPS: 1B.2	Pebble plains, upper montane coniferous forest. Sloping hillsides, in shade under pines and *Quercus kelloggii*, with heavy pine litter; also, in openings. 1980-2805 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Phrynosoma blainvillii	coast horned lizard	None/ None	G3G4; S3S4; CDFW: SSC	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	This species has not been documented in the Big Bear Valley and the Project Area is likely outside the current range of this species. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Physaria kingii ssp. *bernardina*	San Bernardino Mountains bladderpod	Endangered/ None	G5T1; S1; CNPS: 1B.1	Pinyon and juniper woodland, lower montane coniferous forest, subalpine coniferous forest. Dry sandy to rocky carbonate soils. 1980-2590 m.	The habitats this species is associated with are absent from the Project Area this species was absent at the time of survey (June-July 2022; July 2023).
Piranga rubra	summer tanager	None/ None	G5; S1; CDFW: SSC	Summer resident of desert riparian along lower Colorado River, and locally elsewhere in California deserts. Requires cottonwood-willow riparian for nesting and foraging; prefers older, dense stands along streams.	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.
Poa atropurpurea	San Bernardino blue grass	Endangered/ None	G2; S2; CNPS: 1B.2	Meadows and seeps. Mesic meadows of open pine forests and grassy slopes, loamy alluvial to sandy loam soil. 1255-2655 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species was absent at the time of survey (June-July 2022; July 2023).
Poliomintha incana	frosted mint	None/ None	G5; SH; CNPS: 2A	Lower montane coniferous forest. In boggy soil. 1600-1700 m.	The Project Area is outside the known elevation range for this species. Occurrence potential is low.
Psychomastax deserticola	desert monkey grasshopper	None/ None	G1G2; S1S2	Occurs in very arid environments in the vicinity of the San Bernardino Mtns. Known to occur on chamise (*Adenostoma fasciculatum*).	No suitable habitat for this species exists within the Project Area. Occurrence potential is low.
Pyrrocoma uniflora var. *gossypina*	Bear Valley pyrrocoma	None/ None	G5T1; S1; CNPS: 1B.2	Pebble plain, meadows and seeps. Meadows, meadow edges, and along streams in or near pebble plain habitat. 2040-2280 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Rana muscosa	southern mountain yellow-legged frog	Endangered/ Endangered	G1; S1; CDFW: WL	Federal listing refers to populations in the San Gabriel, San Jacinto and San Bernardino mountains (southern DPS). Northern DPS was determined to warrant listing as endangered, Apr 2014, effective Jun 30, 2014. Always encountered within a few feet of water. Tadpoles may require 2 - 4 yrs. to complete their aquatic development.	The aquatic habitats required by this species are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.
Rosa woodsii var. *glabrata*	Cushenbury rose	None/ None	G5T1; S1; CNPS: 1B.1	Mojavean desert scrub. Springs. 1095-1220 m.	The Project Area is outside the known elevation range for this species and the habitats this species is associated with are absent from the Project Area. Therefore, this species is presumed absent from the proposed Project footprint.
Saltugilia latimeri	Latimer's woodland-gilia	None/ None	G3; S3; CNPS: 1B.2	Chaparral, Mojavean desert scrub, pinyon and juniper woodland. Rocky or sandy substrate; sometimes in washes, sometimes limestone. 120-2200 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley. Occurrence potential is low.
Sidalcea hickmanii ssp. *parishii*	Parish's checkerbloom	None/ Rare	G3T1; S1; CNPS: 1B.2	Chaparral, cismontane woodland, lower montane coniferous forest. Disturbed burned or cleared areas on dry, rocky slopes, in fuel breaks and fire roads along the mountain summits. 1095-2135 m.	The habitats this species is associated with are absent from the Project Area and this species has not been documented in the Big Bear Valley area. Therefore, this species is presumed absent from the proposed Project footprint.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Sidalcea malviflora ssp. *dolosa*	Bear Valley checkerbloom	None/ None	G5T2; S2; CNPS: 1B.2	Meadows and seeps, riparian woodland, lower montane coniferous forest, upper montane coniferous forest. Known from wet areas within forested habitats. Affected by hydrological changes. 1575-2590 m.	Some of the habitat this species is associated with is present in the Project vicinity and this species has been documented nearby. Occurrence potential is moderate.
Sidalcea pedata	bird-foot checkerbloom	Endangered/ Endangered	G1; S1; CNPS: 1B.1	Meadows and seeps, pebble plains. Vernally mesic sites in meadows or pebble plains. 1840-2305 m.	This species is present within the proposed Baldwin Lake conveyance pipeline alternative and BBARWA WWTP solar evaporation ponds components.
Sisyrinchium longipes	timberland blue-eyed grass	None/ None	G3G4; S1; CNPS: 2B.2	Meadows and seeps. Mesic areas in meadows; seeps. 2060 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley. Occurrence potential is low.
	Southern California Threespine Stickleback Stream	None/ None	GNR; SNR		This aquatic habitat is present within the Project Area.
Sphenopholis obtusata	prairie wedge grass	None/ None	G5; S2; CNPS: 2B.2	Cismontane woodland, meadows and seeps. Open moist sites, along rivers and springs, alkaline desert seeps. 15-2625 m.	Some of the habitat this species is associated with is present in the Project vicinity, but this species has not been documented in the Big Bear Valley. Occurrence potential is low.
Streptanthus bernardinus	Laguna Mountains jewelflower	None/ None	G3G4; S3S4; CNPS: 4.3	Chaparral, lower montane coniferous forest. Clay or decomposed granite soils; sometimes in disturbed areas such as stream sides or roadcuts. 1440-2500 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, the nearest documented occurrence is approx. 6.2 miles W of the site. Occurrence potential is low.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Streptanthus campestris	southern jewelflower	None/ None	G3; S3; CNPS: 1B.3	Chaparral, lower montane coniferous forest, pinyon and juniper woodland. Open, rocky areas. 605-2590 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, the only documented occurrence for this species is approx. 2.3 miles SW of the site. Occurrence potential is low.
Streptanthus juneae	June's jewelflower	None/ None	G2; S2 CNPS: 1B.2	Lower montane coniferous forest, chaparral (montane). Openings. 2155-2370 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, the only documented occurrence for this species is approx. 2.8 miles W of the site. Occurrence potential is low.
Symphyotrichum defoliatum	San Bernardino aster	None/ None	G2; S2; CNPS: 1B.2	Meadows and seeps, cismontane woodland, coastal scrub, lower montane coniferous forest, marshes and swamps, valley and foothill grassland. Vernally mesic grassland or near ditches, streams and springs; disturbed areas. 3-2045 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, there is only one documented occurrence for this species in the Big Bear Valley. Occurrence potential is low.
Taraxacum californicum	California dandelion	Endangered/ None	G1G2; S1S2; CNPS: 1B.1	Meadows and seeps. Mesic meadows, usually free of taller vegetation. 1620-2590 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species was absent at the time of survey (June-July 2022; July 2023).
Thamnophis hammondii	two-striped garter snake	None/ None	G4; S3S4; CDFW: SSC	Coastal California from vicinity of Salinas to northwest Baja California. From sea to about 7,000 ft elevation. Highly aquatic, found in or near permanent fresh water. Often along streams with rocky beds and riparian growth.	The aquatic habitats required by this species are absent from the Project Area. Therefore, this species is presumed absent from the Project Area.

Scientific Name	Common Name	Listing Status Federal/ State	Other Status	Habitat	Occurrence Potential
Thelypodium stenopetalum	slender-petaled thelypodium	Endangered/ Endangered	G1; S1; CNPS: 1B.1	Meadows and seeps. Seasonally moist alkaline clay soils; associated with seeps and springs in the pebble plains. 2045-2240 m.	Some of the habitat this species is associated with is present in the Project vicinity. However, this species was absent at the time of survey (June-July 2022; July 2023).
Viola pinetorum ssp. *grisea*	grey-leaved violet	None/ None	G4G5T3; S3; CNPS: 1B.2	Subalpine coniferous forest, upper montane coniferous forest, meadows, and seeps. Dry mountain peaks and slopes. 1580-3700 m.	The only documented occurrence for this species is a 1886 collection from the "historic Bear Valley" area. Occurrence potential is low.

Coding and Terms

E = Endangered T = Threatened C = Candidate FP = Fully Protected SSC = Species of Special Concern R = Rare

State Species of Special Concern: An administrative designation given to vertebrate species that appear to be vulnerable to extinction because of declining populations, limited acreages, and/or continuing threats. Raptor and owls are protected under section 3502.5 of the California Fish and Game code: "It is unlawful to take, possess or destroy any birds in the orders Falconiformes or Strigiformes or to take, possess or destroy the nest or eggs of any such bird."

State Fully Protected: The classification of Fully Protected was the State's initial effort in the 1960's to identify and provide additional protection to those animals that were rare or faced possible extinction. Lists were created for fish, mammals, amphibians and reptiles. Fully Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock.

Global Rankings (Species or Natural Community Level):
G1 = Critically Imperiled – At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 = Imperiled – At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3 = Vulnerable – At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 = Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 = Secure – Common; widespread and abundant.

Subspecies Level: Taxa which are subspecies or varieties receive a taxon rank (T-rank) attached to their G-rank. Where the G-rank reflects the condition of the entire species, the T-rank reflects the global situation of just the subspecies. For example: the Point Reyes mountain beaver, *Aplodontia rufa* ssp. *phaea* is ranked G5T2. The G-rank refers to the whole species range i.e., *Aplodontia rufa.* The T-rank refers only to the global condition of ssp. *phaea*.

State Ranking:
S1 = Critically Imperiled – Critically imperiled in the State because of extreme rarity (often 5 or fewer populations) or because of factor(s) such as very steep declines making it especially vulnerable to extirpation from the State.
S2 = Imperiled – Imperiled in the State because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the State.
S3 = Vulnerable – Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the State.
S4 = Apparently Secure – Uncommon but not rare in the State; some cause for long-term concern due to declines or other factors.
S5 = Secure – Common, widespread, and abundant in the State.

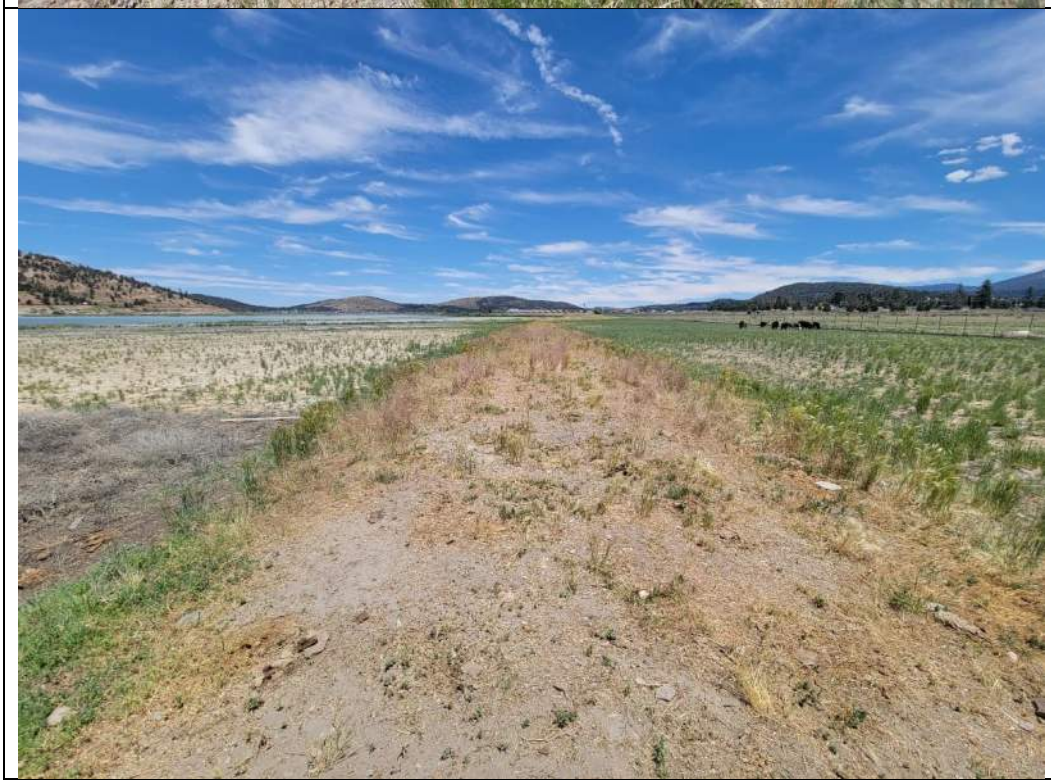
California Rare Plant Rankings (CNPS List):
1A = Plants presumed extirpated in California and either rare or extinct elsewhere.
1B = Plants rare, threatened, or endangered in California and elsewhere.
2A = Plants presumed extirpated in California, but common elsewhere.
2B = Plants rare, threatened, or endangered in California, but more common elsewhere.
3 = Plants about which more information is needed; a review list.
4 = Plants of limited distribution; a watch list.

Threat Ranks:
.1 = Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
.2 = Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
.3 = Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Appendix B. Site Photos

	Photo 1. East Neighborhoods conveyance pipeline alternative; looking south along Palomino Drive from the BBARWA WWTP (2022).
	Photo 2. Representative photo of the East Neighborhoods conveyance pipeline alternative; looking north along Pintail Drive from the intersection of Pintail Drive and E Mountain View Boulevard (2022).

	Photo 3. Representative photo of the West Neighborhoods conveyance pipeline alternative; looking east along Aeroplane Boulevard from the intersection of Aeroplane Boulevard and Division Drive (2022).
	Photo 4. Stanfield Marsh discharge outlet Alternative 2.

	Photo 5. Baldwin Lake conveyance pipeline alternative; looking west along alignment from the east end of the alignment within the BBARWA WWTP (2023).
	Photo 6. Baldwin Lake conveyance pipeline alternative; looking west along alignment from the east end of the alignment within the W Baldwin Lake Trail (2023).

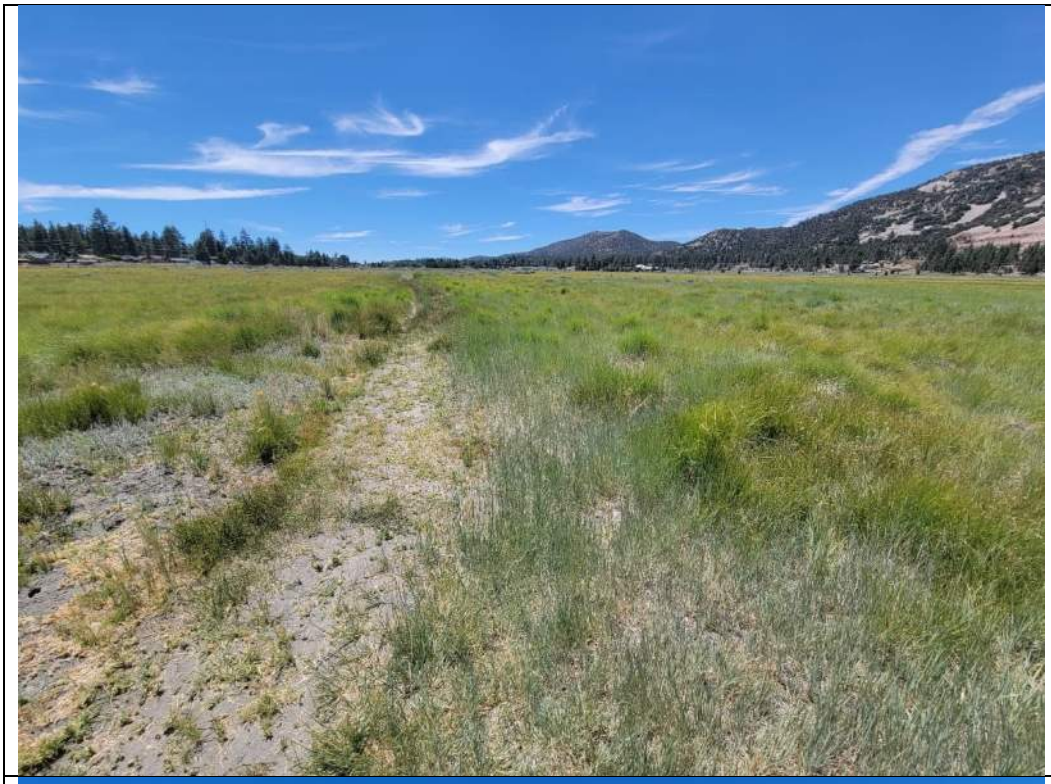
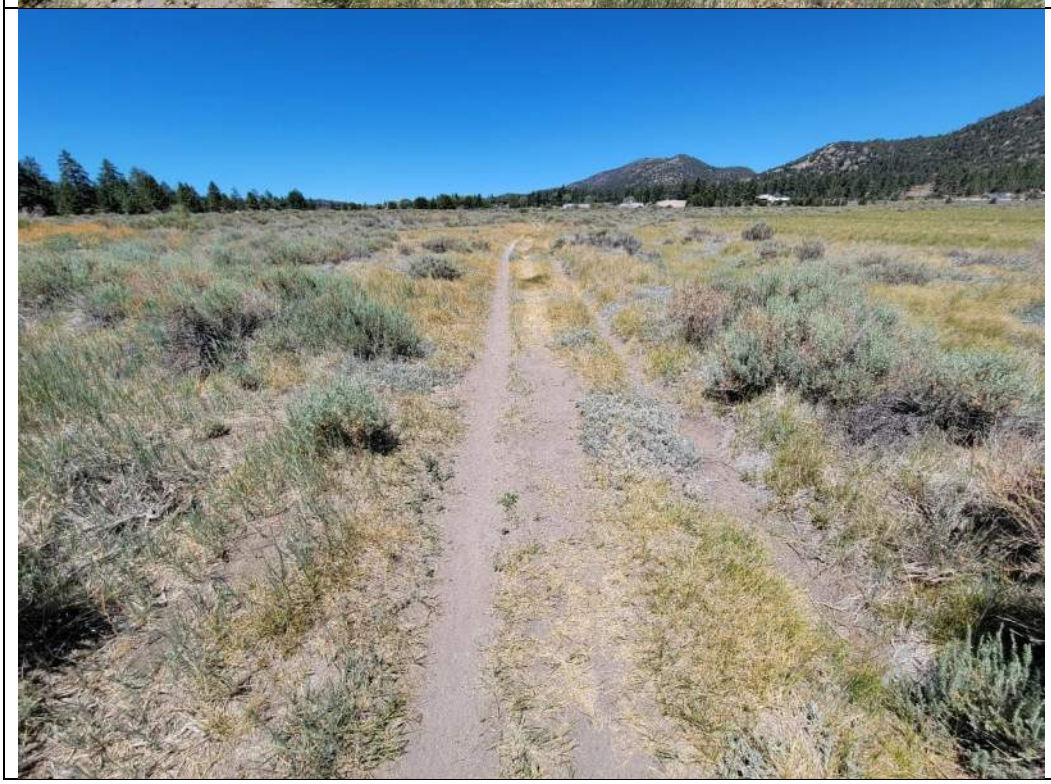
	Photo 7. Baldwin Lake conveyance pipeline alternative; looking west along alignment from the middle portion of the alignment within the W Baldwin Lake Trail (2023).
	Photo 8. Baldwin Lake conveyance pipeline alternative; looking west along alignment from the west end of the alignment within the W Baldwin Lake Trail (2022).

	Photo 9. Baldwin Lake conveyance pipeline alternative; looking east along alignment from the west end of the alignment at Paradise Way (2022).
	Photo 10. Representative photo of the Meadow Lane conveyance pipeline alternative; looking south along Sequoia Drive from the intersection of Sequoia Drive and Arbor Lane (2022).

	Photo 11. Representative photo of the North Airport Corridor conveyance pipeline alternative; looking west along the airport taxiway (2022).
	Photo 12. Stanfield Marsh discharge outlet Alternative 1.

	Photo 13. East end of proposed new solar evaporation ponds site, looking northeast (2023).
	Photo 14. East end of proposed new solar evaporation ponds site, looking northwest (2023).

	Photo 15. West end of proposed new solar evaporation ponds site, looking northwest (2023).
	Photo 16. BBARWA WWTP Upgrades site (2022).

	Photo 17. Proposed solar energy site adjacent south side of BBARWA admin building (2023).
	Photo 18. Additional proposed solar energy site along eastern end of BBARWA WWTP (2023).

	Photo 19. New 4-inch Shay Pond conveyance pipeline alignment in Cascade Street; looking east from west end of alignment (2022).
	Photo 20. Shay Pond (UTS habitat); looking southwest from potential discharge outlet location (2023).

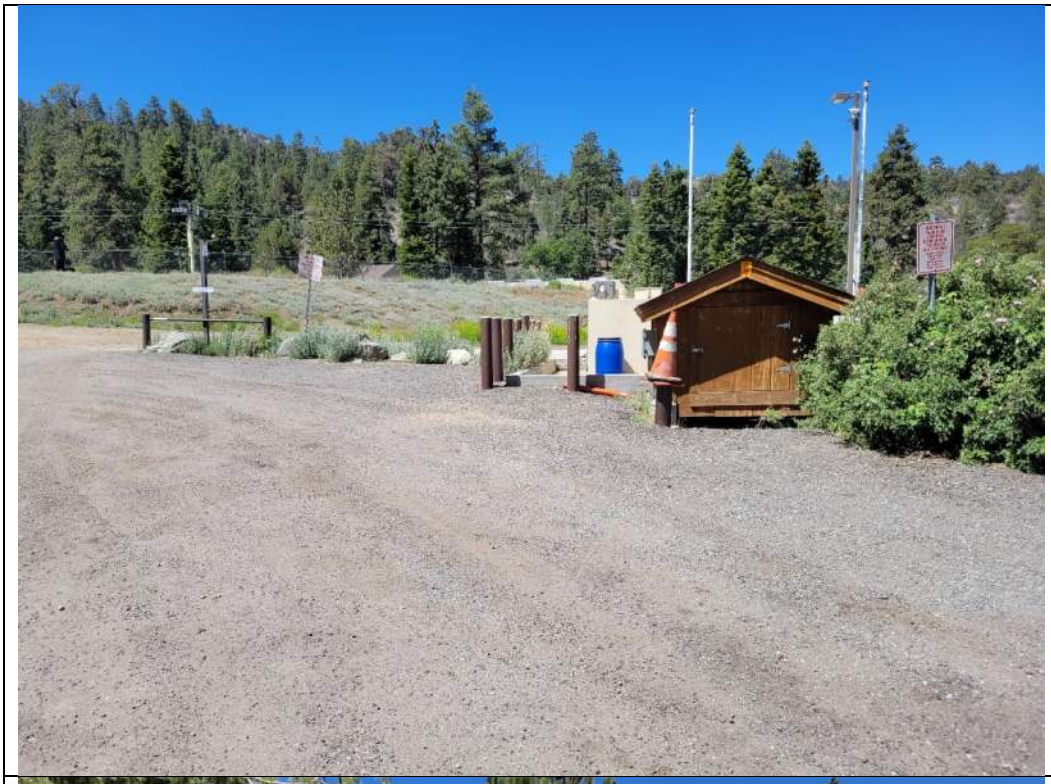
	Photo 21. New Sand Canyon Recharge booster pump station site (2022).
	Photo 22. Representative Sand Canyon Recharge conveyance pipeline alignment in Moonridge neighborhood (2022).

	Photo 23. Potential Sand Canyon Recharge conveyance pipeline discharge outlet to Sand Canyon location (2022).
	Photo 23. Sand Canyon Recharge area (2022).

Appendix C. Plant Species List

List of Plant Species Observed within the Project Area

Scientific Name	Common Name	Life Form
Asteraceae	Aster Family	
Achillea millefolium	common yarrow	perennial herb
Artemisia dracunculus	tarragon	perennial herb
Artemisia ludoviciana	silver wormwood	perennial herb
Artemisia rothrockii	Rothrock sagebrush	shrub
Artemisia tridentata	common sagebrush	shrub
Chrysothamnus viscidiflorus	yellow rabbitbrush	shrub
Ericameria nauseosa	rubber rabbitbrush	shrub
Erigeron divergens	diffuse daisy	biennial or perennial herb
Gnaphalium palustre	lowland cudweed	annual herb
Lactuca serriola	prickly lettuce	annual herb
Symphyotrichum ascendens	western aster	perennial herb
Taraxacum officinale	common dandelion	perennial herb
*Tragopogon dubius**	goat's beard*	perennial herb
Brassicaceae	Mustard Family	
*Chorispora tenella**	crossflower*	annual herb
*Descurainia sophia**	herb sophia*	annual herb
Erysimum capitatum	western wallflower	perennial herb
Lepidium virginicum	Virginia pepperweed	annual herb
*Sisymbrium altissimum**	tumble mustard*	annual herb
Boraginaceae	Forget-Me-Not Family	
Cryptantha sp.	cryptantha	annual herb
Heliotropium curassavicum var. *oculatum*	alkali heliotrope	Perennial herb
Chenopodiaceae	Goosefoot Family	
Atriplex truncata	wedgescale saltweed	annual herb
*Chenopodium chenopodioides**	low goosefoot*	annual herb
*Kochia scoparia***	common red sage**	annual herb
*Salsola tragus***	Russian thistle**	annual herb
Cupressaceae	cypress family	
Juniperus grandis	Sierra juniper	tree
Cyperaceae	Sedge Family	
Carex spp.	sedges	perennial herb

Scientific Name	Common Name	Life Form
Schoenoplectus acutus var. *occidentalis*	tule	perennial herb
Fabaceae	Legume Family	
Astragalus lentiginosus var. *sierrae*	Big Bear Valley milk vetch	perennial herb
Lupinus lepidus var. *confertus*	clustered tidy lupine	perennial herb
Melilotus sp.*	sweetclover*	annual herb
Trifolium sp.	clover	perennial herb
Fagaceae	Beech Family	
Quercus kelloggii	black oak	tree
Geraniaceae	Geranium Family	
Erodium cicutarium	coastal heron's bill	annual herb
Hydrophyllaceae	Waterleaf Family	
Phacelia hastata	white leafed phacelia	perennial herb
Juncaceae	Rush Family	
Juncus spp.	rushes	perennial herb
Malvaceae	Mallow Family	
Malva neglecta	dwarf mallow	annual herb
Sidalcea pedata	bird-foot checkerbloom	perennial herb
Montiaceae	Miner's Lettuce Family	
Calyptridium umbellatum	pussy toes	annual or perennial herb
Onagraceae	Evening Primrose Family	
Epilobium brachycarpum	annual fireweed	annual herb
Oenothera californica	California evening primrose	perennial herb
Orobanchaceae	Broomrape Family	
Castilleja applegatei	wavy leaf paintbrush	perennial herb
Pedicularis semibarbata	pinewoods lousewort	perennial herb
Pinaceae	Pine Family	
Abies concolor	white fir	tree
Pinus jeffreyi	Jeffrey pine	tree
Pinus ponderosa	yellow pine	tree

Scientific Name	Common Name	Life Form
Plantaginaceae	Plantain Family	
Collinsia parviflora	few flowered blue eyed Mary	annual herb
Penstemon caesius	San Bernardino beardtongue	perennial herb
Penstemon labrosus	San Gabriel beardtongue	perennial herb
Penstemon rostriflorus	Bridge's penstemon	perennial herb
Poaceae	Grass Family	
*Bromus tectorum***	cheatgrass**	annual grass
Distichlis spicata	salt grass	perennial grass
Elymus elymoides	squirrel tail grass	perennial grass
Elymus triticoides	beardless wild rye	perennial grass
Hordeum jubatum	fox tail barley	perennial grass
*Poa pratensis***	Kentucky blue grass**	perennial grass
Stipa sp.	grass	perennial grass
Polygonaceae	Buckwheat Family	
Eriogonum baileyi	Bailey's buckwheat	annual herb
Eriogonum davidsonii	Davidson buckwheat	annual herb
Eriogonum wrightii var. *subscaposum*	Wright's buckwheat	perennial herb or shrub
*Rumex crispus**	curly dock*	perennial herb
Rhamnaceae	Buckthorn Family	
Ceanothus cordulatus	mountain whitethorn	shrub
Rosaceae	Rose Family	
Amelanchier utahensis	pale leaved serviceberry	shrub
Cercocarpus ledifolius	desert mountain mahogany	tree or shrub
Horkelia rydbergii	Rydberg's horkelia	perennial herb
Potentilla anserina	silver weed cinquefoil	perennial herb
Potentilla spp.	cinquefoil	perennial herb
Salicaceae	Willow Family	
Salix scouleriana	Scouler willow	tree or shrub
Scrophulariaceae	Figwort Family	
*Verbascum thapsus***	common mullein**	perennial herb

*Nonnative **Invasive, nonnative

Appendix D. Regulatory Framework

Federal Regulations

Clean Water Act

The purpose of the Clean Water Act (CWA) of 1977 is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." Section 404 of the CWA prohibits the discharge of dredged or fill material into "waters of the United States" (WOTUS) without a permit from the United States Army Corps of Engineers (USACE). The definition of waters of the United States includes rivers, streams, estuaries, territorial seas, ponds, lakes, and wetlands. Wetlands are defined as those areas "that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [CFR] 328.3 7b). The U.S. Environmental Protection Agency (EPA) also has authority over wetlands and may override a USACE permit. Substantial impacts to wetlands may require an individual permit. Projects that only minimally affect wetlands may meet the conditions of one of the existing Nationwide Permits. A Water Quality Certification or waiver pursuant to Section 401 of the CWA is required for Section 404 permit actions; in California this certification or waiver is issued by the Regional Water Quality Control Board (RWQCB).

Federal Endangered Species Act (ESA)

The federal Endangered Species Act (ESA) of 1973 protects plants and wildlife that are listed by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) as endangered or threatened. Section 9 of the ESA (USA) prohibits the taking of endangered wildlife, where taking is defined as any effort to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct" (50 CFR 17.3). For plants, this statute governs removing, possessing, maliciously damaging, or destroying any endangered plant on federal land and removing, cutting, digging up, damaging, or destroying any endangered plant on non-federal land in knowing violation of state law (16 United States Code [USC] 1538). Under Section 7 of the ESA, federal agencies are required to consult with the USFWS if their actions, including permit approvals or funding, could adversely affect an endangered species (including plants) or its Critical Habitat. Through consultation and the issuance of a biological opinion, the USFWS may issue an incidental take statement allowing take of the species that is incidental to an otherwise authorized activity, provided the action will not jeopardize the continued existence of the species. The ESA specifies that the USFWS designate habitat for a species at the time of its listing in which are found the physical or biological features "essential to the conservation of the species," or which may require "special Management consideration or protection…" (16 USC § 1533[a][3].2; 16 USC § 1532[a]). This designated Critical Habitat is then afforded the same protection under the ESA as individuals of the species itself, requiring issuance of an Incidental Take Permit prior to any activity that results in "the destruction or adverse modification of habitat determined to be critical" (16 USC § 1536[a][2]).

Interagency Consultation and Biological Assessments

Section 7 of ESA provides a means for authorizing the "take" of threatened or endangered species by federal agencies, and applies to actions that are conducted, permitted, or funded by a federal agency. The statute requires federal agencies to consult with the USFWS or National Marine Fisheries Service (NMFS), as appropriate, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of Critical Habitat for these species. If a Proposed Project "may affect" a listed species or destroy or modify Critical Habitat, the lead agency is required to prepare a biological assessment evaluating the nature and severity of the potential effect.

Habitat Conservation Plans

Section 10 of the federal ESA requires the acquisition of an Incidental Take Permit (ITP) from the USFWS by non-federal landowners for activities that might incidentally harm (or "take") endangered or threatened wildlife on

their land. To obtain a permit, an applicant must develop a Habitat Conservation Plan that is designed to offset any harmful impacts the proposed activity might have on the species.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. Sections 661 to 667e et seq.) applies to any federal Project where any body of water is impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and the appropriate state wildlife agency.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (The Eagle Act) (1940), amended in 1962, was originally implemented for the protection of bald eagles (*Haliaeetus leucocephalus*). In 1962, Congress amended the Eagle Act to cover golden eagles (*Aquila chrysaetos*), a move that was partially an attempt to strengthen protection of bald eagles, since the latter were often killed by people mistaking them for golden eagles. This act makes it illegal to import, export, take (molest or disturb), sell, purchase, or barter any bald eagle or golden eagle or part thereof. The golden eagle, however, is accorded somewhat lighter protection under the Eagle Act than that of the bald eagle.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 implements international treaties between the United States and other nations created to protect migratory birds, any of their parts, eggs, and nests from activities, such as hunting, pursuing, capturing, killing, selling, and shipping, unless expressly authorized in the regulations or by permit. As authorized by the MBTA, the USFWS issues permits to qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, special purposes (rehabilitation, education, migratory game bird propagation, and salvage), take of depredating birds, taxidermy, and waterfowl sale and disposal. The regulations governing migratory bird permits can be found in 50 CFR Part 13 General Permit Procedures and 50 CFR part 21 Migratory Bird Permits. The State of California has incorporated the protection of birds of prey in Sections 3800, 3513, and 3503.5 of the California Fish and Game Code (CFGC).

Executive Orders (EO)

> *Invasive Species – EO 13112 (1999)*: Issued on February 3, 1999, promotes the prevention and introduction of invasive species and provides for their control and minimizes the economic, ecological, and human health impacts that invasive species cause through the creation of the Invasive Species Council and Invasive Species Management Plan.
>
> *Migratory Bird – EO 13186 (2001)*: Issued on January 10, 2001, promotes the conservation of migratory birds and their habitats and directs federal agencies to implement the Migratory Bird Treaty Act. Protection and Enhancement of Environmental Quality – EO 11514 (1970a), issued on March 5, 1970, supports the purpose and policies of the National Environmental Policy Act (NEPA) and directs federal agencies to take measures to meet national environmental goals.

Migratory Bird Treaty Reform Act

The Migratory Bird Treaty Reform Act (Division E, Title I, Section 143 of the Consolidated Appropriations Act, 2005, PL 108–447) amends the Migratory Bird Treaty Act (16 U.S.C. Sections 703 to 712) such that nonnative birds or birds that have been introduced by humans to the United States or its territories are excluded from protection under the Act. It defines a native migratory bird as a species present in the United States and its territories as a result of natural biological or ecological processes. This list excluded two additional species commonly observed in the United States, the rock pigeon (*Columba livia*) and domestic goose (*Anser domesticus*).

Birds of Conservation Concern

Birds of Conservation Concern (BCC) is a USFWS list of bird species identified to have the highest conservation priority, and with the potential for becoming candidates for listing as federally threatened or endangered. The chief legal authority for BCC is the Fish and Wildlife Conservation Act of 1980 (FWCA). Other authorities include the FESA, the Fish and Wildlife Act of 1956, and the Department of the Interior U.S Code (16 U.S.C. § 701). The 1988 amendment to the FWCA (Public Law 100-653, Title VIII) requires the Secretary of the Interior, through the USFWS, to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973" (USFWS, 2008a).

State Regulations

California Fish and Game Code Sections 1600 through 1607 of the CFGC

This section requires that a Streambed Alteration Application be submitted to the CDFW for "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." The CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the Department and the applicant is the Streambed Alteration Agreement. Often, Projects that require a Streambed Alteration Agreement also require a permit from the USACE under Section 404 of the CWA. In these instances, the conditions of the Section 404 permit and the Streambed Alteration Agreement may overlap.

California Porter-Cologne Water Quality Control Act

The Porter-Cologne Act is the principal law governing water quality in California. It establishes a comprehensive program to protect water quality and the beneficial uses of water. Unlike the federal CWA, Porter-Cologne applies to both surface water and ground water. Porter-Cologne designated the State Water Resources Control Board (State Board) as the statewide water quality planning agency, and also gave authority to the RWQCB. Beyond establishment of a state framework, this act has been revised to comply with the federal CWA.

The State Board is responsible for developing statewide water quality plans (e.g., Ocean Plan, Inland Surface Waters Plan), while the RWQCB is responsible for developing Regional Water Quality Plans (basin plans). The basin plans in turn are approved by the State Board and EPA. Amendments to basin plans, such as Total Maximum Daily Loads (TMDLs), must also be approved by the Office of Administrative Law. These plans, both statewide and basin, include the identification of beneficial uses, water quality objectives, and implementation plans. The RWQCB has the primary responsibility for implementing the provisions in both statewide and basin plans.

California Endangered Species Act

The California Endangered Species Act (CESA) (Sections 2050 to 2085) establishes the policy of the state to conserve, protect, restore, and enhance threatened or endangered species and their habitats by protecting "all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation." Animal species are listed by the CDFW as threatened or endangered, and plants are listed as rare, threatened, or endangered. However, only those plant species listed as threatened or endangered receive protection under the California ESA.

CESA mandates that state agencies do not approve a Project that would jeopardize the continued existence of these species if reasonable and prudent alternatives are available that would avoid a jeopardy finding. There are no state agency consultation procedures under the California ESA. For Projects that would affect a species that is federally and state listed, compliance with ESA satisfies the California ESA if the California Department of Fish and Wildlife (CDFW) determines that the federal incidental take authorization is consistent with the CESA under Section 2080.1. For Projects that would result in take of a species that is state listed only, the Project sponsor must apply for a take permit, in accordance with Section 2081(b).

Fully Protected Species

Four sections of the California Fish and Game Code (CFGC) list 37 fully protected species (CFGC Sections 3511, 4700, 5050, and 5515). These sections prohibit take or possession "at any time" of the species listed, with few exceptions, and state that "no provision of this code or any other law will be construed to authorize the issuance of permits or licenses to 'take' the species," and that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

Bird Nesting Protections

Bird nesting protections (Sections 3503, 3503.5, 3511, 3513 and 3800) in the CFGC include the following:

- Section 3503 prohibits the take, possession, or needless destruction of the nest or eggs of any bird.
- Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (new world vultures, hawks, eagles, ospreys, and falcons, among others), and Strigiformes (owls).
- Section 3511 prohibits the take or possession of Fully protected birds.
- Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the MBTA. To avoid violation of the take provisions, it is generally required that Project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle.

Section 3800 prohibits the take of any non-game bird (i.e., bird that is naturally occurring in California that is not a gamebird, migratory game bird, or fully protected bird).

Native Plant Protection Act

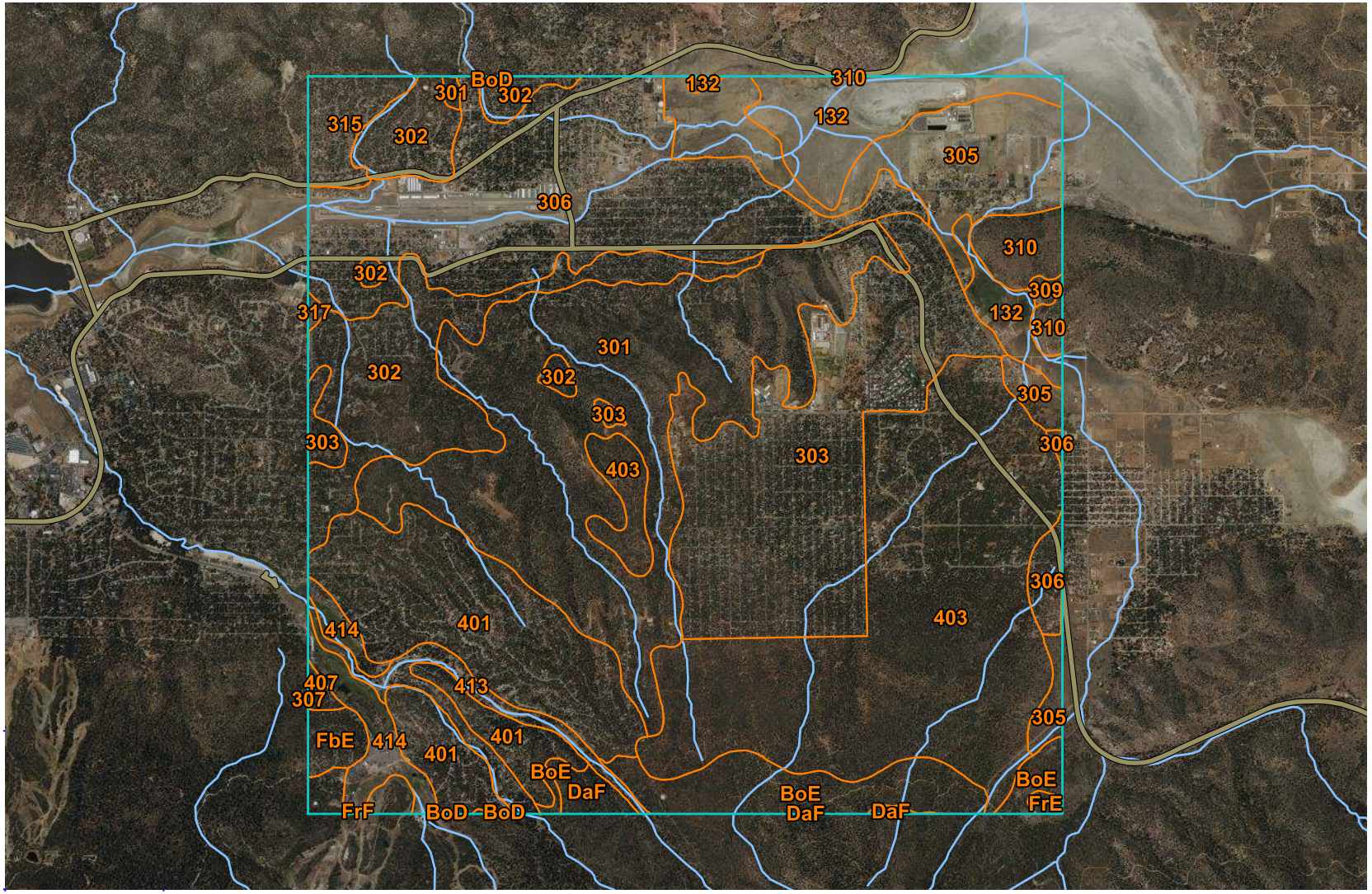
The Native Plant Protect Act (NPPA) (1977) (CFGC Sections 1900-1913) was created with the intent to "preserve, protect, and enhance rare and endangered plants in this State." The NPPA is administered by CDFW. The Fish and Game Commission has the authority to designate native plants as endangered or rare and to

protect endangered and rare plants from take. CESA (CFGC 2050-2116) provided further protection for rare and endangered plant species, but the NPPA remains part of the Fish and Game Code.

Appendix E. Soil Map of the Project Area and Surrounding Vicinity

Soil Map—San Bernardino National Forest Area, California
(Replenish Big Bear Project)

116° 53' 24" W
116° 46' 59" W
34° 16' 37" N
34° 13' 10" N



Map Scale: 1:45,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2000 4000 8000 12000

Map projection: Web Mercator Corner coordinates: WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino National Forest Area, California
Survey Area Data: Version 14, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
132	Aquents-Grunney complex, 0 to 4 percent slopes	296.8	4.1%
301	Garloaf-Cariboucreek complex, 15 to 30 percent slopes	1,204.9	16.8%
302	Garloaf-Cariboucreek-Urban land complex, 9 to 15 percent slopes	569.9	7.9%
303	Garloaf-Urban land complex, 4 to 9 percent slopes	892.6	12.4%
305	Moonridge-Shayroad-Cariboucreek complex, 0 to 4 percent slopes	452.0	6.3%
306	Moonridge-Cariboucreek-Urban land complex, 0 to 4 percent slopes	953.2	13.3%
307	Doble-Shayroad complex, 4 to 9 percent slopes	0.6	0.0%
309	Goldmountain-Deadmansridge-Deadpan complex, 15 to 30 percent slopes	9.8	0.1%
310	Goldmountain-Deadmansridge-Deadpan complex, 30 to 50 percent slopes	95.0	1.3%
315	Minnelusa-Cariboucreek complex, 9 to 15 percent slopes	95.4	1.3%
317	Pacifico-Groutcreek-Rock outcrop complex, 15 to 30 percent slopes	5.2	0.1%
401	Garloaf-Cariboucreek-Urban land complex, 15 to 30 percent slopes	672.0	9.3%
403	Garloaf very cobbly loam, 4 to 9 percent slopes	1,313.2	18.3%
407	Doble-Shayroad-Urban land complex, 4 to 9 percent slopes	11.5	0.2%
413	Aquents-Riverwash complex, 0 to 4 percent slopes	112.1	1.6%
414	Moonridge-Urban land complex, 4 to 9 percent slopes	120.4	1.7%
BoD	Morical, very deep-Hecker families complex, 2 to 15 percent slopes	4.0	0.1%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BoE	Morical, very deep-Hecker families complex, 15 to 30 percent slopes	249.5	3.5%
DaF	Pacifico-Wapi families complex, 30 to 50 percent slopes	42.3	0.6%
FbE	Merkel-Switchback families complex, 15 to 30 percent slopes	43.8	0.6%
FrE	Lizzant family-Lithic Xerorthents, calcareous association, 15 to 30 percent slopes	8.5	0.1%
FrF	Lithic Xerorthents, calcareous-Lazzant family association, 30 to 50 percent slopes	40.2	0.6%
Totals for Area of Interest		**7,193.2**	**100.0%**

Appendix F. USFWS IPaC, CNDDB, & CNPS Species Lists

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Location

San Bernardino County, California

Local office

Carlsbad Fish And Wildlife Office

(760) 431-9440
(760) 431-5901

2177 Salk Avenue - Suite 250

2177 Salk Avenue Suite 250
Carlsbad, CA 92008-7385

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

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2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Spotted Owl Strix occidentalis occidentalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7266	Proposed Endangered
Southwestern Willow Flycatcher Empidonax traillii extimus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/6749	Endangered

Reptiles

NAME	STATUS
Desert Tortoise Gopherus agassizii There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4481	Threatened

Fishes

NAME	STATUS
Unarmored Threespine Stickleback Gasterosteus aculeatus williamsoni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7002	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

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Flowering Plants

NAME	STATUS
Ash-grey Paintbrush Castilleja cinerea Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/3702	Threatened
Bear Valley Sandwort Arenaria ursina Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/7317	Threatened
California Taraxacum Taraxacum californicum Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/7421	Endangered
Cushenbury Buckwheat Eriogonum ovalifolium var. vineum Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/6852	Endangered
Cushenbury Milk-vetch Astragalus albens Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8232	Endangered
Cushenbury Oxytheca Oxytheca parishii var. goodmaniana Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5225	Endangered
Parish's Daisy Erigeron parishii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8446	Threatened

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Pedate Checker-mallow Sidalcea pedata — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1340

San Bernardino Bluegrass Poa atropurpurea — Endangered
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/4641

San Bernardino Mountains Bladderpod Lesquerella kingii ssp. bernardina — Endangered
Wherever found
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/809

Slender-petaled Mustard Thelypodium stenopetalum — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/1658

Southern Mountain Wild-buckwheat Eriogonum kennedyi var. austromontanum — Threatened
Wherever found
There is **final** critical habitat for this species. Your location overlaps the critical habitat.
https://ecos.fws.gov/ecp/species/7201

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Ash-grey Paintbrush Castilleja cinerea https://ecos.fws.gov/ecp/species/3702#crithab	Final

Bear Valley Sandwort Arenaria ursina https://ecos.fws.gov/ecp/species/7317#crithab	Final
California Taraxacum Taraxacum californicum https://ecos.fws.gov/ecp/species/7421#crithab	Final
San Bernardino Bluegrass Poa atropurpurea https://ecos.fws.gov/ecp/species/4641#crithab	Final
Southern Mountain Wild-buckwheat Eriogonum kennedyi var. austromontanum https://ecos.fws.gov/ecp/species/7201#crithab	Final

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Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list,click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the

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probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

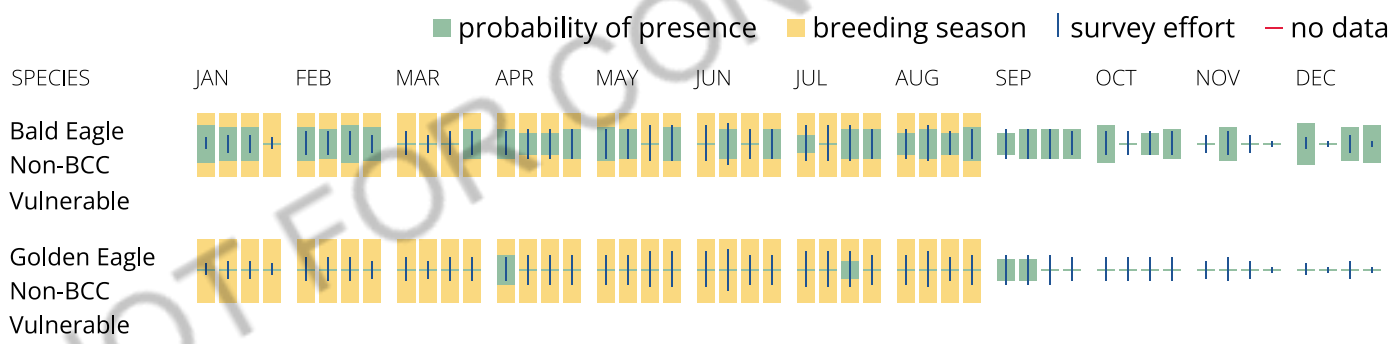
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



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What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

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Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date

range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird *Selasphorus sasin* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow *Passerculus sandwichensis beldingi* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Tern *Chlidonias niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Black-chinned Sparrow *Spizella atrogularis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9447	Breeds Apr 15 to Jul 31
Bullock's Oriole *Icterus bullockii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25

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California Gull Larus californicus — Breeds Mar 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

California Thrasher Toxostoma redivivum — Breeds Jan 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Cassin's Finch Carpodacus cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

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Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Pinyon Jay Gymnorhinus cyanocephalus — Breeds Feb 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9420

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and

understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

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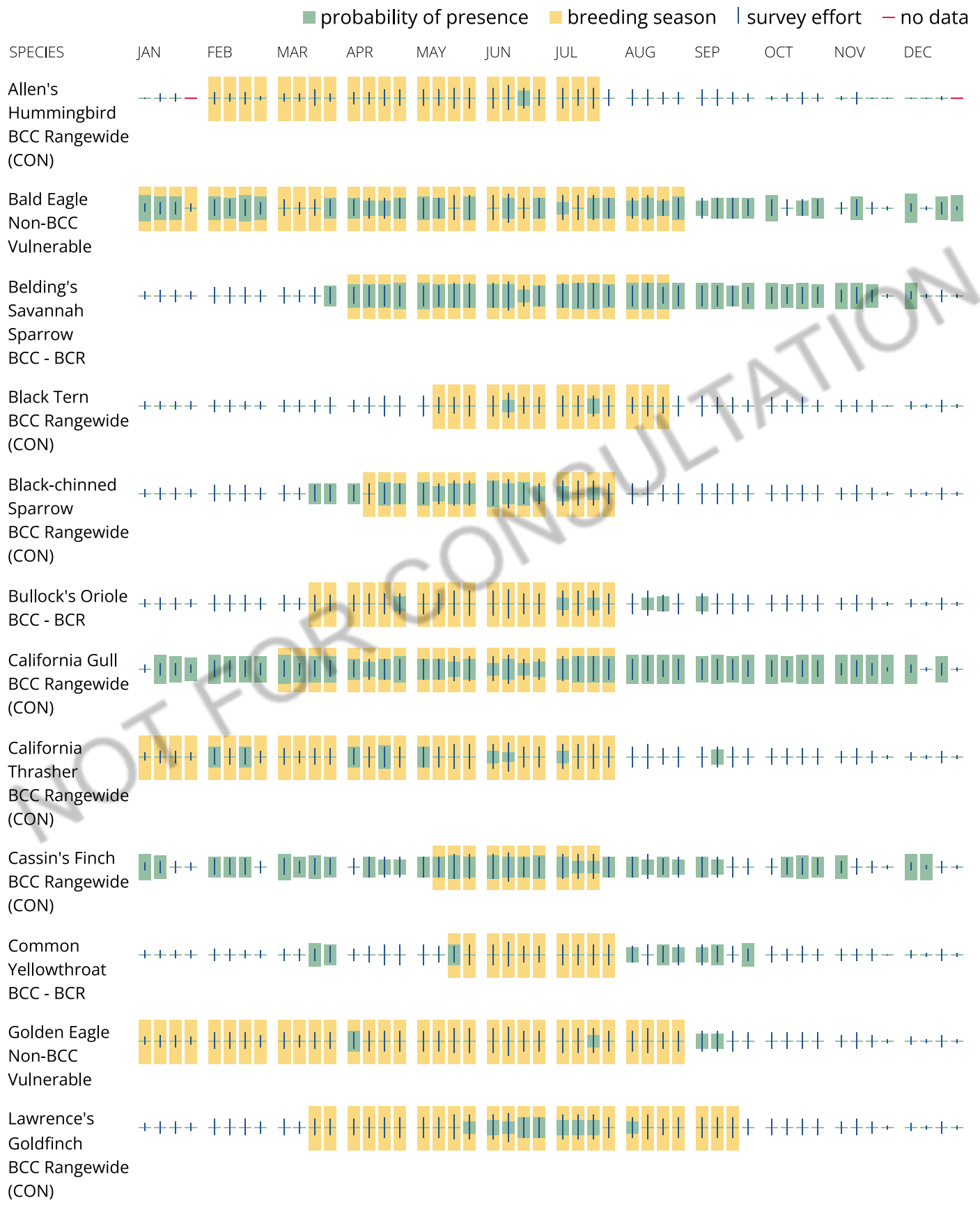
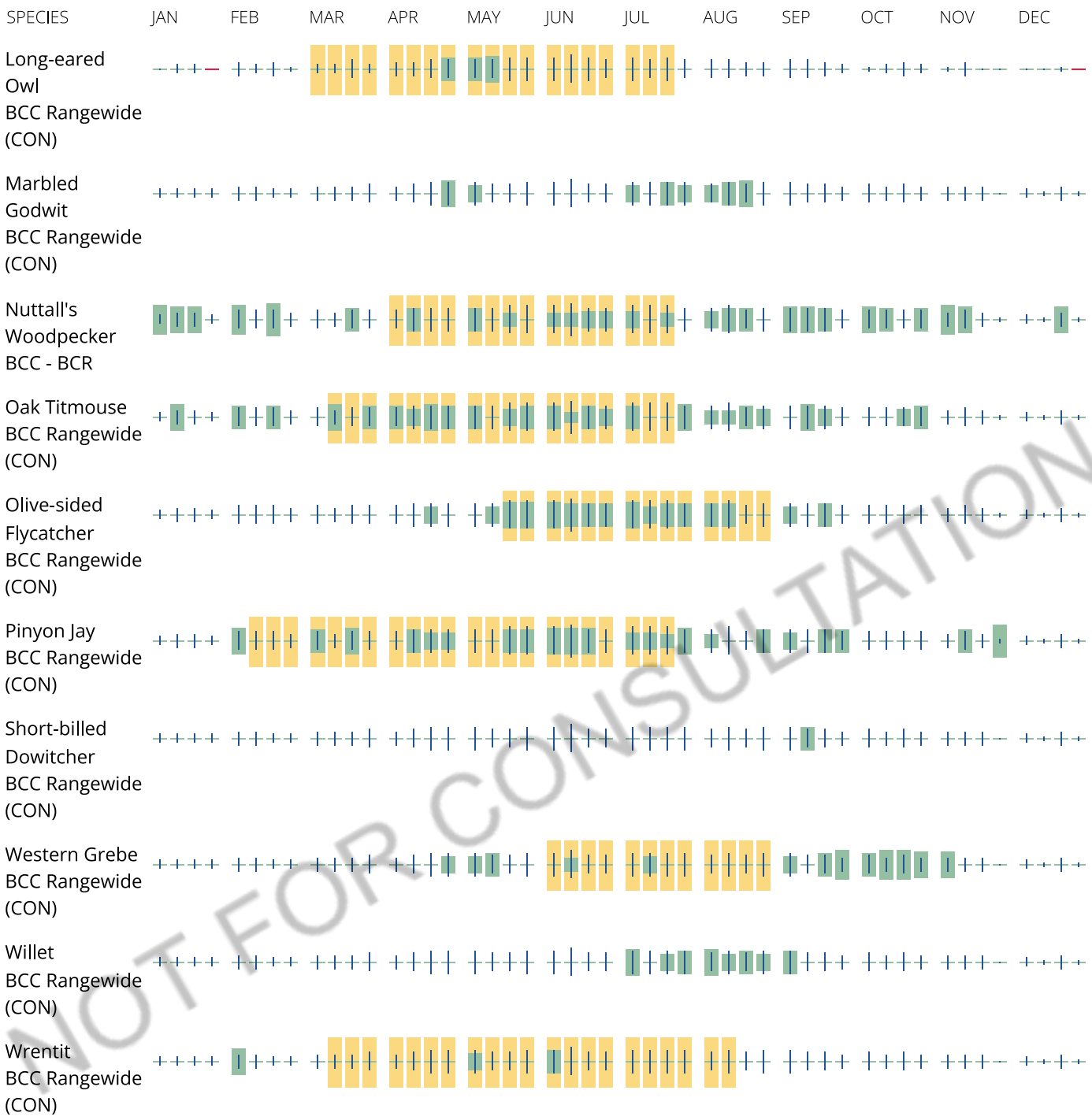
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



NOT FOR CONSULTATION



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

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Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1B
- PEM1Ch
- PEM1Ax
- PEM1Cx

FRESHWATER FORESTED/SHRUB WETLAND

- PSSB

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PSSA

FRESHWATER POND

PUBHx
PUSCx
PUSJ
PUSAx

LAKE

L2USC
L2USA
L2ABKx
L2USJ

RIVERINE

R4SBC
R2ABF
R5UBFx
R4SBA
R5UBF
R4SBAx
R4SBCx
R3UBF

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

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Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Big Bear City (3411637) OR Big Bear Lake (3411628) OR Moonridge (3411627) OR Fawnskin (3411638))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Acanthoscyphus parishii var. cienegensis Cienega Seca oxytheca	PDPGN0J042	None	None	G4?T2	S2	1B.3
Acanthoscyphus parishii var. goodmaniana Cushenbury oxytheca	PDPGN0J043	Endangered	None	G4?T1	S1	1B.1
Accipiter cooperii Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
Anniella stebbinsi Southern California legless lizard	ARACC01060	None	None	G3	S3	SSC
Antennaria marginata white-margined everlasting	PDAST0H1G0	None	None	G4G5	S1	2B.3
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Arenaria lanuginosa var. saxosa rock sandwort	PDCAR040E4	None	None	G5T5	S2	2B.3
Astragalus albens Cushenbury milk-vetch	PDFAB0F0A0	Endangered	None	G1	S1	1B.1
Astragalus bernardinus San Bernardino milk-vetch	PDFAB0F190	None	None	G3	S3	1B.2
Astragalus lentiginosus var. sierrae Big Bear Valley milk-vetch	PDFAB0FB9L	None	None	G5T2	S2	1B.2
Astragalus leucolobus Big Bear Valley woollypod	PDFAB0F4T0	None	None	G2	S2	1B.2
Astragalus tidestromii Tidestrom's milk-vetch	PDFAB0F8X0	None	None	G4	S2	2B.2
Atriplex parishii Parish's brittlescale	PDCHE041D0	None	None	G1G2	S1	1B.1
Berberis fremontii Fremont barberry	PDBER06060	None	None	G5	S3	2B.3
Boechera dispar pinyon rockcress	PDBRA060F0	None	None	G3	S3	2B.3
Boechera lincolnensis Lincoln rockcress	PDBRA061M3	None	None	G4G5	S3	2B.3
Boechera parishii Parish's rockcress	PDBRA061C0	None	None	G2	S2	1B.2
Boechera shockleyi Shockley's rockcress	PDBRA061V0	None	None	G3	S2	2B.2
Bombus caliginosus obscure bumble bee	IIHYM24380	None	None	G2G3	S1S2	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G2	S2	
Bombus morrisoni Morrison bumble bee	IIHYM24460	None	None	G3	S1S2	
Botrychium crenulatum scalloped moonwort	PPOPH010L0	None	None	G4	S3	2B.2
Calochortus palmeri var. palmeri Palmer's mariposa-lily	PMLIL0D122	None	None	G3T2	S2	1B.2
Calochortus plummerae Plummer's mariposa-lily	PMLIL0D150	None	None	G4	S4	4.2
Calochortus striatus alkali mariposa-lily	PMLIL0D190	None	None	G3	S2S3	1B.2
Calyptridium pygmaeum pygmy pussypaws	PDPOR09070	None	None	G1G2	S1S2	1B.2
Carex occidentalis western sedge	PMCYP039M0	None	None	G4	S3	2B.3
Castilleja cinerea ash-gray paintbrush	PDSCR0D0H0	Threatened	None	G1G2	S1S2	1B.2
Castilleja lasiorhyncha San Bernardino Mountains owl's-clover	PDSCR0D410	None	None	G2?	S2?	1B.2
Chaetodipus fallax pallidus pallid San Diego pocket mouse	AMAFD05032	None	None	G5T3T4	S3S4	SSC
Charina umbratica southern rubber boa	ARADA01011	None	Threatened	G2G3	S2	
Claytonia peirsonii ssp. bernardinus San Bernardino spring beauty	PDPOR03122	None	None	G2G3T1	S1	1B.1
Claytonia peirsonii ssp. californacis Furnace spring beauty	PDPOR03123	None	None	G2G3T1	S1	1B.1
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G4	S2	SSC
Cymopterus multinervatus purple-nerve cymopterus	PDAPI0U0Q0	None	None	G4G5	S2	2B.2
Drymocallis cuneifolia var. cuneifolia wedgeleaf woodbeauty	PDROS2D011	None	None	G2T1	S1	1B.1
Dryopteris filix-mas male fern	PPDRY0A0B0	None	None	G5	S2	2B.3
Dudleya abramsii ssp. affinis San Bernardino Mountains dudleya	PDCRA04013	None	None	G4T2	S2	1B.2
Empidonax traillii extimus southwestern willow flycatcher	ABPAE33043	Endangered	Endangered	G5T2	S3	
Ensatina eschscholtzii klauberi large-blotched salamander	AAAAD04013	None	None	G5T2?	S3	WL

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Eremogone ursina Big Bear Valley sandwort	PDCAR040R0	Threatened	None	G1	S1	1B.2
Erigeron parishii Parish's daisy	PDAST3M310	Threatened	None	G2	S2	1B.1
Eriogonum evanidum vanishing wild buckwheat	PDPGN08780	None	None	G2	S1	1B.1
Eriogonum kennedyi var. alpigenum southern alpine buckwheat	PDPGN083B1	None	None	G4T3	S3	1B.3
Eriogonum kennedyi var. austromontanum southern mountain buckwheat	PDPGN083B2	Threatened	None	G4T2	S2	1B.2
Eriogonum microthecum var. johnstonii Johnston's buckwheat	PDPGN083W5	None	None	G5T2	S2	1B.3
Eriogonum microthecum var. lacus-ursi Bear Lake buckwheat	PDPGN083WF	None	None	G5T1	S1	1B.1
Eriogonum ovalifolium var. vineum Cushenbury buckwheat	PDPGN084F8	Endangered	None	G5T1	S1	1B.1
Erythranthe exigua San Bernardino Mountains monkeyflower	PDSCR1B140	None	None	G2	S2	1B.2
Erythranthe purpurea little purple monkeyflower	PDSCR1B2B0	None	None	G2	S2	1B.2
Euchloe hyantis andrewsi Andrew's marble butterfly	IILEPA5032	None	None	G4G5T1	S2	
Euphydryas editha quino quino checkerspot butterfly	IILEPK405L	Endangered	None	G5T1T2	S1S2	
Gasterosteus aculeatus williamsoni unarmored threespine stickleback	AFCPA03011	Endangered	Endangered	G5T1	S1	FP
Gentiana fremontii Fremont's gentian	PDGEN060Y0	None	None	G4	S2	2B.3
Gilia leptantha ssp. leptantha San Bernardino gilia	PDPLM040W1	None	None	G4T2	S2	1B.3
Glaucomys oregonensis californicus San Bernardino flying squirrel	AMAFB09021	None	None	G5T1T2	S1S2	SSC
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Heuchera parishii Parish's alumroot	PDSAX0E1F0	None	None	G3	S3	1B.3
Horkelia wilderae Barton Flats horkelia	PDROS0W0J0	None	None	G1	S1	1B.1
Hulsea vestita ssp. pygmaea pygmy hulsea	PDAST4Z077	None	None	G5T1	S1	1B.3
Hydroporus simplex simple hydroporus diving beetle	IICOL55050	None	None	G3G4	S3S4	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Icteria virens yellow-breasted chat	ABPBX24010	None	None	G5	S4	SSC
Ivesia argyrocoma var. argyrocoma silver-haired ivesia	PDROS0X021	None	None	G2T2	S2	1B.2
Lewisia brachycalyx short-sepaled lewisia	PDPOR04010	None	None	G4	S2	2B.2
Lilium parryi lemon lily	PMLIL1A0J0	None	None	G3	S3	1B.2
Linanthus killipii Baldwin Lake linanthus	PDPLM090N0	None	None	G1	S1	1B.2
Malaxis monophyllos var. brachypoda white bog adder's-mouth	PMORC1R010	None	None	G5T4T5	S1	2B.1
Myotis evotis long-eared myotis	AMACC01070	None	None	G5	S3	
Myotis thysanodes fringed myotis	AMACC01090	None	None	G4	S3	
Myotis volans long-legged myotis	AMACC01110	None	None	G4G5	S3	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia peninsularis Baja navarretia	PDPLM0C0L0	None	None	G3	S2	1B.2
Neotamias speciosus speciosus lodgepole chipmunk	AMAFB02172	None	None	G4T3T4	S2	
Oncorhynchus mykiss irideus pop. 10 steelhead - southern California DPS	AFCHA0209J	Endangered	Candidate Endangered	G5T1Q	S1	
Oreonana vestita woolly mountain-parsley	PDAPI1G030	None	None	G3	S3	1B.3
Oxytropis oreophila var. oreophila rock-loving oxytrope	PDFAB2X0H3	None	None	G5T4T5	S2	2B.3
Packera bernardina San Bernardino ragwort	PDAST8H0E0	None	None	G2	S2	1B.2
Pebble Plains Pebble Plains	CTT47000CA	None	None	G1	S1.1	
Perideridia parishii ssp. parishii Parish's yampah	PDAPI1N0C2	None	None	G4T3T4	S2	2B.2
Phlox dolichantha Big Bear Valley phlox	PDPLM0D0P0	None	None	G2	S2	1B.2
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G4	S4	SSC
Physaria kingii ssp. bernardina San Bernardino Mountains bladderpod	PDBRA1N0W1	Endangered	None	G5T1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Piranga rubra summer tanager	ABPBX45030	None	None	G5	S1	SSC
Poa atropurpurea San Bernardino blue grass	PMPOA4Z0A0	Endangered	None	G2	S2	1B.2
Poliomintha incana frosted mint	PDLAM1L020	None	None	G5	SH	2A
Psychomastax deserticola desert monkey grasshopper	IIORT15010	None	None	G2G3	S1	
Pyrrocoma uniflora var. gossypina Bear Valley pyrrocoma	PDASTDT0K1	None	None	G5T1	S1	1B.2
Rana muscosa southern mountain yellow-legged frog	AAABH01330	Endangered	Endangered	G1	S2	WL
Rosa woodsii var. glabrata Cushenbury rose	PDROS1J191	None	None	G5T1	S1	1B.1
Saltugilia latimeri Latimer's woodland-gilia	PDPLM0H010	None	None	G3	S3	1B.2
Sidalcea hickmanii ssp. parishii Parish's checkerbloom	PDMAL110A3	None	Rare	G3T1	S1	1B.2
Sidalcea malviflora ssp. dolosa Bear Valley checkerbloom	PDMAL110FH	None	None	G5T2	S2	1B.2
Sidalcea pedata bird-foot checkerbloom	PDMAL110L0	Endangered	Endangered	G1	S1	1B.1
Sisyrinchium longipes timberland blue-eyed grass	PMIRI0D0Y0	None	None	G3	S1	2B.2
Southern California Threespine Stickleback Stream Southern California Threespine Stickleback Stream	CARE2320CA	None	None	GNR	SNR	
Sphenopholis obtusata prairie wedge grass	PMPOA5T030	None	None	G5	S2	2B.2
Streptanthus bernardinus Laguna Mountains jewelflower	PDBRA2G060	None	None	G3G4	S3S4	4.3
Streptanthus campestris southern jewelflower	PDBRA2G0B0	None	None	G3	S3	1B.3
Streptanthus juneae June's jewelflower	PDBRA2G540	None	None	G2	S2	1B.2
Symphyotrichum defoliatum San Bernardino aster	PDASTE80C0	None	None	G2	S2	1B.2
Taraxacum californicum California dandelion	PDAST93050	Endangered	None	G1G2	S1S2	1B.1
Thamnophis hammondii two-striped gartersnake	ARADB36160	None	None	G4	S3S4	SSC
Thelypodium stenopetalum slender-petaled thelypodium	PDBRA2N0F0	Endangered	Endangered	G1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Viola pinetorum ssp. grisea	PDVIO04431	None	None	G4G5T3	S3	1B.2
grey-leaved violet						

Record Count: 104

CNPS Rare Plant Inventory

California Native Plant Society

Search Results

83 matches found. Click on scientific name for details

Search Criteria: Quad is one of [**3411637:3411628:3411627:3411638**], **1945** meters between Plant low elevation and high elevation, **2327** meters between Plant low elevation and high elevation

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	GENERAL HABITATS	MICROHABITATS
Abronia nana var. *covillei*	Coville's dwarf abronia	Nyctaginaceae	perennial herb	None	None	G4T3	S3	4.2	Great Basin scrub, Joshua tree "woodland", Pinyon and juniper woodland, Subalpine coniferous forest, Upper montane coniferous forest	Carbonate, Sandy
Acanthoscyphus parishii var. *cienegensis*	Cienega Seca oxytheca	Polygonaceae	annual herb	None	None	G4?T2	S2	1B.3	Joshua tree "woodland", Pinyon and juniper woodland, Upper montane coniferous forest (granitic, sandy)	
Acanthoscyphus parishii var. *goodmaniana*	Cushenbury oxytheca	Polygonaceae	annual herb	FE	None	G4?T1	S1	1B.1	Pinyon and juniper woodland (carbonate, talus)	Carbonate, Sandy
Acanthoscyphus parishii var. *parishii*	Parish's oxytheca	Polygonaceae	annual herb	None	None	G4? T3T4	S3S4	4.2	Chaparral, Lower montane coniferous forest	Gravelly (sometimes), Sandy (sometimes)
Antennaria marginata	white-margined everlasting	Asteraceae	perennial stoloniferous herb	None	None	G4G5	S1	2B.3	Lower montane coniferous forest, Upper montane coniferous forest	
Arenaria lanuginosa var. *saxosa*	rock sandwort	Caryophyllaceae	perennial herb	None	None	G5T5	S2	2B.3	Subalpine coniferous forest, Upper montane coniferous forest	Mesic, Sandy
Astragalus albens	Cushenbury milk-vetch	Fabaceae	perennial herb	FE	None	G1	S1	1B.1	Joshua tree "woodland", Mojavean desert scrub, Pinyon and juniper woodland	Carbonate (usually), Granitic (rarely)

Astragalus bernardinus	San Bernardino milk-vetch	Fabaceae	perennial herb	None	None	G3	S3	1B.2	Joshua tree "woodland", Pinyon and juniper woodland	Carbonate (often), Granitic (often)
Astragalus bicristatus	crested milk-vetch	Fabaceae	perennial herb	None	None	G3	S3	4.3	Lower montane coniferous forest, Upper montane coniferous forest	Carbonate (usually), Rocky (sometimes), Sandy (sometimes)
Astragalus lentiginosus var. *sierrae*	Big Bear Valley milk-vetch	Fabaceae	perennial herb	None	None	G5T2	S2	1B.2	Meadows and seeps, Mojavean desert scrub, Pinyon and juniper woodland, Upper montane coniferous forest	Gravelly (sometimes), Rocky (sometimes)
Astragalus leucolobus	Big Bear Valley woollypod	Fabaceae	perennial herb	None	None	G2	S2	1B.2	Lower montane coniferous forest, Pebble (Pavement) plain, Pinyon and juniper woodland, Upper montane coniferous forest	Rocky
Boechera dispar	pinyon rockcress	Brassicaceae	perennial herb	None	None	G3	S3	2B.3	Joshua tree "woodland", Mojavean desert scrub, Pinyon and juniper woodland	Granitic, Gravelly
Boechera lincolnensis	Lincoln rockcress	Brassicaceae	perennial herb	None	None	G4G5	S3	2B.3	Chenopod scrub, Mojavean desert scrub	Carbonate
Boechera parishii	Parish's rockcress	Brassicaceae	perennial herb	None	None	G2	S2	1B.2	Pebble (Pavement) plain, Pinyon and juniper woodland, Upper montane coniferous forest	Carbonate (sometimes), Rocky
Boechera shockleyi	Shockley's rockcress	Brassicaceae	perennial herb	None	None	G3	S2	2B.2	Pinyon and juniper woodland (carbonate, gravelly, quartzite, rocky)	

Botrychium crenulatum	scalloped moonwort	Ophioglossaceae	perennial rhizomatous herb	None	None	G4	S3	2B.2	Bogs and fens, Lower montane coniferous forest, Marshes and swamps (freshwater), Meadows and seeps, Upper montane coniferous forest	
Calochortus palmeri var. palmeri	Palmer's mariposa-lily	Liliaceae	perennial bulbiferous herb	None	None	G3T2	S2	1B.2	Chaparral, Lower montane coniferous forest, Meadows and seeps	Mesic
Calyptridium pygmaeum	pygmy pussypaws	Montiaceae	annual herb	None	None	G1G2	S1S2	1B.2	Subalpine coniferous forest, Upper montane coniferous forest	Gravelly (sometimes), Sandy (sometimes)
Carex occidentalis	western sedge	Cyperaceae	perennial rhizomatous herb	None	None	G4	S3	2B.3	Lower montane coniferous forest, Meadows and seeps	
Castilleja cinerea	ash-gray paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	FT	None	G1G2	S1S2	1B.2	Meadows and seeps, Mojavean desert scrub, Pebble (Pavement) plain, Pinyon and juniper woodland, Upper montane coniferous forest (clay, openings)	
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	Orobanchaceae	annual herb (hemiparasitic)	None	None	G2?	S2?	1B.2	Chaparral, Meadows and seeps, Pebble (Pavement) plain, Riparian woodland, Upper montane coniferous forest	Mesic
Castilleja montigena	Heckard's paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	None	None	G3	S3	4.3	Lower montane coniferous forest, Pinyon and juniper woodland, Upper montane coniferous forest	

Castilleja plagiotoma	Mojave paintbrush	Orobanchaceae	perennial herb (hemiparasitic)	None	None	G4	S4	4.3	Great Basin scrub (alluvial), Joshua tree "woodland", Lower montane coniferous forest, Pinyon and juniper woodland	
Cleomella brevipes	short-pedicelled cleomella	Cleomaceae	annual herb	None	None	G4	S3	4.2	Marshes and swamps, Meadows and seeps, Playas	Alkaline
Cordylanthus eremicus ssp. *eremicus*	desert bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	None	None	G3T3	S3	4.3	Joshua tree "woodland", Mojavean desert scrub, Pinyon and juniper woodland	
Delphinium parryi ssp. *purpureum*	Mt. Pinos larkspur	Ranunculaceae	perennial herb	None	None	G4T4	S4	4.3	Chaparral, Mojavean desert scrub, Pinyon and juniper woodland	
Diplacus johnstonii	Johnston's monkeyflower	Phrymaceae	annual herb	None	None	G4	S4	4.3	Lower montane coniferous forest (disturbed areas, gravelly, roadsides, rocky, scree)	
Drymocallis cuneifolia var. *cuneifolia*	wedgeleaf woodbeauty	Rosaceae	perennial herb	None	None	G2T1	S1	1B.1	Riparian scrub, Upper montane coniferous forest	Carbonate (sometimes)
Dudleya abramsii ssp. *affinis*	San Bernardino Mountains dudleya	Crassulaceae	perennial herb	None	None	G4T2	S2	1B.2	Pebble (Pavement) plain, Pinyon and juniper woodland, Upper montane coniferous forest	Carbonate (sometimes), Granitic (sometimes)
Eremogone ursina	Big Bear Valley sandwort	Caryophyllaceae	perennial herb	FT	None	G1	S1	1B.2	Meadows and seeps, Pebble (Pavement) plain, Pinyon and juniper woodland	Mesic, Rocky
Erigeron parishii	Parish's daisy	Asteraceae	perennial herb	FT	None	G2	S2	1B.1	Mojavean desert scrub, Pinyon and juniper woodland	Carbonate (usually), Granitic (sometimes)
Eriogonum evanidum	vanishing wild buckwheat	Polygonaceae	annual herb	None	None	G2	S1	1B.1	Chaparral, Cismontane woodland, Lower montane coniferous forest, Pinyon and juniper woodland	Gravelly (sometimes), Sandy (sometimes)

Eriogonum kennedyi var. *austromontanum*	southern mountain buckwheat	Polygonaceae	perennial herb	FT	None	G4T2	S2	1B.2	Lower montane coniferous forest (gravelly), Pebble (Pavement) plain	
Eriogonum microthecum var. *johnstonii*	Johnston's buckwheat	Polygonaceae	perennial deciduous shrub	None	None	G5T2	S2	1B.3	Subalpine coniferous forest, Upper montane coniferous forest	Rocky
Eriogonum ovalifolium var. *vineum*	Cushenbury buckwheat	Polygonaceae	perennial herb	FE	None	G5T1	S1	1B.1	Joshua tree "woodland", Mojavean desert scrub, Pinyon and juniper woodland	Carbonate
Eriogonum umbellatum var. *minus*	alpine sulfur-flowered buckwheat	Polygonaceae	perennial herb	None	None	G5T4	S4	4.3	Subalpine coniferous forest, Upper montane coniferous forest	Gravelly
Eriophyllum lanatum var. *obovatum*	southern Sierra woolly sunflower	Asteraceae	perennial herb	None	None	G5T4	S4	4.3	Lower montane coniferous forest, Upper montane coniferous forest	Loam, Sandy
Erythranthe exigua	San Bernardino Mountains monkeyflower	Phrymaceae	annual herb	None	None	G2	S2	1B.2	Meadows and seeps, Pebble (Pavement) plain, Upper montane coniferous forest	Clay, Mesic
Erythranthe purpurea	little purple monkeyflower	Phrymaceae	annual herb	None	None	G2	S2	1B.2	Meadows and seeps, Pebble (Pavement) plain, Upper montane coniferous forest	
Frasera neglecta	pine green-gentian	Gentianaceae	perennial herb	None	None	G4	S4	4.3	Lower montane coniferous forest, Pinyon and juniper woodland, Upper montane coniferous forest	
Fritillaria pinetorum	pine fritillary	Liliaceae	perennial bulbiferous herb	None	None	G4	S4	4.3	Chaparral, Lower montane coniferous forest, Pinyon and juniper woodland, Subalpine coniferous forest, Upper montane coniferous forest	Granitic (sometimes), Metamorphic (sometimes)
Galium angustifolium ssp. *gabrielense*	San Antonio Canyon bedstraw	Rubiaceae	perennial herb	None	None	G5T3	S3	4.3	Chaparral, Lower montane coniferous forest	Granitic, Rocky (sometimes), Sandy (sometimes)

Galium jepsonii	Jepson's bedstraw	Rubiaceae	perennial rhizomatous herb	None	None	G3	S3	4.3	Lower montane coniferous forest, Upper montane coniferous forest	Granitic, Gravelly (sometimes), Rocky (sometimes)
Galium johnstonii	Johnston's bedstraw	Rubiaceae	perennial herb	None	None	G4	S4	4.3	Chaparral, Lower montane coniferous forest, Pinyon and juniper woodland, Riparian woodland	
Gilia leptantha ssp. *leptantha*	San Bernardino gilia	Polemoniaceae	annual herb	None	None	G4T2	S2	1B.3	Lower montane coniferous forest (gravelly, sandy)	
Gilia leptantha ssp. *pinetorum*	pine gilia	Polemoniaceae	annual herb	None	None	G4T4	S4	4.3	Lower montane coniferous forest (rocky, sandy)	
Heuchera caespitosa	urn-flowered alumroot	Saxifragaceae	perennial rhizomatous herb	None	None	G3	S3	4.3	Cismontane woodland, Lower montane coniferous forest, Riparian forest (montane), Upper montane coniferous forest	Rocky
Heuchera parishii	Parish's alumroot	Saxifragaceae	perennial rhizomatous herb	None	None	G3	S3	1B.3	Alpine boulder and rock field, Lower montane coniferous forest, Subalpine coniferous forest, Upper montane coniferous forest	Carbonate (sometimes), Rocky
Horkelia wilderae	Barton Flats horkelia	Rosaceae	perennial herb	None	None	G1	S1	1B.1	Chaparral (edges), Lower montane coniferous forest, Upper montane coniferous forest	
Hulsea vestita ssp. *parryi*	Parry's sunflower	Asteraceae	perennial herb	None	None	G5T4	S4	4.3	Lower montane coniferous forest, Pinyon and juniper woodland, Upper montane coniferous forest	Carbonate (sometimes), Granitic (sometimes), Openings, Rocky
Ivesia argyrocoma var. *argyrocoma*	silver-haired ivesia	Rosaceae	perennial herb	None	None	G2T2	S2	1B.2	Meadows and seeps (alkaline), Pebble (Pavement) plain, Upper montane coniferous forest	

Juncus duranii	Duran's rush	Juncaceae	perennial rhizomatous herb	None	None	G3	S3	4.3	Lower montane coniferous forest, Meadows and seeps, Upper montane coniferous forest	Mesic
Lewisia brachycalyx	short-sepaled lewisia	Montiaceae	perennial herb	None	None	G4	S2	2B.2	Lower montane coniferous forest, Meadows and seeps	Mesic
Lilium parryi	lemon lily	Liliaceae	perennial bulbiferous herb	None	None	G3	S3	1B.2	Lower montane coniferous forest, Meadows and seeps, Riparian forest, Upper montane coniferous forest	Mesic
Linanthus killipii	Baldwin Lake linanthus	Polemoniaceae	annual herb	None	None	G1	S1	1B.2	Joshua tree "woodland", Meadows and seeps (alkaline), Pebble (Pavement) plain, Pinyon and juniper woodland	
Malaxis monophyllos var. *brachypoda*	white bog adder's-mouth	Orchidaceae	perennial bulbiferous herb	None	None	G5T4T5	S1	2B.1	Bogs and fens, Meadows and seeps, Upper montane coniferous forest	Mesic
Muilla coronata	crowned muilla	Themidaceae	perennial bulbiferous herb	None	None	G3	S3	4.2	Chenopod scrub, Joshua tree "woodland", Mojavean desert scrub, Pinyon and juniper woodland	
Navarretia peninsularis	Baja navarretia	Polemoniaceae	annual herb	None	None	G3	S2	1B.2	Chaparral (openings), Lower montane coniferous forest, Meadows and seeps, Pinyon and juniper woodland	Mesic
Oreonana vestita	woolly mountain-parsley	Apiaceae	perennial herb	None	None	G3	S3	1B.3	Lower montane coniferous forest, Subalpine coniferous forest, Upper montane coniferous forest	Gravelly (sometimes), Talus (sometimes)

Packera bernardina	San Bernardino ragwort	Asteraceae	perennial herb	None	None	G2	S2	1B.2	Meadows and seeps (mesic, sometimes alkaline), Pebble (Pavement) plain, Upper montane coniferous forest	
Packera ionophylla	Tehachapi ragwort	Asteraceae	perennial herb	None	None	G4	S4	4.3	Lower montane coniferous forest, Upper montane coniferous forest	Granitic, Rocky
Perideridia parishii ssp. *parishii*	Parish's yampah	Apiaceae	perennial herb	None	None	G4T3T4	S2	2B.2	Lower montane coniferous forest, Meadows and seeps, Upper montane coniferous forest	
Phacelia exilis	Transverse Range phacelia	Hydrophyllaceae	annual herb	None	None	G4Q	S4	4.3	Lower montane coniferous forest, Meadows and seeps, Pebble (Pavement) plain, Upper montane coniferous forest	Gravelly (sometimes), Sandy (sometimes)
Phacelia mohavensis	Mojave phacelia	Hydrophyllaceae	annual herb	None	None	G4Q	S4	4.3	Cismontane woodland, Lower montane coniferous forest, Meadows and seeps, Pinyon and juniper woodland	Gravelly (sometimes), Sandy (sometimes)
Phlox dolichantha	Big Bear Valley phlox	Polemoniaceae	perennial herb	None	None	G2	S2	1B.2	Pebble (Pavement) plain, Upper montane coniferous forest (openings)	
Physaria kingii ssp. *bernardina*	San Bernardino Mountains bladderpod	Brassicaceae	perennial herb	FE	None	G5T1	S1	1B.1	Lower montane coniferous forest, Pinyon and juniper woodland, Subalpine coniferous forest	Carbonate (usually)
Poa atropurpurea	San Bernardino blue grass	Poaceae	perennial rhizomatous herb	FE	None	G2	S2	1B.2	Meadows and seeps (mesic)	
Pyrrocoma uniflora var. *gossypina*	Bear Valley pyrrocoma	Asteraceae	perennial herb	None	None	G5T1	S1	1B.2	Meadows and seeps, Pebble (Pavement) plain	

Rupertia rigida	Parish's rupertia	Fabaceae	perennial herb	None	None	G4	S4	4.3	Chaparral, Cismontane woodland, Lower montane coniferous forest, Meadows and seeps, Pebble (Pavement) plain, Valley and foothill grassland	
Sedum niveum	Davidson's stonecrop	Crassulaceae	perennial rhizomatous herb	None	None	G3	S3	4.2	Lower montane coniferous forest, Subalpine coniferous forest, Upper montane coniferous forest	Rocky
Sidalcea hickmanii ssp. *parishii*	Parish's checkerbloom	Malvaceae	perennial herb	None	CR	G3T1	S1	1B.2	Chaparral, Cismontane woodland, Lower montane coniferous forest	
Sidalcea malviflora ssp. *dolosa*	Bear Valley checkerbloom	Malvaceae	perennial herb	None	None	G5T2	S2	1B.2	Lower montane coniferous forest (meadows, seeps), Meadows and seeps, Riparian woodland, Upper montane coniferous forest (meadows, seeps)	
Sidalcea pedata	bird-foot checkerbloom	Malvaceae	perennial herb	FE	CE	G1	S1	1B.1	Meadows and seeps (mesic), Pebble (Pavement) plain	
Sidotheca caryophylloides	chickweed oxytheca	Polygonaceae	annual herb	None	None	G4	S4	4.3	Lower montane coniferous forest (sandy)	
Sphenopholis obtusata	prairie wedge grass	Poaceae	perennial herb	None	None	G5	S2	2B.2	Cismontane woodland, Meadows and seeps	Mesic
Streptanthus bernardinus	Laguna Mountains jewelflower	Brassicaceae	perennial herb	None	None	G3G4	S3S4	4.3	Chaparral, Lower montane coniferous forest	
Streptanthus campestris	southern jewelflower	Brassicaceae	perennial herb	None	None	G3	S3	1B.3	Chaparral, Lower montane coniferous forest, Pinyon and juniper woodland	Rocky

Streptanthus juneae	June's jewelflower	Brassicaceae	perennial herb	None	None	G2	S2	1B.2	Chaparral (montane), Lower montane coniferous forest	Openings
Symphyotrichum defoliatum	San Bernardino aster	Asteraceae	perennial rhizomatous herb	None	None	G2	S2	1B.2	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marshes and swamps, Meadows and seeps, Valley and foothill grassland (vernally mesic)	Streambanks
Taraxacum californicum	California dandelion	Asteraceae	perennial herb	FE	None	G1G2	S1S2	1B.1	Meadows and seeps (mesic)	
Thelypodium stenopetalum	slender-petaled thelypodium	Brassicaceae	perennial herb	FE	CE	G1	S1	1B.1	Meadows and seeps (mesic, alkaline)	
Trichostema micranthum	small-flowered bluecurls	Lamiaceae	annual herb	None	None	G4	S3	4.3	Lower montane coniferous forest, Meadows and seeps	Mesic
Viola pinetorum ssp. *grisea*	grey-leaved violet	Violaceae	perennial herb	None	None	G4G5T3	S3	1B.2	Meadows and seeps, Subalpine coniferous forest, Upper montane coniferous forest	

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IDENTIFICATION AND EVALUATION OF HISTORIC PROPERTIES

REPLENISH BIG BEAR PROGRAM DEIR

Big Bear Valley Area
San Bernardino County, California

For Submittal to:

Big Bear Area Regional Wastewater Agency
121 Palomino Drive/P.O. Box 517
Big Bear City, CA 92314
and
State Water Resources Control Board
1001 I Street/P.O. Box 100
Sacramento, CA 95814

Prepared for:

Kaitlyn Dodson-Hamilton, Vice-president
Tom Dodson & Associates
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CRM TECH
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Bai "Tom" Tang, Principal Investigator
Michael Hogan, Principal Investigator

August 27, 2023
CRM TECH Contract No. 3969

Title: Identification and Evaluation of Historic Properties: Replenish Big Bear Program DEIR, Big Bear Valley Area, San Bernardino County, California

Author(s): Bai "Tom" Tang, Principal Investigator/Historian
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Date: August 27, 2023

For Submittal to: Big Bear Area Regional Wastewater Agency
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Big Bear City, CA 92314
(909) 584-4018
and
State Water Resources State Water Resources Control Board
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Sacramento, CA 95814
(916) 341-5057

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USGS Quadrangle: Big Bear City and Moonridge, Calif., 7.5' quadrangles (Sections 11-15 and 26, T2N R1E, and Sections 7 and 18, T2N R2E, San Bernardino Baseline and Meridian)

Project Size: Approximately 110.5 acres and 9.6 linear miles

Keywords: San Bernardino Mountains; Phase I historical/archaeological resources survey; Site 36-002060 (lithic scatter): no longer extant in the APE; Site 36-015027 (Baldwin Lake; California Point of Historical Interest No. SBr-014): no adverse effect; Big Bear Area Regional Wastewater Agency wastewater treatment plant (temporarily designated Site 3969-1H) and 14 previously recorded historic-era roads: not "historic properties" or "historical resources"

EXECUTIVE SUMMARY

Between November 2022 and August 2023, at the request of Tom Dodson & Associates, CRM TECH performed a cultural resources study on the Area of Potential Effects (APE) for the Replenish Big Bear Program DEIR, a multi-component series of wastewater improvements in and near the unincorporated communities of Big Bear City and Moonridge, in the Big Bear Valley area of San Bernardino County, California. The program will expand and improve discharge areas and groundwater recharge capabilities, install monitoring wells and pump stations, and implement other upgrades. The APE encompasses a total of approximately 110.5 acres and 9.6 linear miles of pipeline alignment located mostly within existing road rights-of-ways. The vertical extent of the APE is anticipated to range between 4.5 and 6.0 feet below surface for the pipelines and upgrades and between 250 to 750 feet below surface for the monitoring wells. The entire APE lies within portions of Sections 11-15 and 26, T2N R1E, and Sections 7 and 18, T2N R2E, San Bernardino Baseline and Meridian.

The study is a part of the environmental review process for the undertaking, as required by the lead agencies, namely the Big Bear Area Regional Wastewater Agency (BBARWA) under the California Environmental Quality Act (CEQA) and the State Water Resources Control Board (SWRCB) under Section 106 of the National Historic Preservation Act (NHPA). The purpose of the study is to provide the BBARWA and the SWRCB with the necessary information and analysis to determine whether the undertaking would have an adverse effect on any "historic properties," as defined by 36 CFR 800.16(l), or "historical resources," as defined by Calif. PRC §5020.1(j), that may exist in or near the APE. In order to accomplish this objective, CRM TECH conducted a historical/archaeological resources records search, pursued historical and geoarchaeological background research, consulted with Native American representatives, and carried out a systematic field survey.

As a result of these research procedures, 16 previously recorded historical/archaeological sites and 1 previously undocumented site were identified as lying within or partially within in the APE, as listed below:

Primary No.	Other Designation	Description
36-002060	CA-SBR-2060	Prehistoric lithic scatter
36-015027	CPHI No. SBr-014	Baldwin Lake
36-024007	CA-SBR-15192H	Division Drive
36-024051	CA-SBR-15236H	Bufflehead Drive
36-024052	CA-SBR-15237H	Teal Drive
36-024053	CA-SBR-15238H	Gold Mountain Drive
36-024054	CA-SBR-15239H	Mount Doble Drive
36-024059	CA-SBR-15244H	Arbor Lane
36-024547	CA-SBR-15588H	Shore Drive
36-024556	CA-SBR-15597H	Gildart Drive
36-024557	CA-SBR-15598H	Rose Hill Drive
36-024558	CA-SBR-15599H	Saw Mill Drive
36-024559	CA-SBR-15600H	Pinon Drive
36-024560	CA-SBR-15601H	Big Tree Drive
36-024562	CA-SBR-15603H	Pine View Drive
36-024563	CA-SBR-15604H	Holcomb View Drive
Pending	3969-1H*	BBARWA wastewater treatment plant

* Temporary designation, pending assignment of permanent identification number

Of these 17 cultural resources, 1 is prehistoric (i.e., Native American) in origin, 15 dates to the historic period, and 1 is a natural feature that acquired cultural significance in both prehistory and history, namely Baldwin Lake. The 15 historic-period sites include 14 roads that remain in use and the circa 1966 BBARWA wastewater treatment plant, which also remains operational. None of these 15 sites appear to be eligible for listing in the National Register of Historic Places or the California Register of Historical Resources. Therefore, they do not meet the statutory definitions of "historic properties" or "historical resources."

The prehistoric site, 36-002060, was first recorded in 1969 as a lithic scatter near the intersection of Shay Road and Palomino Drive, in an area that has since been developed into residential properties. The portion of the APE across the site lies entirely within the public right-of-way along Palomino Drive, where no remnants of the site were observed during this study. In light of the extensive ground disturbance that occurred at this location during road construction and underground utility installation, it is highly unlikely for any archaeological features or artifact deposits associated with the site to survive intact below the ground surface. As a result, this study concludes that Site 36-002060 no longer exists within the APE.

Baldwin Lake (36-015027) was designated a California Point of Historical Interest (No. SBr-014) in 1973 due to its well-known association with colorful events in early California history and thus inherently qualifies as a "historical resource" under CEQA. Because of the same historical association, and because of its prominent role in local Native American creation story, Baldwin Lake may be considered eligible for the National Register of Historic Places upon full evaluation and thereby qualify as a "historic property" under Section 106 provisions as well. However, since the APE overlaps only a small portion of the lakebed at the BBARWA wastewater treatment plant and along the Palomino Drive and Baldwin Lake Trail rights-of-way, a full evaluation of the historical significance of Baldwin Lake is well beyond the scope of this study.

Given the limited involvement of the lakebed in the project plans and the previously altered cultural landscape in this portion of the APE, the proposed undertaking has little potential to affect the existing characteristics of Baldwin Lake. Based on these considerations, the present study concludes that Baldwin Lake as a whole may be presumed to be a "historic property" for the purpose of this undertaking, with the understanding that the limited impact the undertaking may bring about to the current condition of the APE will not constitute an adverse effect on this "historic property"/"historical resource."

In summary, among the 17 cultural resources identified in the APE, the 15 historic-period sites do not appear to qualify as "historic properties" or "historical resources," the prehistoric site (36-002060) is no longer extant within the APE boundaries, and the undertaking will not have an adverse effect on Baldwin Lake, a "historical resource" under CEQA and a presumed "historic property" under Section 106. Meanwhile, the subsurface sediments in the vertical APE appear to be relatively low in sensitivity for potentially significant archaeological deposits of prehistoric origin.

Pursuant to 36 CFR 800.4(d)(1) and Calif. PRC §21084.1, CRM TECH recommends to the SWRCB and the BBARWA a conclusion that the undertaking will not adversely affect any "historic properties" or "historical resources." No further cultural resources investigation is recommended for the undertaking unless project plans undergo such changes as to include areas not covered by this study. However, if buried cultural materials are encountered during any earth-moving operations associated with the undertaking, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

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INTRODUCTION

Between November 2022 and August 2023, at the request of Tom Dodson & Associates, CRM TECH performed a cultural resources study on the Area of Potential Effects (APE) for the Replenish Big Bear Program DEIR, a multi-component series of wastewater improvements in and near the unincorporated communities of Big Bear City and Moonridge, in the Big Bear Valley area of San Bernardino County, California. The program will expand and improve discharge areas and groundwater recharge capabilities, install monitoring wells and pump stations, and implement other upgrades.

The APE for the undertaking encompasses a total of approximately 110.5 acres and 9.6 linear miles of pipeline alignment located mostly within existing road rights-of-ways. The vertical extent of the APE is anticipated to range between 4.5 and 6.0 feet below surface for the pipelines and upgrades and between 250 to 750 feet below surface for the monitoring wells. The entire APE lies within portions of Sections 11-15 and 26, T2N R1E, and Sections 7 and 18, T2N R2E, San Bernardino Baseline and Meridian (Figs. 1-4).

The study is a part of the environmental review process for the undertaking, as required by the lead agencies, namely the Big Bear Area Regional Wastewater Agency (BBARWA) under the California Environmental Quality Act (CEQA) and the State Water Resources Control Board (SWRCB) under Section 106 of the National Historic Preservation Act (NHPA). The purpose of the study is to provide the BBARWA and the SWRCB with the necessary information and analysis to determine whether the undertaking would have an adverse effect on any "historic properties," as defined by 36 CFR 800.16(l), or "historical resources," as defined by Calif. PRC §5020.1(j), that may exist in or near the APE.

In order to accomplish this objective, CRM TECH conducted a historical/archaeological resources records search, pursued historical and geoarchaeological background research, consulted with Native American representatives, and carried out a systematic field survey. The following report is a complete account of the methods, results, and conclusion of the study. Personnel who participated in the study are named in the appropriate sections below, and their qualifications are provided in Appendix 1.

SETTING

CURRENT NATURAL SETTING

Situated in the eastern portion of Big Bear Valley and deep in the San Bernardino Mountains, the APE is characterized by its alpine climate and forest-dominated environment, in sharp contrast to the Mediterranean climate and desert environment in most of southern California. Seasonal temperatures in Big Bear Valley range from an average low of nine degrees Fahrenheit in January to an average high of 89 degrees in July, much closer to the national average than to that of the nearby San Bernardino-Riverside region (NOAA n.d.). The average annual precipitation reaches more than 18 inches of rainfall and 35 inches of snowfall (*ibid.*). Most of the APE is situated in the vicinity of Baldwin Lake, the only large natural lake in the San Bernardino Mountains, the shoreline of which is subject to substantial changes due to ambient mountain runoff.

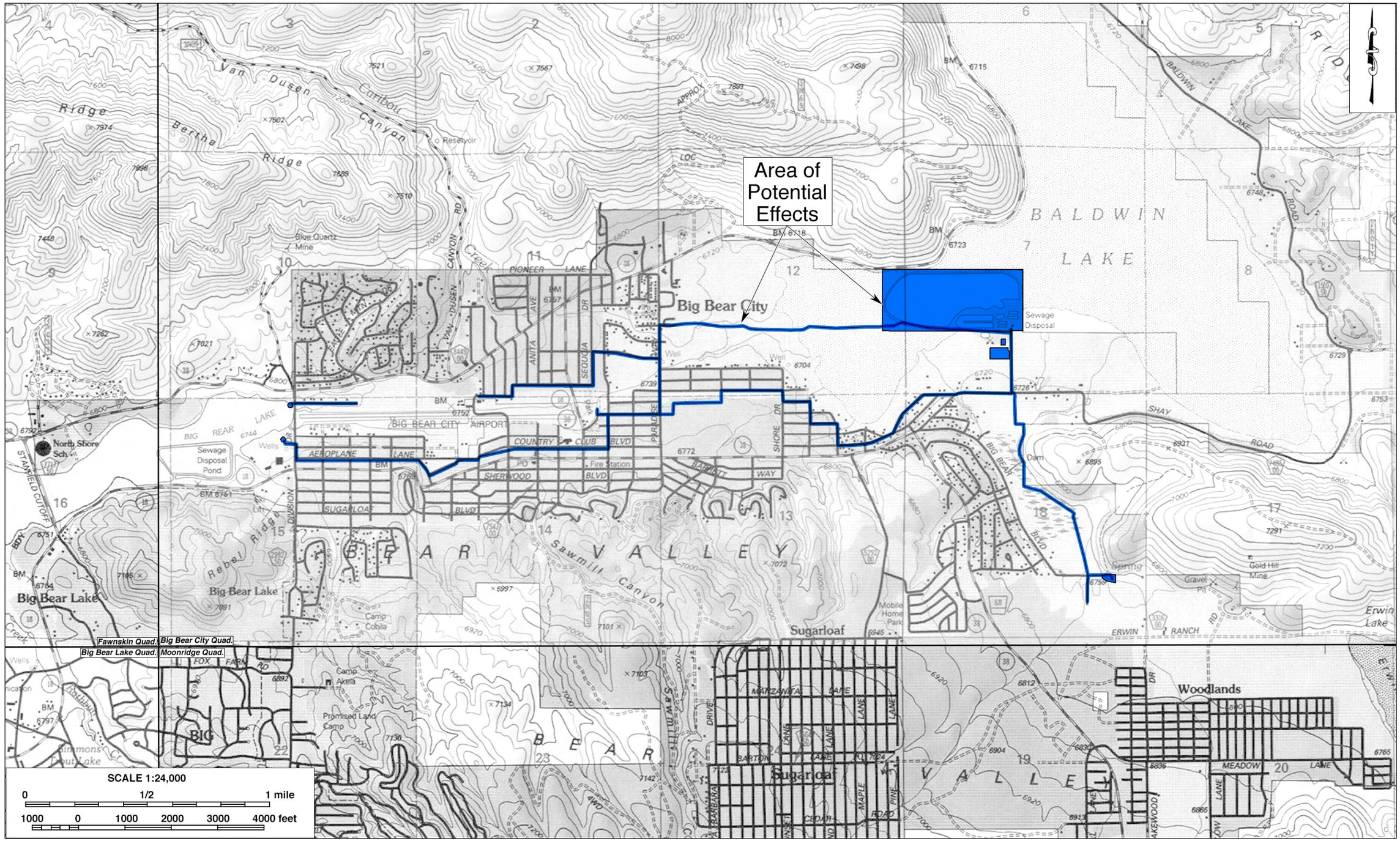

Figure 1. Area of Potential Effects, northern portion. (Based on USGS Big Bear City, Big Bear Lake, Fawnskin, and Moonridge, Calif., 7.5' quadrangles [USGS 1996a-1996d])

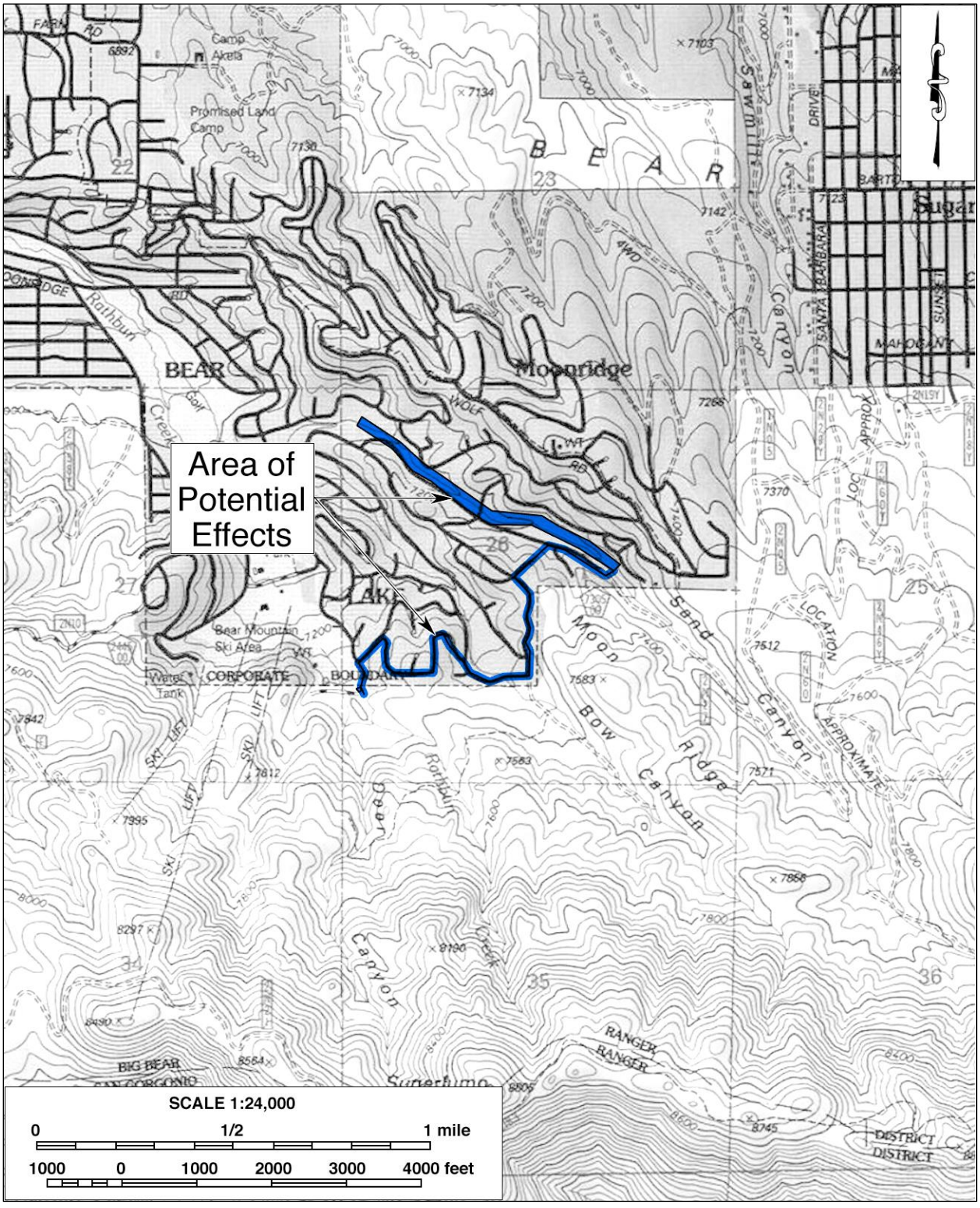

Figure 2. Area of Potential Effects, southern portion. (Based on USGS Moonridge, Calif., 7.5' quadrangle [USGS 1996d])

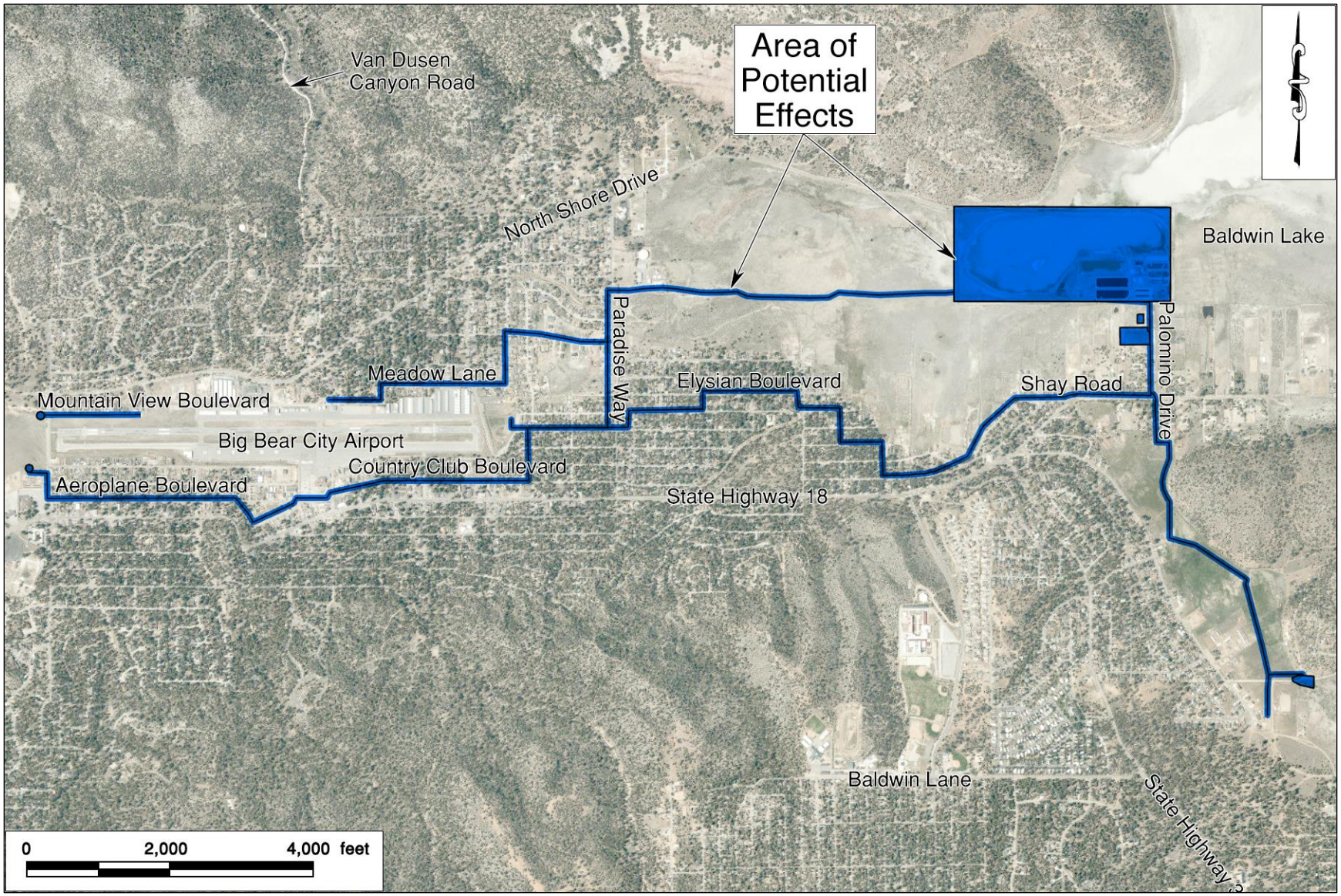

Figure 3. Aerial view of the APE, northern portion. (Based on Google Earth imagery)

Figure 4. Aerial view of the APE, southern portion. (Based on Google Earth imagery)

The largest portion of the APE falls within the 93.5-acre BBARWA treatment plant at 122 Palomino Drive, on a peninsula on the south shore of Baldwin Lake, along with the agency's headquarters at 121 Palomino Drive and an adjacent two-acre field (Figs. 1, 3). Next largest is some 14 acres within the Sand Canyon recharge site and channel, a northwest-southeast trending drainage in the Moonridge area, and the one-acre Shay Pond recharge (Figs. 1-4). Another component of the APE is approximately 9.4 miles of pipeline alignment within various roads in residential areas to the west of Baldwin Lake and in the southern portion of the Moonridge area (Figs. 1-4). At these locations, the project plans will expand and improve discharge areas and groundwater recharge capabilities, install monitoring wells and pump stations, and implement other upgrades.

The ground surface throughout the APE has been extensively disturbed by construction and maintenance of the wastewater treatment facilities and public roads, by mechanical clearing of the open field, and by water movement and discharge activities at Sand Channel and Shay Pond (Fig. 5). Surface soils are composed of sandy alluvium mixed with quartzite and granitic cobbles. Elevations in the APE range around approximately 6,000 to 9,900 feet above mean sea level, with the lower elevations near the Baldwin Lake shoreline. Vegetation in the vicinity includes conifer and evergreen trees, low-lying brush and grasses, and landscaping plants near the roadways.

CULTURAL SETTING

Archaeological Context

The earliest evidence of human occupation in inland southern California was discovered below the surface of an alluvial fan in the northern portion of the Lakeview Mountains, overlooking the San Jacinto Valley, with radiocarbon dates clustering around 9,500 before present (B.P.; Horne and McDougall 2008). Another site found near the shoreline of Lake Elsinore, close to the confluence of Temescal Wash and the San Jacinto River, yielded radiocarbon dates between 8,000 and 9,000 B.P. (Grenda 1997). Additional sites with isolated Archaic dart points, bifaces, and other associated lithic artifacts from the same age range have been found in the Cajon Pass area of the San Bernardino Mountains, typically on top of knolls with good viewsheds (Basgall and True 1985; Goodman and McDonald 2001; Goodman 2002; Milburn et al. 2008).

The cultural history of southern California has been summarized into numerous chronologies, including those developed by Chartkoff and Chartkoff (1984), Warren (1984), and others. Specifically, the prehistory of the inland region has been addressed by O'Connell et al. (1974), McDonald et al. (1987), Keller and McCarthy (1989), Grenda (1993), Goldberg (2001), and Horne and McDougall (2008). Although the beginning and ending dates of the recognized cultural horizons vary among different parts of the region, the general framework for the prehistory can be broken into three primary periods:

- Paleoindian Period (ca. 18,000-9,000 B.P.): Native peoples of this period created fluted spearhead bases designed to be hafted to wooden shafts. The distinctive method of thinning bifaces and spearhead preforms by removing long, linear flakes leave diagnostic Paleoindian markers at tool-making sites. Other artifacts associated with the Paleoindian toolkit include choppers, cutting tools, retouched flakes, and perforators. Sites from this period are very sparse across the landscape and most are deeply buried.

Figure 5. Typical landscapes in the APE. *Clockwise from top left*: northernmost setting pond in the BBARWA treatment plant, view to the northeast; elevated berm at the plant, view to the north; pipeline alignment from Mt. View Boulevard toward the treatment plant, view to the east; open field adjacent to the BBARWA headquarters, view to the north; pipeline alignment at the intersection of Paradise Way and Greenfall Lane, view to the south; Sand Canyon Channel, view to the northwest. (Photographs taken between April 21 and July 19, 2023)

- Archaic Period (ca. 9,000-1,500 B.P.): Archaic sites are characterized by abundant lithic scatters of considerable size with many biface thinning flakes, bifacial preforms broken during manufacture, and well-made groundstone bowls and basin metates. As a consequence of making dart points, many biface thinning waste flakes were generated at individual production stations, which is a diagnostic feature of Archaic sites.
- Late Prehistoric Period (ca. 1,500 B.P.-contact): Sites from this period typically contain small lithic scatters from the manufacture of small arrow points, expedient groundstone tools such as tabular metates and unshaped manos, wooden mortars with stone pestles, acorn or mesquite bean granaries, ceramic vessels, shell beads suggestive of extensive trading networks, and steatite implements such as pipes and arrow shaft straighteners.

Ethnohistorical Context

Big Bear Valley lies in the heart of the homeland of the Serrano, which together with Vanyume people, linguistically a subgroup, also includes part of the San Gabriel Mountains, much of the San Bernardino Valley, and the Mojave River valley in the southern portion of the Mojave Desert, reaching as far east as the Cady, Bullion, Sheep Hole, and Coxcomb Mountains. The name "Serrano" was derived from a Spanish term meaning "mountaineer" or "highlander." The basic written sources on Serrano culture are Kroeber (1925), Strong (1929), and Bean and Smith (1978). The following ethnographic discussion of the Serrano people is based mainly on these sources.

At least two Serrano clans lived in or near Big Bear Valley during prehistoric and protohistoric times, according to Strong (1929:11), settling mostly on elevated terraces, hills, and finger ridges near where flowing water emerged from the mountains. The Yuhavetum (or Yuhaaviatam) clan's territory stretched from Big Bear Valley to the present-day Highland area in the San Bernardino Valley. The Pervetum clan's territory extended from the vicinity of Big Bear Valley to the headwaters of the Santa Ana River, across Sugarloaf Mountain. The two clans often intermarried. Tthe clans were in turn affiliated with one of two exogamous moieties, the Wildcat (*Tukutam*) or the Coyote (*Wahiiam*). The core of the unit was the patrilineage, although women retained their own lineage names after marriage.

In Serrano oral tradition, the Big Bear Valley area is known as Yuhaaviat, or "Pine Place," and is remembered as the point of origin for the nearby Yuhaaviatam of San Manuel Nation (formerly known as the San Manuel Band of Mission Indians; Ramos 2009). It is well-documented in ethnographic literature that Big Bear Valley figures prominently in the Serrano creation story. As Kroeber (1925:619) notes:

> Kukitat [younger brother of Pakrokitat, creator of Man], feeling death approach, gave instructions for his cremation; but the suspected coyote, although sent away on a pretended errand, returned in time to squeeze through badger's legs in the circle of the mourners and make away with Kukitat's heart. This happened at *Hatauva* (compare Luiseño Tova, where Wiyot died) in Bear Valley.

In a newspaper article, James Ramos, former Chairman of the Yuhaaviatam of San Manuel Nation, generally corroborates Kroeber's account and provides the accurate spelling of the deities' names in the Serrano language, Kruktat and Pakruktat (Ramos 2009). In addition, he identifies the location of

Hatauva as being in the general vicinity of a white quartz dome known to tribal members as Aapahunane't, or Eye of God, to the east of Baldwin Lake (*ibid*.).

Prior to European contact, Serrano subsistence was defined by the surrounding landscape and primarily based on the gathering of wild and cultivated foods and hunting, exploiting nearly all of the resources available. Common tools included manos and metates, mortars and pestles, hammerstones, fire drills, awls, arrow straighteners, and stone knives and scrapers. These lithic tools were made from locally sourced material as well as materials procured through trade or travel. They also used wood, horn, and bone spoons and stirrers; baskets for winnowing, leaching, transporting, parching, storing, and cooking; and pottery vessels for carrying water, storage, cooking, and serving food and drink.

Although contact with Europeans may have occurred as early as 1771 or 1772, Spanish influence on Serrano lifeways was minimal until the 1810s, when a mission *asistencia* was established on the southern edge of Serrano territory. Between then and the end of the mission era in 1834, most of the Serrano in the western portion of their traditional territory were removed to the nearby missions. In the eastern portion, a series of punitive expeditions in 1866-1870 resulted in the death or displacement of almost all remaining Serrano population in the San Bernardino Mountains. Today, most Serrano descendants are affiliated with the Yuhaaviatam of San Manuel Nation, the Morongo Band of Mission Indians, or the Serrano Nation of Indians.

Historical Context

In 1772, a small force of Spanish soldiers under the command of Pedro Fages, military *comandante* of Alta California, became the first Europeans to set foot in the San Bernardino Mountains, followed shortly afterwards by the famed explorer Francisco Garcés in 1776 (Beck and Haase 1974:15). During the next 70 years, however, the Spanish and Mexican colonization activities in Alta California, concentrated predominantly in the coastal regions, left little physical impact on the San Bernardinos. Aside from occasional explorations and punitive expeditions against livestock raiders, the mountainous hinterland of California remained largely beyond the attention of the missionaries, the *rancheros*, and the provincial authorities. The name "San Bernardino" was bestowed on the region in the 1810s, when the mission *asistencia* and an associated rancho were established under that name in present-day Loma Linda (Lerch and Haenszel 1981).

For the Big Bear Valley area, the historic period began in 1845, when Benjamin "Benito" Wilson, influential *ranchero* in the San Bernadino Valley, and a group of young *Californios* "discovered" the valley while avenging an Indian raid (Drake 1949:12). Observing a large number of grizzly bears in the vicinity of today's Baldwin Lake, Wilson bestowed "Bear Lake" as its original name. Some 30 years later, the lake's had become Baldwin Lake, named for Elias J. "Lucky" Baldwin, who owned most of the land around the lakebed between 1874 and 1909, and briefly operated the nearby Gold Mountain Mine in 1874-1875.

After the U.S. annexation of Alta California in 1848, the dense forest covering the mountainside became the scene—and victim—of a booming lumber industry, which brought the first wagon roads and industrial establishments into the San Bernardinos (Robinson 1989:23). In Big Bear Valley, lumbering was largely limited to a number of small sawmills in support of local construction (*ibid*.:44-45), meanwhile mining quickly rose when gold was discovered near Baldwin Lake in 1855

(Robinson 1989:47). Then in 1860, William F. Holcomb hit "pay dirt" on a hillside above Big Bear Valley, and later again in the valley now bearing his name, triggering a gold rush that brought 1,000 prospectors to the San Bernardino Mountains by that fall (Holcomb 1900:273-276; Robinson 1989:48-50). By the late 19th century, mining was big business, with Elias J. "Lucky" Baldwin's Gold Mountain Mining Company usurping individual prospectors as the dominant force in the industry (Drake 1949:19; Robinson 1989:57-71). Still, the much-anticipated "mother lode" was never found, and by the late 1940s mining was no longer the leading industry in the valley (Core 1980:11-12; Robinson 1989:57, 61-62, 70-71).

Around the same time as the Bear-Holcomb Valley gold rush, the San Bernardino Mountains' reputation as a premium summer grazing ground for sheep and cattle also grew, with Big Bear Valley at the epicenter (Robinson 1989:85). Some of the most prominent figures in early local history, including Augustus "Gus" Knight, Sr., James W. Smart, John R. Metcalf, and the Talmadge brothers, were also among those at the forefront of the cattle industry (*ibid.*:85-86). Beef sales from the valley peaked in 1921 before going into decline afterwards, as increasing resort and residential development drove up real estate value and shrank the availability of pastureland (Drake 1949:25; Robinson 1989:88, 93-94).

Along with its colorful history in lumber, gold, and cattle, Big Bear Valley owes much of its growth over the past century to the creation of Big Bear Lake, a reservoir built for the purpose of irrigating the vast citrus groves in the eastern San Bernardino Valley. Frank E. Brown and Edward G. Judson, founders of the Redlands colony, organized the Bear Valley Land and Water Company in 1883 and completed construction of the Big Bear dam in 1884 (Robinson 1989:170). The reservoir was filled during the following winter (Hall 1888:188; Hinckley 1974:41). The project's much-celebrated success was cut short over the next five years as the company's successors attempted to expand the irrigation scheme into Riverside County and became overextended (Robinson 1989:173).

A financial panic in 1893 was later compounded in the late 1890s by drought so severe that Big Bear Lake completely dried up in the summers of 1898, 1899, and 1900 (Hinckley 1983:1). As a remedy, in 1903 citrus growers in the Redlands-Highland area incorporated as the Bear Valley Mutual Water Company and took over the Bear Valley system (*ibid.*:1-2; Robinson 1989:173). Between 1910 and 1912, the new water company constructed the second Big Bear dam that is still in use today (Hinckley 1974:43; 1983:11). The new dam, although only 20 feet higher than the first, substantially increased the size of the reservoir and nearly tripled its capacity (Robinson 1989:174).

By the 1890s, excessive logging and sheep grazing in the San Bernardino Mountains had given rise to a forest conservation movement among residents of the San Bernardino Valley to protect the watershed. In 1893, the movement succeeded in persuading the U.S. government to create the San Bernardino Forest Reserve, later renamed the San Bernardino National Forest, and over the next few decades effectively brought an end to logging and sheep grazing in the San Bernardino Mountains (Robinson 1989:96-99; Robinson and Risher 1990:9).

Meanwhile, Big Bear Lake proved a powerful lure for vacationers and sportsmen, who would commandeer the log cabins left by construction crews (Atchley 1980:21-22). In 1887, the state authorities stocked the lake with thousands of Lake Tahoe trout, signaling the beginning of its development as a recreational property (*ibid.*:22). Three decades later, in 1916, the Bear Valley Mutual Water Company officially dedicated the lake surface to the free use by the public for

hunting, fishing, and boating (Hinckley 1983:43, 79), thereby guaranteeing Big Bear Valley's future as one of the most popular mountain resorts in southern California.

The first commercial resort established on the lakeshore was Gus Knight, Jr., and John Metcalf's Bear Valley Hotel, which opened for business in 1888 (Atchley 1980:22-23). After the Redlands-based Pine Knot Resort Company purchased the hotel in 1906 and renamed it the Pine Knot Lodge, a small community bearing the same name began to form around the lodge (Robinson 1989:181-182). Knight would later develop the Wild Rose Park and Knight's Camp near Baldwin Lake (*ibid.*), and in the meantime became a tireless promoter for the construction of new and better roads between the San Bernardino Valley and his resorts. His efforts helped bring about the roads through City Creek Canyon (1892), Mill Creek Canyon (1888), and Santa Ana Canyon (1899), and culminated with the completion of Rim of the World Drive in 1915 (Atchley 1980:23-26; Robinson 1989:179-183).

The completion of Rim of the World Drive brought about an exponential rise in the number of resorts in Big Bear Valley from two in 1913 to 52 in 1921 (Drake 1949:26; Robinson 1989:183-185). Winter snow in the mountains held its own attraction and brought a new set of residents and visitors as the Big Bear Valley area became a year-round getaway. A popular but rudimentary ski jump built in 1932 to the south of Pine Knot spurred the formation of the Big Bear Lake Park District two years later, which in turn brought about the first ski lift in the valley in 1949 (Robinson 1989:193-194). Since then, winter sports have become one of Big Bear Valley's leading attractions.

Adding to the allure, in the early 20th century Hollywood moviemakers found Big Bear Valley to be a suitable scenic backdrop for films such as *Paint Your Wagon*, *The Parent Trap*, *Bonanza*, *Kissin' Cousins*, and *Dr. Dolittle* (Atchley 1980:24-25). In 1916, the Bear Valley Mutual Water Company started a land boom in Big Bear Valley when it created a subsidiary, the Bear Valley Development Company, to subdivide, sell, and lease the company's land holdings around the reservoir (Hinckley 1983:42). Other landowners in the valley, such as the Knights and the Talmadges, soon joined in to take advantage of the increasing popularity of Big Bear Lake (Robinson 1989:187). The boom continued into the 1920s, with summer homes springing up at the rate of 50 to 100 per year (Robinson 1989:189). In 1938, Pine Knot and its surrounding area came to be known as the community of Big Bear Lake, while a smaller cluster of homes and hostelries between Big Bear and Baldwin Lakes became Big Bear City (*ibid.*:193).

More recent development in Bear Valley began in earnest after the end of World War II (NETR Online 1938-1969), with progress along Big Bear Lake's shoreline eclipsing Baldwin Lake due to its seasonal nature. In 1980, Big Bear Lake became the first incorporated city in the San Bernardino Mountains, while less urbanized communities in the eastern portion of the valley, including Moonridge and Big Bear City, have remained unincorporated to the present time.

RESEARCH METHODS

RECORDS SEARCH

On December 14, 2022, CRM TECH archaeologist Nina Gallardo conducted the cultural resources record search for this study at the South Central Coastal Information Center (SCCIC) on the campus

of California State University, Fullerton, which is the official repository for San Bernardino County in the California Historical Resources Information System. During the records search, Gallardo examined the SCCIC's digital maps, records, and databases for previously identified cultural resources and existing cultural resources reports within a one-mile radius of the APE. Previously identified cultural resources included properties designated as California Historical Landmarks, Points of Historical Interest, and San Bernardino County Landmarks, as well as those listed in the National Register of Historic Places, the California Register of Historical Resources, or the California Historical Resources Inventory.

GEOARCHAEOLOGICAL ANALYSIS

As part of the research procedures, CRM TECH archaeologist Deirdre Encarnación pursued geoarchaeological analysis to assess the APE's potential for the deposition and preservation of subsurface cultural deposits from the prehistoric period, which cannot be detected through a standard surface archaeological survey. Sources consulted for this purpose included primarily topographic and geologic maps and reports pertaining to the surrounding area. Findings from these sources were used to develop a geomorphologic history of the APE and address geoarchaeological sensitivity of the vertical APE.

NATIVE AMERICAN PARTICIPATION

On November 21, 2022, CRM TECH submitted a written request to the State of California Native American Heritage Commission (NAHC) for a records search in the commission's Sacred Lands File. Following the NAHC's recommendations and previously established consultation protocol, on December 30, 2022, CRM TECH further contacted a total of 13 Native American groups in the region in writing for additional information on potential Native American cultural resources in the project vicinity. Follow-up telephone solicitations were carried out between January 13 and February 17, 2023. Correspondence between CRM TECH and the Native American representatives is summarized below, and a complete record is attached to this report in Appendix 2.

HISTORICAL BACKGROUND RESEARCH

Historical background research for this study was conducted by CRM TECH historian Terri Jacquemain. Sources consulted during the research included published literature in local history, historical maps of the Big Bear Valley area, and aerial/satellite photographs of the project vicinity. Among the maps consulted for this study were U.S. General Land Office (GLO) land survey plat maps dated 1858 and U.S. Geological Survey (USGS) topographic maps dated 1902-1996, which are accessible at the websites of the USGS and the U.S. Bureau of Land Management. The aerial and satellite photographs, taken between 1938 and 2022, are available at the Nationwide Environmental Title Research (NETR) Online website and through the Google Earth software.

FIELD SURVEY

The field survey of the APE was carried out in several phases. On April 21, 2023, CRM TECH field director Daniel Ballester and project archaeologist Hunter O'Donnell carried out the initial survey using both reconnaissance- and intensive-level methods. The reconnaissance survey primarily covered the pipeline alignments and was conducted by driving along the paved roadways along the

proposed pipeline alignment and visually inspecting the surrounding area for any indication of cultural resources. The intensive-level survey was conducted on foot in areas where ground surface was exposed, such as along unpaved roads and one pipeline alignment located south of Shay Road leading to Shay Pond.

On April 28, 2023, Hunter O'Donnell conducted the survey of the BBARWA treatment plant and the surrounding pipeline alignments to the best of possibility as much of the western end and northeast corner of the facility were inundated by waters from the adjacent Baldwin Lake. Portions of nearby pipeline alignments were also inaccessible due to flooding. O'Donnell was able to survey the unflooded portion of the plant at an intensive level and inspect the structures, basins, and ponds situated at higher elevations.

As additional facility sites and pipeline alignments were identified in the design process and added to the APE, Daniel Ballester surveyed these areas on June 21 and July 19, 2023, using similar methods. In this way, the ground surface in the entire APE was systematically and carefully examined for any evidence of human activities dating to the prehistoric or historic period (i.e., 50 years ago or older). Other than areas obscured by pavement or flooding, visibility of the native ground surface ranged from poor to good depending on the density of the vegetation growth (Fig. 5).

RESULTS AND FINDINGS

RECORDS SEARCH

According to SCCIC records, various portions of the APE were included in some two dozen past cultural resources studies completed between 1977 and 2011, but the APE as a whole had not been surveyed systematically prior to this study. As a result of these past studies, SCCIC records identified 16 historical/archaeological resources as lying partially within the APE, including 1 prehistoric (i.e., Native American) site, 1 natural feature that acquired cultural significance, and segments of 14 roads dating to the historic period (see App. 3 for locations). These 16 known cultural resources are listed in Table 1, and further information about them is presented in Appendix 4.

Prehistoric site 36-002060 was originally recorded in 1969 as containing "points, flakes (some obsidian), and sherds" that was scattered over a half-mile near the present-day intersection of Shay Road and Palomino Drive (Simpson 1969:1). These or similar artifacts were observed during field visits in 1989 and 1990, and the catalog expanded to include additional flakes, scrapers, primary flakes, a projectile point (McKenna 1989:1), as well as manos, possible metate fragments, and a bone needle (Love and DeWitt 1990:1). A monitoring program in 1996 further noted recovery of three quartzite flakes and 11 tested cores (Sander 1996:2). Most recently, the site area was revisited in 2004, after much of the land had been developed for residential use (NETR Online 2002; 2005; County of San Bernardino n.d.), but only three flakes were observed at that time (Zavala et al. 2004:1).

Baldwin Lake (36-015027) received official recognition in 1973 as California Point of Historical Interest No. SBr-014 as the only naturally occurring lake in the San Bernardino Mountains and because of its colorful early history in connection to the 1845 Wilson expedition (State of California

Table 1. Previously Recorded Cultural Resources in the APE		
Primary No.	**Other Designation**	**Description**
36-002060	CA-SBR-2060	Prehistoric lithic scatter
36-015027	CPHI No. SBr-014	Baldwin Lake
36-024007	CA-SBR-15192H	Division Drive
36-024051	CA-SBR-15236H	Bufflehead Drive
36-024052	CA-SBR-15237H	Teal Drive
36-024053	CA-SBR-15238H	Gold Mountain Drive
36-024054	CA-SBR-15239H	Mount Doble Drive
36-024059	CA-SBR-15244H	Arbor Lane
36-024547	CA-SBR-15588H	Shore Drive
36-024556	CA-SBR-15597H	Gildart Drive
36-024557	CA-SBR-15598H	Rose Hill Drive
36-024558	CA-SBR-15599H	Saw Mill Drive
36-024559	CA-SBR-15600H	Pinon Drive
36-024560	CA-SBR-15601H	Big Tree Drive
36-024562	CA-SBR-15603H	Pine View Drive
36-024563	CA-SBR-15604H	Holcomb View Drive

1973; see "Historical Context," above). In addition, as mentioned above (see "Ethnohistorical Context"), local Serrano creation legend identifies Baldwin Lake as the location where the deity Kruktat died and was cremated (Kroeber 1925:619; Ramos 2009). As such, Baldwin Lake, the original Bear Lake before the present-day Big Bear Lake reservoir was built, is clearly a property of both Native American traditional cultural value and later Anglo-American historical interest.

The 14 road segments in the APE were all recorded during a 2011 reconnaissance-level study of road rights-of-way in the Big Bear City area between Big Bear Lake and Baldwin Lake. They were described predominantly as paved two-lane roads that generally date to the early post World War II years.

Within the one-mile scope of the records search, SCCIC records identify roughly 150 additional previous studies, in all covering roughly 80% of the total acreage, attesting to the vigorous development in the Big Bear City area in recent decades. These studies have resulted in the recording of some 250 additional cultural resources within the one-mile radius. Of these, 120 were prehistoric in origin, including 76 archaeological sites and 46 isolates, or localities with fewer than three artifacts. The rest of the previously recorded cultural resources dated to the historic period, including 110 sites and a handful of isolates. Among the sites were refuse scatters, mining prospects, camp remains, and linear features such as roads, ditches, and fences, and the isolates included cans and a metal badge. The locations of these resources are provided in Appendix 3.

The prehistoric sites were predominantly bedrock milling features, lithic scatters, and sites that contained both, in one case with a scatter of ceramic sherds as well, with at least one rock shelter and a trail also recorded. The types of sites are associated mostly with resources procurement, but several of the larger lithic scatters and/or bedrock milling feature clusters were interpreted as village sites or camp sites. The majority of the prehistoric isolates consisted of lithic flakes, either of jasper or quartzite materials. Other isolate types included milling slabs, mano and mano fragments, and point fragments.

GEOARCHAEOLOGICAL ANALYSIS

According to Bortugno and Spittler (1986), the APE is situated upon lake deposits (*Ql*) and well-dissected alluvial fan sediments (*Qod*), both of them Pleistocene in age, as well as Holocene-age undifferentiated alluvium (*Q*). Miller (2004) has mapped the surface sediments at the BBARWA treatment plant and along the northerly pipeline alignments as mostly *Qyf* and some *Ql*, with *Qs* sediments present along the southerly alignments in the northern portion of the APE. *Qyf* is defined as young alluvial fan deposits of Holocene and late Pleistocene age, *Ql* is very young lacustrine deposits (lake deposits) of Holocene age, and *Qs* is very young surficial deposits dating to the late Holocene, including wash, fan, colluvium, and alluvial-valley deposits (*ibid*.).

In light of their relatively young age and alluvial origin, the subsurface sediments in the APE have the potential to contain buried deposits of prehistoric cultural remains. However, geospatial analyses of known prehistoric sites in the vicinity show the majority of these sites, especially the potential habitation sites, to be located primarily to the north or southeast, away from the shores of Baldwin Lake. While the APE would likely have been used for resource procurement, travel, and occasional camping during these activities, the potential for inundation along the shores of Lake Baldwin as part of seasonal cycles would not have made the treatment plant site or most of the pipeline alignments ideal areas for long-term habitation. This is corroborated by the ethnographic literature that identifies foothills as the preferred settlement environment for Native Americans of the inland region (Bean and Smith 1978).

Most of the APE, nearly 94 of 110 acres, lies within the lakebed of Baldwin Lake, while much of the rest is along natural drainages. Neither of these settings would have been considered suitable for permanent villages in ancient times. As most of it coincides with existing water facilities and public roads, the ground surface in the APE has typically been extensively disturbed by construction and maintenance activities as well as natural fluvial erosion. In short, land in these settings is not conducive to either the deposition or the preservation of potentially significant prehistoric cultural remains.

According to as-built plans for a recent street improvement project on nearby Big Bear Boulevard, underground electric and gas lines within the right-of-way required excavations to the depth of four feet and eight inches for the placement of a six-inch-diameter conduit (Caltrans 2013:U28-U29). While no such data has been obtained for the current APE, a similar depth of prior disturbance is typical within the rights-of-way for paved roads. Other than the relatively shallow disturbances along the proposed pipeline alignments and for equipment upgrades at existing facility sites, the most notable, deep-reaching disturbance will be associated with the monitoring wells, which are small-diameter borings reaching well beyond any expected subsurface archaeological deposits. Based on these considerations, the likelihood of encountering intact, potentially significant prehistoric cultural remains within the vertical APE appears to be relatively low.

NATIVE AMERICAN PARTICIPATION

On December 16, 2022, the NAHC replied in writing that the Sacred Lands File identified unspecified Native American cultural resource(s) in the vicinity of the APE and referred further inquiries to the Yuhaaviatam of San Manuel Nation and the Morongo Band of Mission Indians

Council (see App. 2). Meanwhile, the NAHC also recommended consulting with other local Native American groups and provided a list of potential contacts in the region for that purpose.

Upon receiving the NAHC's reply, CRM TECH initiated consultation with all 13 local Native American groups on the referral list (see App. 2). In some cases, the designated tribal spokespersons on cultural resources issues were contacted in lieu of individuals identified by the NAHC, as recommended in the past by the appropriate tribal government staff. The 13 Native American representatives contacted are listed below:

- Patricia Garcia-Plotkin, Tribal Historic Preservation Officer, Agua Caliente Band of Cahuilla Indians;
- Amanda Vance, Chairperson, Augustine Band of Cahuilla Mission Indians;
- Michael Mirelez, Director of Cultural Affairs, Cabazon Band of Mission Indians;
- BobbyRay Esparza, Cultural Coordinator, Cahuilla Band of Indians;
- Ray Chapparosa, Chairperson, Los Coyotes Band of Cahuilla and Cupeño Indians;
- Ann Brierty, Tribal Historic Preservation Officer, Morongo Band of Mission Indians;
- Jill McCormick, Historic Preservation Officer, Quechan Tribe of the Fort Yuma Reservation;
- John Gomez, Jr., Cultural Resource Coordinator, Ramona Band of Cahuilla Indians;
- Jessica Mauck, Cultural Resources Analyst, Yuhaaviatam of San Manuel Nation;
- Vanessa Minott, Tribal Administrator, Santa Rosa Band of Cahuilla Indians;
- Mark Cochrane, Co-Chairperson, Serrano Nation of Mission Indians;
- Joseph Ontiveros, Cultural Resources Director, Soboba Band of Luiseño Indians;
- Alesia Reed, Cultural Committee, Torres-Martinez Desert Cahuilla Indians.

As of this time, seven tribal representatives have responded to the inquiry (see App. 2). Among them, the Santa Rosa Band, the Los Coyotes Band, and the Quechan Tribe had no comments on this undertaking. The Quechan Tribe deferred to tribes located in closer proximity to the APE, as did the Agua Caliente Band, who found the APE to be outside their traditional use area. Meanwhile, Soboba Band deferred specifically to the Yuhaaviatam of San Manuel Nation.

The Augustine Band stated that they were unaware of any cultural resources in the APE but requested immediate notification if such resources were discovered during the undertaking. The Morongo Band identified the APE as a part of their ancestral territory and indicated that they would pursue government-to-government consultation with the lead agencies. As a part of that process, the Morongo Band requested to review all cultural resources documentation for the undertaking.

HISTORICAL BACKGROUND RESEARCH

Despite Big Bear Valley's long history of Native American habitation and early Euro-American enterprises such as gold mining, lumbering, and cattle ranching, the only human-made features known to be present in or near the APE in the 1850s were two Indian trails (Figs. 6, 7). The "dry bed of Bear Lake," or present-day Baldwin Lake, was noted about 1,500 feet to the east of the northern portion of the APE at that time (Fig. 6). By the turn of the century, a sparse web of roads has emerged in the project vicinity, connecting a few named locations in the eastern Big Bear Valley, such as Gold Mountain, Saragossa Springs, Doble and, closest to the APE, Lakeview Mill (Fig. 8).

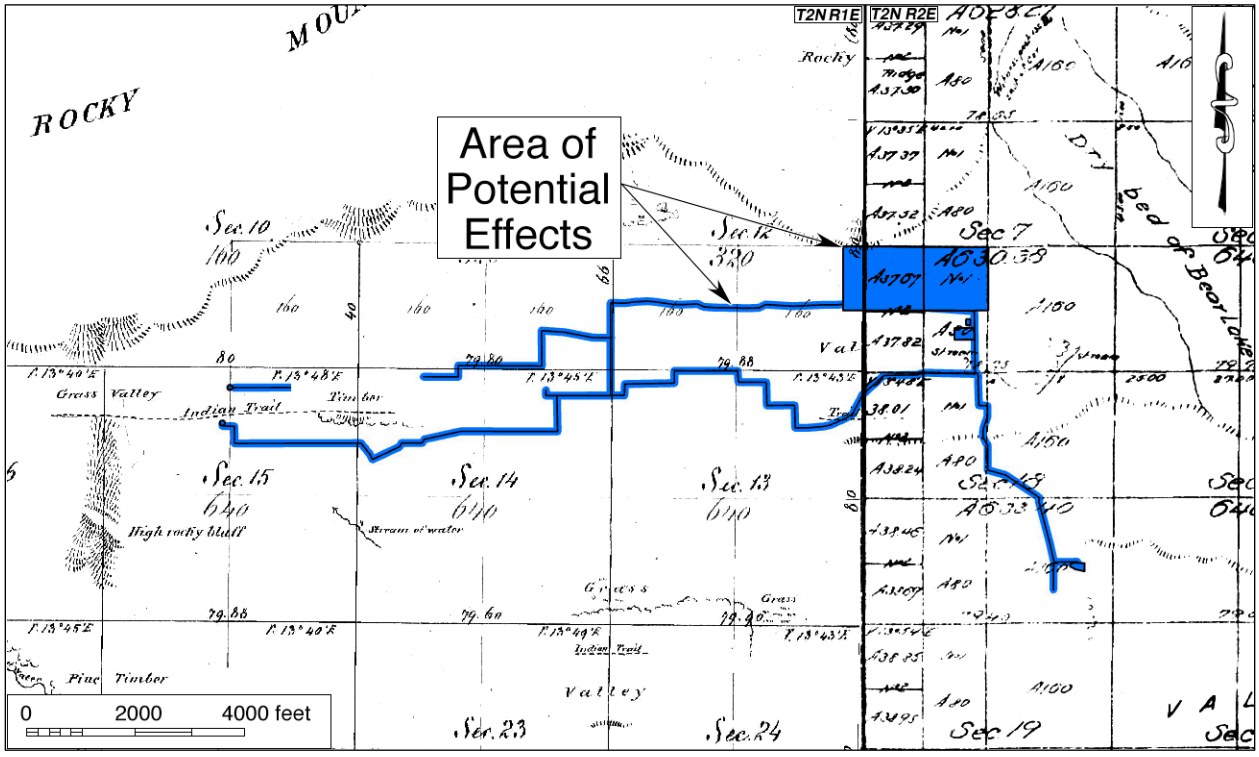

Figure 6. Northern portion of the APE in 1857-1858. (Source: GLO 1858a; 1858b)

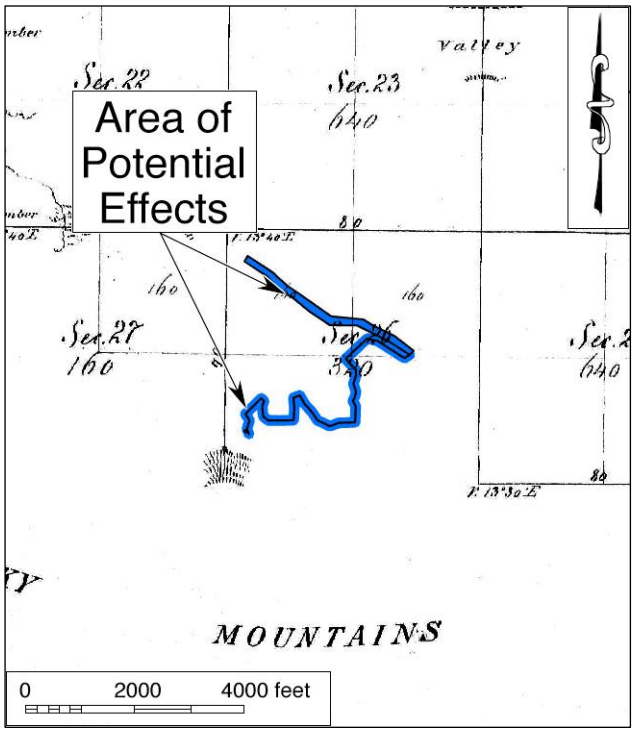

Figure 7. Southern portion of the APE in 1857-1858. (Source: GLO 1858a)

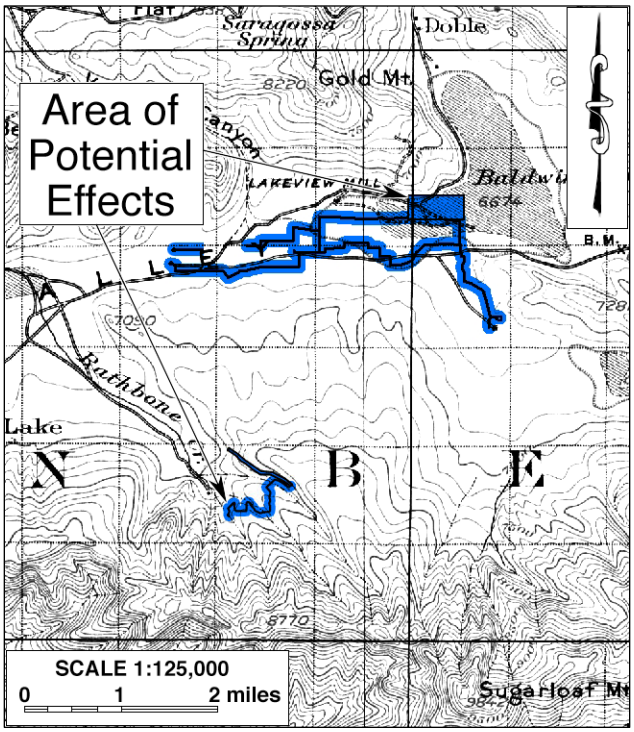

Figure 8. The APE in 1899. (Source: USGS 1902)

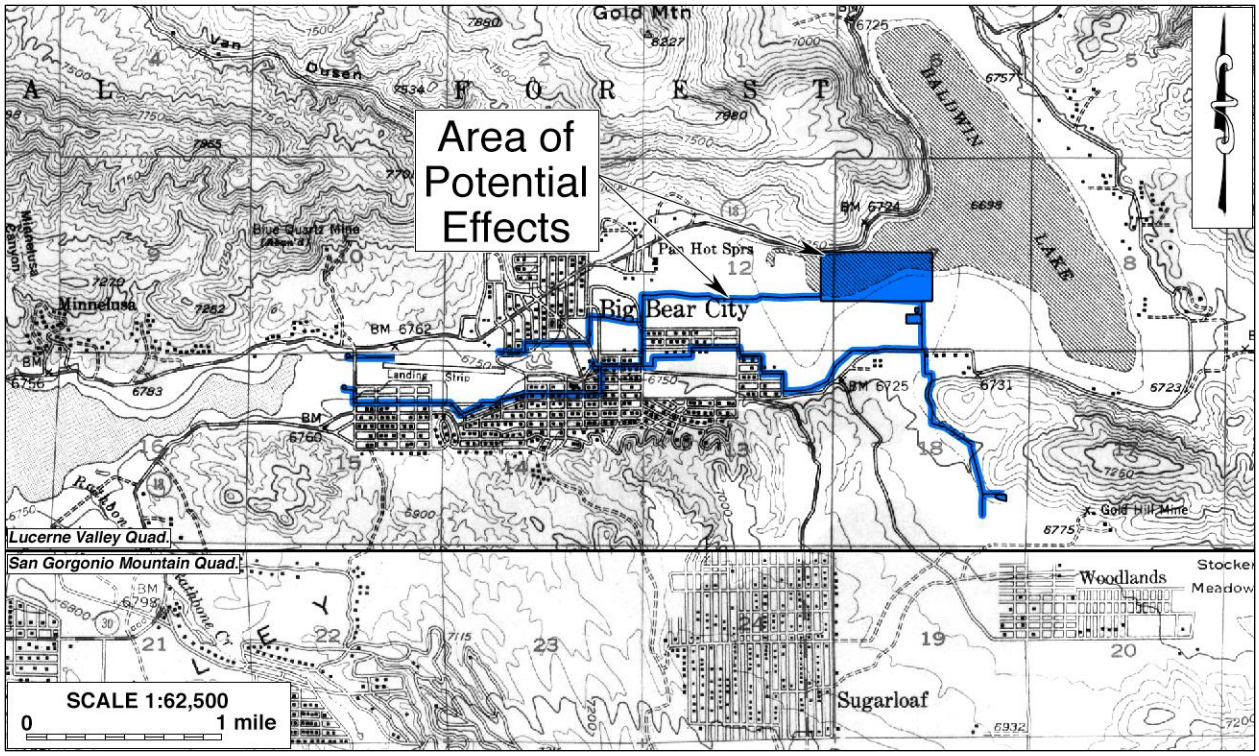

Figure 9. Northern portion of the APE in 1945-1954. (Source: USGS 1947; 1954)

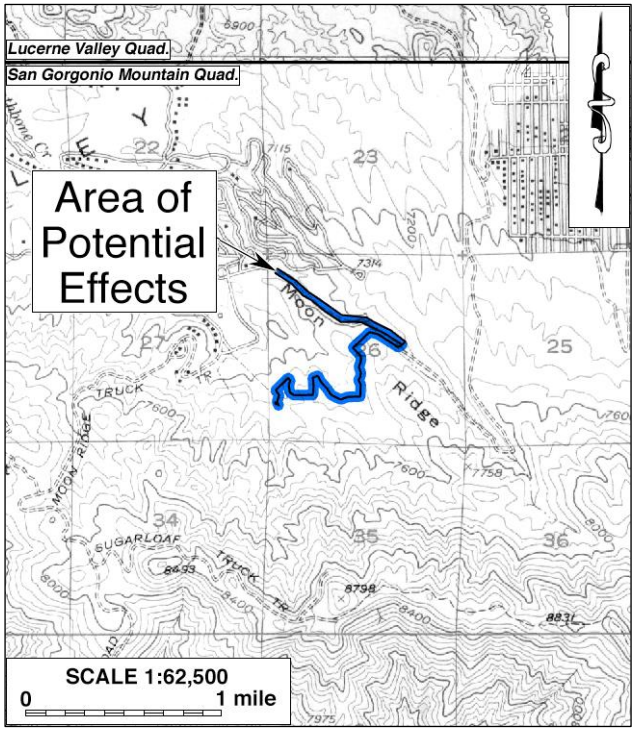

Figure 10. Southern portion of the APE in 1945-1954. (Source: USGS 1947; 1954)

By the mid-20th century Big Bear City had taken shaped, marked by a dense grid of roads lined by buildings, with the similar but smaller communities of Sugarloaf, Woodlands, and Moonridge also established nearby (NETR Online 1938; 1945; Figs. 9, 10). Development in this area continued through the rest of the 20th century, albeit at a slower pace than the City of Big Bear Lake (NETR Online 1945-2020). Nevertheless, over the next three decades new building filled most of the neighborhoods, and by the end of the 20th century there were few vacant lots left (NETR Online 1945-2002; Google Earth 1985-2002). The pace of development has since steadied, with the surrounding area retaining a largely rural character to this day (NETR Online 2002-2020; Google Earth 2002-2022).

Construction began on the wastewater plant (WWTP) and oxidation ponds in circa 1966 (*San Bernardino County Sun* 1965), with

weather-related setbacks faced during construction once work was almost completed

(*San Bernardino County* Sun 1967). In December 1966, sewer trenches were washed out in storms, and a pump station was installed but inoperable (*ibid.*). The WWTP facility is apparent in an aerial photo taken in 1969, with the two balance chambers, the berm surrounding the facility, and what may be an oxidation pond that is no longer present visible (NETR Online 1969). Clarifiers No. 1 and No. 2 and rotors were later constructed in April 1974 (Burton 2023), followed by the two southernmost aeration tanks and basins and several outbuildings (NETR Online 1983).

As a result of further growth in eastern Big Bear Valley, a Joint Powers Agreement was signed in 1972 between the Big Bear City Community Services District, the Big Bear Lake Sanitation District, and the County of San Bernardino to develop a study regarding sewage treatment, disposal, and wastewater management (Burton 2023). This would lead to the formation of the Big Bear Valley Wastewater Planning Commission and ultimately, in 1974, the BBARWA. Expansions and upgrades continued at the WWTP through the formation of the BBARWA, including at least six outfall line modifications and realignments between 1981 and 2011, and the construction of a 10-million-gallon storage pond at the WWTP in 2002 (*ibid.*).

FIELD SURVEY

During the field survey, the BBARWA WWTP was observed as containing both historical and modern components, with the former sufficiently consistent in appearance to their late-1960s origin to warrant recordation and further study as a potential cultural resource. The entire plant was subsequently recorded into the California Historical Resources Inventory under the temporary designation of Site 3969-1H, pending assignment of a permanent identification number by the SCCIC. Site 3969-1H is discussed further below, and additional information is provided in the site record forms in Appendix 4.

Site 3969-1H occupies a peninsula jutting from the south shoreline of Lake Baldwin in the northeastern portion of the APE. As is typical for public utility facilities, the structures and other features at the plant are standard in design and utilitarian in character. Components original to its initial construction and still in use include two concrete balance chambers, settling ponds, an oval-shaped elevated berm/perimeter, two clarifiers (No. 1 and 2), rotors, and a clarifier splitter (Burton 2023). More recent components have been added to the facility beginning around 1974 and continuing through the 1990s and to at least 2011 (NETR Online 1969-2012; Google Earth 1995-2009; Burton 2023). Due to the alterations and additions since 1969, the overall appearance of the facility is predominantly modern.

No evidence of Site 36-002060, the previously recorded prehistoric lithic scatter, was found in the APE. Noted in 2004 as having been impacted by road and residential development near the intersection of Shay Road and Palomino Drive, the site at that time consisted of three lithic flakes located in an open area outside the current APE (Zavala 2004). The portion of the APE across the site lies entirely within the public right-of-way along Palomino Drive, where the surface and near-surface sediments have been extensively disturbed by road construction and underground utility installation. Consequently, it is highly unlikely for any archaeological features or artifact deposits

As noted above, many of the roadways within or across the APE trace their origins to the late historic period, and 14 of them were previously recorded into the California Historical Resources Inventory. As infrastructure features of historical origin that remain in service, however, the current configuration and appearance of these roadways reflect the results of upgrading and maintenance during the modern period, and none of them demonstrate any distinctive historical character today. The other cultural resource in the APE, Baldwin Lake (36-015027), was observed as having a relatively robust reach at the time of the field survey, inundating the western end and part of the northeastern portions of the BBARWA WWTP.

MANAGEMENT CONSIDERATIONS

APPLICABLE STATUTORY/REGULATORY GUIDELINES

The purpose of this study is to identify any "historic properties" or "historical resources" that may exist within the APE. "Historic properties," as defined by the Advisory Council on Historic Preservation, include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior" (36 CFR 800.16(l)). The eligibility for inclusion in the National Register is determined by applying the following criteria, developed by the National Park Service as per provision of the National Historic Preservation Act:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
> (b) that are associated with the lives of persons significant in our past; or
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
> (d) that have yielded, or may be likely to yield, information important in prehistory or history. (36 CFR 60.4)

For CEQA-compliance considerations, the State of California's Public Resources Code (PRC) establishes the definitions and criteria for "historical resources," which require similar protection to what NHPA Section 106 mandates for "historic properties." "Historical resources," according to PRC §5020.1(j), "includes, but is not limited to, any object, building, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California."

More specifically, CEQA guidelines state that the term "historical resources" applies to any such resources listed in or determined to be eligible for listing in the California Register of Historical Resources, included in a local register of historical resources, or determined to be historically significant by the lead agency (Title 14 CCR §15064.5(a)(1)-(3)). Regarding the proper criteria of historical significance, CEQA guidelines mandate that "generally a resource shall be considered by

the lead agency to be 'historically significant' if the resource meets the criteria for listing on the California Register of Historical Resources" (Title 14 CCR §15064.5(a)(3)). A resource may be listed in the California Register if it meets any of the following criteria:

(1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
(2) Is associated with the lives of persons important in our past.
(3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
(4) Has yielded, or may be likely to yield, information important in prehistory or history. (PRC §5024.1(c))

DISCUSSION

In summary, 17 historical/archaeological sites, including 1 prehistoric site, 15 historic-period site, and 1 natural feature that acquired cultural significance in both prehistory and history, were identified as lying within or partially within in the APE, as listed below:

Primary No.	Other Designation	Description
36-002060	CA-SBR-2060	Prehistoric lithic scatter
36-015027	CPHI No. SBr-014	Baldwin Lake
36-024007	CA-SBR-15192H	Division Drive
36-024051	CA-SBR-15236H	Bufflehead Drive
36-024052	CA-SBR-15237H	Teal Drive
36-024053	CA-SBR-15238H	Gold Mountain Drive
36-024054	CA-SBR-15239H	Mount Doble Drive
36-024059	CA-SBR-15244H	Arbor Lane
36-024547	CA-SBR-15588H	Shore Drive
36-024556	CA-SBR-15597H	Gildart Drive
36-024557	CA-SBR-15598H	Rose Hill Drive
36-024558	CA-SBR-15599H	Saw Mill Drive
36-024559	CA-SBR-15600H	Pinon Drive
36-024560	CA-SBR-15601H	Big Tree Drive
36-024562	CA-SBR-15603H	Pine View Drive
36-024563	CA-SBR-15604H	Holcomb View Drive
Pending	3969-1H	BBARWA wastewater treatment plant

The prehistoric site, 36-002060, was first recorded in 1969 near the intersection of Shay Road and Palomino Drive, in an area that has since been developed into residential properties (NETR Online 1970-2020). During this study, no artifacts or features of prehistoric origin were observed in the portion of the site lying within the APE boundaries, which is confined in the public right-of-way of Palomino Drive. As stated above, in light of the extent of prior ground disturbance at this location, this study concludes that Site 36-002060 no longer exists within the APE.

Among 15 historic-period sites, 14 are segments of various public roadways that coincide with or cross the proposed pipeline alignments. As working components of the modern transportation infrastructure, these roadways have undergone extensive upgrading and maintenance work since the end of the historic period, and none of them demonstrate any distinctive historical character. All these roadways were built in the late historic period in accordance with standard designs and

construction practices. As such, none of them demonstrate any notable qualities in architecture, technology, or aesthetics, nor do they demonstrate the potential for any important historical/ archaeological data. Furthermore, there is no evidence that any of them is closely associated with any historic figures or events of recognized significance. Therefore, none of these 14 previously recorded roadways appear to meet any of the criteria for listing in the National Register of Historic Places or the California Register of Historical Resources, and none of them qualify as "historic properties" or "historical resources" under Section 106 and CEQA provisions.

Similarly, the BBARWA treatment plant (3969-1H) does not appear to be eligible for listing in the National Register or the California Register. Under Criterion A/1, the original construction of the plant dates to a period of rapid population growth in the Big Bear Valley area during the post-WWII suburban boom, which is arguably a pattern of events that substantially influenced the course of local, regional, as well as national history. However, as one of the numerous public utility projects completed at the time, the plant does not demonstrate a unique or particularly close association with this pattern of events or with any other historic theme. Furthermore, the plant is not known to be closely associated with any specific events of recognized significance in history.

Under Criterion B/2, the historical background research has not identified any important persons in association with the history of the BBARWA treatment plant. Under Criterion C/3, this utilitarian facility of standard design and construction does not exhibit any significant, special, or remarkable merits in architecture, engineering, technology, or aesthetics, nor does it represent an important example of any property type, period, region, and method of construction or embody the work of a prominent architect, engineer, or builder. Under Criterion D/4, the plant holds little promise for important historical or archaeological data for the study of public utility works in the post-WWII era, a subject that is well documented in existing literature and contemporary publications.

In addition, as a result of alterations and additions made in the modern period, the plant's historical components are now mixed with modern additions and replacements on prominent display. Consequently, it no longer retains sufficient historic integrity in the aspects of design, materials, workmanship, and feeling to relate to its early history. Based on these considerations, the BBARWA treatment plant does not appear to meet the definition of a "historic property" or a "historical resource."

The last cultural resource identified in the APE, Baldwin Lake (36-015027), has been designated a California Point of Historical Interest (No. SBr-014) due to its well-known association with colorful events in early California history and thus inherently qualifies as a "historical resource" under CEQA. Because of the same historical association, and because of its prominent role in local Native American creation story, Baldwin Lake may be considered eligible for the National Register of Historic Places upon full evaluation and thereby qualify as a "historic property" under Section 106 provisions as well. However, since the APE overlaps only a small portion of the lakebed at the BBARWA wastewater treatment plant and along the Palomino Drive and Baldwin Lake Trail rights-of-way, a full evaluation of the historical significance of Baldwin Lake is well beyond the scope of this study.

Given the limited involvement of the lakebed in the project plans and the previously altered cultural landscape in this portion of the APE, the proposed undertaking has little potential to affect the

existing characteristics of Baldwin Lake. Based on these considerations, the present study concludes that Baldwin Lake as a whole may be presumed to be a "historic property" for the purpose of this undertaking, with the understanding that the limited impact the undertaking may bring about to the current condition of the APE will not constitute an adverse effect on this "historic property"/ "historical resource."

CONCLUSION AND RECOMMENDATIONS

Section 106 of the National Historic Preservation Act mandates that federal agencies take into account the effects of their undertakings on historic properties and seek ways to avoid, minimize, or mitigate any adverse effects on such properties (36 CFR 800.1(a)). Similarly, CEQA establishes that a project that may cause a substantial adverse change in the significance of a "historical resource" is a project that may have a significant effect on the environment (PRC §21084.1). "Substantial adverse change," according to PRC §5020.1(q), "means demolition, destruction, relocation, or alteration such that the significance of an historical resource would be impaired."

In conclusion, among the 17 cultural resources identified in the APE, the 15 historic-period sites do not appear to qualify as "historic properties" or "historical resources," the prehistoric site (36-002060) is no longer extant within the APE boundaries, and the undertaking will not have an adverse effect on Baldwin Lake, a "historical resource" under CEQA and a presumed "historic property" under Section 106. Meanwhile, the subsurface sediments in the vertical APE appear to be relatively low in sensitivity for potentially significant archaeological deposits of prehistoric origin. Pursuant to 36 CFR 800.4(d)(1) and Calif. PRC §21084.1, CRM TECH presents the following recommendations to the BBARWA and the SWRCB:

- As currently proposed, the undertaking will not have an adverse effect on any "historic properties" or cause a substantial adverse change in the significance of any "historical resources."
- No further cultural resources investigation will be necessary for the undertaking unless project plans undergo such changes as to include areas not covered by this study.
- If buried cultural materials are discovered inadvertently during any earth-moving operations associated with the undertaking, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the find.

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n.d. NOAA Online Weather Data: Almanac for Big Bear Lake, CA. http://w2.weather.gov/climate/xmacis.php?wfo=sgx.
O'Connell, James F., Philip J. Wilke, Thomas F. King, and Carol L. Mix (eds.)
1974 Perris Reservoir Archaeology: Late Prehistoric Demographic Change in Southeastern California. On file, Eastern Information Center, University of California, Riverside.
Ramos, James
2009 Big Bear: Spiritual Home of the Yuhaviatam. *The Press-Telegram* (Long Beach) November 19. https://www.presstelegram.com/2009/11/19/big-bear-spiritual-home-of-the-yuhaviatam/.
Robinson, John W.
1989 *The San Bernardinos: The Mountain Country from Cajon Pass to Oak Glen, Two Centuries of Changing Use*. Big Santa Anita Historical Society, Arcadia, California.
Robinson, John W., and Bruce D. Risher
1989 San Bernardino National Forest: A Century of Federal Stewardship. *San Bernardino County Museum Quarterly* XXXVII(4).
San Bernardino County Sun (accessed through Newspapers.com)
1965 "Big Bear Sewer Plant OK'd."
1967 "County Holding Up Payment on $593,000 Sewer Project."
1970a "Water Quality Control Board Approved Plan for Bear Valley Sewage Problem."
1970b "Supervisors Approve Plan to Halt Pollution of Big Bear, Baldwin Lakes."
Sander, Jay K.
1996 California Historical Resources Inventory record forms, Site 36-002060 (CA-SBR-2060; update). On file, South Central Coastal Information Center, California State University, Fullerton.
Simpson, R.
1969 California Historical Resources Inventory record forms, Site 36-002060 (CA-SBR-2060). On file, South Central Coastal Information Center, California State University, Fullerton.
State of California
1973 Point of Historical Interest No. SBr-014: Baldwin Lake (36-015027). On file, South Central Coastal Information Center, California State University, Fullerton.
Strong, William Duncan
1929 *Aboriginal Society in Southern California*. University of California Publications in American Archaeology and Ethnology 26. Reprinted by Malki Museum Press, Banning, Calif., 1972.
Trampier, Joshua
2011 California Historical Resources Inventory record forms, Site 36-024552 (CA-SBR-15593H). On file, South Central Coastal Information Center, California State University, Fullerton.
USGS (United States Geological Survey, U.S. Department of the Interior)
1902 Map: San Gorgonio, Calif. (30', 1:125,000); surveyed in 1899.
1947 Map: Lucerne Valley, Calif. (15', 1:62,500); aerial photographs taken in 1945.
1954 Map: San Gorgonio Mountain, Calif. (15', 1:62,500); aerial photographs taken in 1952, field-checked in 1954.
1969 Map: San Bernardino, Calif. (1:250,000); 1958 edition revised.
1996a Map: Big Bear City, Calif. (7.5', 1:24,000); 1971 edition photorevised in 1994.

1996b Map: Big Bear Lake, Calif. (7.5', 1:24,000); aerial photographs taken in 1969, photorevised in 1994.

1996c Map: Fawnskin, Calif. (7.5', 1:24,000); aerial photographs taken in 1969, photorevised in 1994.

1996d Map: Moonridge, Calif. (7.5', 1:24,000); 1970 edition photorevised in 1994.

Warren, Claude N.

1984 The Desert Region. In Michael J. Moratto (ed.): *California Archaeology*; pp. 339-430. Academic Press, Orlando, Florida.

Zavala, G., B. Sheets, and K. Maeyama

2004 California Historical Resources Inventory record forms, Site 36-002060 (CA-SBR-2060; update). On file, South Central Coastal Information Center, California State University, Fullerton.

APPENDIX 1
PERSONNEL QUALIFICATIONS

PRINCIPAL INVESTIGATOR/HISTORIAN
Bai "Tom" Tang, M.A.

Education

1988-1993	Graduate Program in Public History/Historic Preservation, University of California, Riverside.
1987	M.A., American History, Yale University, New Haven, Connecticut.
1982	B.A., History, Northwestern University, Xi'an, China.
2000	"Introduction to Section 106 Review," presented by the Advisory Council on Historic Preservation and the University of Nevada, Reno.
1994	"Assessing the Significance of Historic Archaeological Sites," presented by the Historic Preservation Program, University of Nevada, Reno.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1993-2002	Project Historian/Architectural Historian, CRM TECH, Riverside, California.
1993-1997	Project Historian, Greenwood and Associates, Pacific Palisades, California.
1991-1993	Project Historian, Archaeological Research Unit, University of California, Riverside.
1990	Intern Researcher, California State Office of Historic Preservation, Sacramento.
1990-1992	Teaching Assistant, History of Modern World, University of California, Riverside.
1988-1993	Research Assistant, American Social History, University of California, Riverside.
1985-1988	Research Assistant, Modern Chinese History, Yale University.
1985-1986	Teaching Assistant, Modern Chinese History, Yale University.
1982-1985	Lecturer, History, Xi'an Foreign Languages Institute, Xi'an, China.

Cultural Resources Management Reports

Preliminary Analyses and Recommendations Regarding California's Cultural Resources Inventory System (with Special Reference to Condition 14 of NPS 1990 Program Review Report). California State Office of Historic Preservation working paper, Sacramento, September 1990.

Numerous cultural resources management reports with the Archaeological Research Unit, Greenwood and Associates, and CRM TECH, since October 1991.

PRINCIPAL INVESTIGATOR/ARCHAEOLOGIST
Michael Hogan, Ph.D., Registered Professional Archaeologist #28576644

Education

1991	Ph.D., Anthropology, University of California, Riverside.
1981	B.S., Anthropology, University of California, Riverside; with honors.
1980-1981	Education Abroad Program, Lima, Peru.
2002	"Section 106—National Historic Preservation Act: Federal Law at the Local Level," UCLA Extension Course #888.
2002	"Recognizing Historic Artifacts," workshop presented by Richard Norwood, Historical Archaeologist.
2002	"Wending Your Way through the Regulatory Maze," symposium presented by the Association of Environmental Professionals.
1992	"Southern California Ceramics Workshop," presented by Jerry Schaefer.
1992	"Historic Artifact Workshop," presented by Anne Duffield-Stoll.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1999-2002	Project Archaeologist/Field Director, CRM TECH, Riverside, California.
1996-1998	Project Director and Ethnographer, Statistical Research, Inc., Redlands, California.
1992-1998	Assistant Research Anthropologist, University of California, Riverside.
1992-1995	Project Director, Archaeological Research Unit, U.C. Riverside.
1993-1994	Adjunct Professor, Riverside Community College, Mt. San Jacinto College, U.C. Riverside, Chapman University, and San Bernardino Valley College.
1991-1992	Crew Chief, Archaeological Research Unit, U.C. Riverside.
1984-1998	Project Director, Field Director, Crew Chief, and Archaeological Technician for various southern California cultural resources management firms.

Research Interests

Cultural Resource Management, Southern Californian Archaeology, Settlement and Exchange Patterns, Specialization and Stratification, Culture Change, Native American Culture, Cultural Diversity.

Cultural Resources Management Reports

Principal investigator for, author or co-author of, and contributor to numerous cultural resources management study reports since 1986.

Memberships

Society for American Archaeology; Society for California Archaeology; Pacific Coast Archaeological Society; Coachella Valley Archaeological Society.

HISTORIAN/REPORT WRITER
Terri Jacquemain, M.A.

Education

2004	M.A., Public History and Historic Resource Management, University of California, Riverside.
2002	B.S., Anthropology, University of California, Riverside.

Professional Experience

2003-	Historian/Report Writer, CRM TECH, Riverside/Colton, California.
2002-2003	Teaching Assistant, Religious Studies Department, University of California, Riverside.
1997-1999	Reporter, *Inland Valley Daily Bulletin*, Ontario, California.
1991-1997	Reporter, *The Press-Enterprise*, Riverside, California.

Memberships

California Council for the Promotion of History.

PROJECT ARCHAEOLOGIST/REPORT WRITER
Deirdre Encarnación, M.A.

Education

2003	M.A., Anthropology, San Diego State University, California.
2000	B.A., Anthropology, minor in Biology, with honors; San Diego State University, California.
2001	Archaeological Field School, San Diego State University.
2000	Archaeological Field School, San Diego State University.

Professional Experience

2004-	Project Archaeologist/Report Writer, CRM TECH, Riverside/Colton, California.
2001-2003	Part-time Lecturer, San Diego State University, California.
2001	Research Assistant for Dr. Lynn Gamble, San Diego State University.
2001	Archaeological Collection Catalog, SDSU Foundation.

PROJECT ARCHAEOLOGIST/NATIVE AMERICAN LIAISON
Nina Gallardo, B.A.

Education

2004 B.A., Anthropology/Law and Society, University of California, Riverside.

Professional Experience

2004- Project Archaeologist, CRM TECH, Riverside/Colton, California.

Cultural Resources Management Reports

Co-author of and contributor to numerous cultural resources management reports since 2004.

PROJECT ARCHAEOLOGIST
Hunter C. O'Donnell, B.A.

Education

2016- M.A. Program, Applied Archaeology, California State University, San Bernardino.
2015 B.A. (*cum laude*), Anthropology, California State University, San Bernardino.
2012 A.A., Social and Behavioral Sciences, Mt. San Antonio College, Walnut, California.
2011 A.A., Natural Sciences and Mathematics, Mt. San Antonio College, Walnut, California.

2014 Archaeological Field School, Santa Rosa Mountains; supervised by Bill Sapp of the United States Forest Service and Daniel McCarthy of the San Manuel Band of Mission Indians.

Professional Experience

2017- Project Archaeologist/Paleontological Surveyor, CRM TECH, Colton, California.
2016-2018 Graduate Research Assistant, Applied Archaeology, California State University, San Bernardino.
2016-2017 Cultural Intern, Cultural Department, Pechanga Band of Luiseño Indians, Temecula, California.
2015 Archaeological Intern, U.S. Bureau of Land Management, Barstow, California.
2015 Peer Research Consultant: African Archaeology, California State University, San Bernardino.

PROJECT ARCHAEOLOGIST/FIELD DIRECTOR
Daniel Ballester, M.S., RPA (Registered Professional Archaeologist)

Education

2013	M.S., Geographic Information System (GIS), University of Redlands, California.
1998	B.A., Anthropology, California State University, San Bernardino.
1997	Archaeological Field School, University of Las Vegas and University of California, Riverside.
1994	University of Puerto Rico, Rio Piedras, Puerto Rico.
2021	An Introduction to Geoarchaeology: How Understanding Basic Soils, Sediments, and Landforms Can Make You a Better Archaeologist; Society for American Archaeology online seminar.
2007	Certificate in Geographic Information Systems (GIS), California State University, San Bernardino.
2002	Historic Archaeology Workshop; presented by Richard Norwood, Base Archaeologist, Edwards Air Force Base, at CRM TECH, Riverside, California.

Professional Experience

2002-	Field Director/GIS Specialist, CRM TECH, Riverside/Colton, California.
2011-2012	GIS Specialist for Caltrans District 8 Project, Garcia and Associates, San Anselmo, California.
2009-2010	Field Crew Chief, Garcia and Associates, San Anselmo, California.
2009-2010	Field Crew, ECorp, Redlands.
1999-2002	Project Archaeologist, CRM TECH, Riverside, California.
1998-1999	Field Crew, K.E.A. Environmental, San Diego, California.
1998	Field Crew, A.S.M. Affiliates, Encinitas, California.
1998	Field Crew, Archaeological Research Unit, University of California, Riverside.

Cultural Resources Management Reports

Field Director, co-author, and contributor to numerous cultural management reports since 2002.

APPENDIX 2

CORRESPONDENCE WITH NATIVE AMERICAN REPRESENTATIVES*

* Thirteen local Native American representatives were contacted during this study; a sample letter is included in the appendix.

SACRED LANDS FILE & NATIVE AMERICAN CONTACTS LIST REQUEST

NATIVE AMERICAN HERITAGE COMMISSION
915 Capitol Mall, RM 364
Sacramento, CA 95814
(916) 653-4082
(916) 657-5390 (fax)
nahc@pacbell.net

Project: Proposed Replenish Big Bear Program DEIR Project (CRM TECH No. 3969)

County: San Bernardino

USGS Quadrangle Name: Big Bear City and Moonridge, Calif.

Township 2 North **Range** 1 East SB **BM; Section(s)**: 10-15 and 26

Township 2 North **Range** 2 East SB **BM; Section(s)**: 7 and 18

Company/Firm/Agency: CRM TECH

Contact Person: Nina Gallardo

Street Address: 1016 E. Cooley Drive, Suite A/B

City: Colton, CA **Zip:** 92324

Phone: (909) 824-6400 **Fax:** (909) 824-6405

Email: ngallardo@crmtech.us

Project Description: The primary component of the project is the installation of pipelines in three different areas totaling approximately 11.2 linear miles, the development of approximately 105 acres for solar evaporation ponds at the existing Big Bear Area Regional Wastewater Agency's (BBARWA) Lucerne facility site, the development of an area near the Sand Canyon Channel for groundwater recharging, improvements to the BBARWA wastewater treatment plant, three proposed discharge areas along lake side of Division Drive and within the Shay Pond site, and the installation of one new pump/booster station, all within the Big Bear Valley area of San Bernardino County, California.

November 21, 2022

NATIVE AMERICAN HERITAGE COMMISSION

CHAIRPERSON
Laura Miranda
Luiseño

VICE CHAIRPERSON
Reginald Pagaling
Chumash

SECRETARY
Sara Dutschke
Miwok

COMMISSIONER
Isaac Bojorquez
Ohlone-Costanoan

COMMISSIONER
Buffy McQuillen
Yokayo Pomo, Yuki, Nomlaki

COMMISSIONER
Wayne Nelson
Luiseño

COMMISSIONER
Stanley Rodriguez
Kumeyaay

COMMISSIONER
[Vacant]

COMMISSIONER
[**Vacant**]

EXECUTIVE SECRETARY
Raymond C. Hitchcock
Miwok/Nisenan

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

December 16, 2022

Nina Gallardo
CRM TECH

Via Email to: ngallardo@crmtech.us

Re: Proposed Replenish Big Bear Program DEIR Project (CRM TECH No. 3969), San Bernardino County

Dear Ms. Gallardo:

A record search of the Native American Heritage Commission (NAHC) Sacred Lands File (SLF) was completed for the information submitted for the above referenced project. The results were positive. Please contact the San Manuel Band of Mission Indians Tribal and Morongo Band of Mission Indians Council on the attached list for information. Please note that tribes do not always record their sacred sites in the SLF, nor are they required to do so. A SLF search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with a project's geographic area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites, such as the appropriate regional California Historical Research Information System (CHRIS) archaeological Information Center for the presence of recorded archaeological sites.

Attached is a list of Native American tribes who may also have knowledge of cultural resources in the project area. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. Please contact all of those listed; if they cannot supply information, they may recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call or email to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from tribes, please notify the NAHC. With your assistance, we can assure that our lists contain current information.

If you have any questions or need additional information, please contact me at my email address: Cameron.vela@nahc.ca.gov.

Sincerely,

Cameron Vela

Cameron Vela
Cultural Resources Analyst

Attachment

Native American Heritage Commission
Native American Contact List
San Bernardino County
12/16/2022

Agua Caliente Band of Cahuilla Indians
Reid Milanovich, Chairperson
5401 Dinah Shore Drive — Cahuilla
Palm Springs, CA, 92264
Phone: (760) 699 - 6800
Fax: (760) 699-6919
laviles@aguacaliente.net

Agua Caliente Band of Cahuilla Indians
Patricia Garcia-Plotkin, Director
5401 Dinah Shore Drive — Cahuilla
Palm Springs, CA, 92264
Phone: (760) 699 - 6907
Fax: (760) 699-6924
ACBCI-THPO@aguacaliente.net

Augustine Band of Cahuilla Mission Indians
Amanda Vance, Chairperson
84-001 Avenue 54 — Cahuilla
Coachella, CA, 92236
Phone: (760) 398 - 4722
Fax: (760) 369-7161
hhaines@augustinetribe.com

Cabazon Band of Mission Indians
Doug Welmas, Chairperson
84-245 Indio Springs Parkway — Cahuilla
Indio, CA, 92203
Phone: (760) 342 - 2593
Fax: (760) 347-7880
jstapp@cabazonindians-nsn.gov

Cahuilla Band of Indians
Daniel Salgado, Chairperson
52701 U.S. Highway 371 — Cahuilla
Anza, CA, 92539
Phone: (951) 763 - 5549
Fax: (951) 763-2808
Chairman@cahuilla.net

Los Coyotes Band of Cahuilla and Cupeño Indians
Ray Chapparosa, Chairperson
P.O. Box 189 — Cahuilla
Warner Springs, CA, 92086-0189
Phone: (760) 782 - 0711
Fax: (760) 782-0712

Morongo Band of Mission Indians
Ann Brierty, THPO
12700 Pumarra Road — Cahuilla, Serrano
Banning, CA, 92220
Phone: (951) 755 - 5259
Fax: (951) 572-6004
abrierty@morongo-nsn.gov

Morongo Band of Mission Indians
Robert Martin, Chairperson
12700 Pumarra Road — Cahuilla, Serrano
Banning, CA, 92220
Phone: (951) 755 - 5110
Fax: (951) 755-5177
abrierty@morongo-nsn.gov

Quechan Tribe of the Fort Yuma Reservation
Jill McCormick, Historic Preservation Officer
P.O. Box 1899 — Quechan
Yuma, AZ, 85366
Phone: (760) 572 - 2423
historicpreservation@quechantribe.com

Quechan Tribe of the Fort Yuma Reservation
Manfred Scott, Acting Chairman
Kw'ts'an Cultural Committee
P.O. Box 1899 — Quechan
Yuma, AZ, 85366
Phone: (928) 750 - 2516
scottmanfred@yahoo.com

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Proposed Replenish Big Bear Program DEIR Project (CRM TECH No. 3969), San Bernardino County.

Native American Heritage Commission
Native American Contact List
San Bernardino County
12/16/2022

Ramona Band of Cahuilla
Joseph Hamilton, Chairperson
P.O. Box 391670 — Cahuilla
Anza, CA, 92539
Phone: (951) 763 - 4105
Fax: (951) 763-4325
admin@ramona-nsn.gov

Ramona Band of Cahuilla
John Gomez, Environmental Coordinator
P. O. Box 391670 — Cahuilla
Anza, CA, 92539
Phone: (951) 763 - 4105
Fax: (951) 763-4325
jgomez@ramona-nsn.gov

San Manuel Band of Mission Indians
Jessica Mauck, Director of Cultural Resources
26569 Community Center Drive — Serrano
Highland, CA, 92346
Phone: (909) 864 - 8933
Jessica.Mauck@sanmanuel-nsn.gov

Santa Rosa Band of Cahuilla Indians
Lovina Redner, Tribal Chair
P.O. Box 391820 — Cahuilla
Anza, CA, 92539
Phone: (951) 659 - 2700
Fax: (951) 659-2228
lsaul@santarosa-nsn.gov

Serrano Nation of Mission Indians
Mark Cochrane, Co-Chairperson
P. O. Box 343 — Serrano
Patton, CA, 92369
Phone: (909) 528 - 9032
serranonation1@gmail.com

Serrano Nation of Mission Indians
Wayne Walker, Co-Chairperson
P. O. Box 343 — Serrano
Patton, CA, 92369
Phone: (253) 370 - 0167
serranonation1@gmail.com

Soboba Band of Luiseno Indians
Joseph Ontiveros, Cultural Resource Department
P.O. BOX 487 — Cahuilla
San Jacinto, CA, 92581 — Luiseno
Phone: (951) 663 - 5279
Fax: (951) 654-4198
jontiveros@soboba-nsn.gov

Soboba Band of Luiseno Indians
Isaiah Vivanco, Chairperson
P. O. Box 487 — Cahuilla
San Jacinto, CA, 92581 — Luiseno
Phone: (951) 654 - 5544
Fax: (951) 654-4198
ivivanco@soboba-nsn.gov

Torres-Martinez Desert Cahuilla Indians
Cultural Committee,
P.O. Box 1160 — Cahuilla
Thermal, CA, 92274
Phone: (760) 397 - 0300
Fax: (760) 397-8146
Cultural-Committee@torresmartinez-nsn.gov

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed Proposed Replenish Big Bear Program DEIR Project (CRM TECH No. 3969), San Bernardino County.

December 30, 2022

RE: Proposed Replenish Big Bear Program DEIR Project
Approximately 105 acres and 11.2 Linear Miles of Pipeline Alignment
In the Big Bear Valley, San Bernardino County, California
CRM TECH Contract #3969

Dear Tribal Representative:

I am writing to bring your attention to an ongoing CEQA-Plus study for the proposed project referenced above, which entails a series of improvements at various locations within the Big Bear Area Regional Wastewater Agency's (BBARWA) service district. The improvements include installation of approximately 11.2 linear miles pipelines along three alignments, development of solar evaporation ponds and other wastewater upgrades on approximately 105 acres within the BBARWA Lucerne facility, groundwater recharging development near the Sand Canyon Channel, creation of three discharge areas along the lake side of Division Drive and within the Shay Pond site, and the installation of a new pump/booster station. The accompanying maps, based on the USGS Big Bear City, Big Bear Lake, Fawnskin, and Moonridge, Calif., 7.5' quadrangles, depict the undertaking's Area of Potential Effects (APE) within Sections 10-15 and 26, T2N R1E, and Sections 7 and 18, T2N R2E, SBBM.

The Native American Heritage Commission reports in a letter dated December 16, 2022, that the results of the Sacred Lands File search were positive and recommends that the Morongo Band of Mission Indians and the Yuhaaviatam of San Manuel Nation (formerly known as San Manuel Band of Mission Indians), as well as local tribes, be contacted for further information (see attached). Therefore, as part of the cultural resources study for this project, I am writing to request your input on potential Native American cultural resources in or near the APE. Any information or concerns may be forwarded to CRM TECH by telephone, e-mail, facsimile, or standard mail. Requests for documentation or information we cannot provide will be forwarded to our client and/or the lead agencies, namely the Big Bear Area Regional Wastewater Agency, but the State Water Resource Control Board will be overseeing the project as well.

We would also like to clarify that, as the cultural resources consultant for the project, CRM TECH is not involved in the AB 52-compliance process or in government-to-government consultations. The purpose of this letter is to seek any information that you may have to help us determine if there are cultural resources in or near the project area that we should be aware of and to help us assess the sensitivity of the APE. Thank you for your time and effort in addressing this important matter.

Respectfully,

Nina Gallardo
CRM TECH Project Archaeologist/Native American liaison
Email: ngallardo@crmtech.us

Encl.: NAHC response letter and project location maps

From: Jill McCormick <historicpreservation@quechantribe.com>
Sent: Friday, December 30, 2022 1:57 PM
To: ngallardo@crmtech.us
Subject: Re: [EXTERNAL]:NA Scoping Letter for the Proposed Replenish Big Bear Program DEIR Project in the Big Bear Valley, San Bernardino County (CRM TECH #3969)

This email is to inform you that we do not wish to comment on this project. We defer to the more local Tribes and support their determinations on this matter.

H. Jill McCormick M. A.
Historic Preservation Officer
Ft. Yuma Quechan Tribe
350 Picacho Road
Winterhaven, CA 92283
Office: 760-572-2423
Cell: 928-261-0254

From: Vanessa Minott <vminott@santarosa-nsn.gov>
Sent: Tuesday, January 3, 2023 7:05 AM
To: ngallardo@crmtech.us
Subject: RE: NA Scoping Letter for the Proposed Replenish Big Bear Program DEIR Project in the Big Bear Valley, San Bernardino County (CRM TECH #3969)

Acha'i Tamit,

Santa Rosa does not have any comments at this time.

Respectfully,

Vanessa Minott

Tribal Administrator
Santa Rosa Band of Cahuilla Indians
W - 951-659-2700 ext. 102
C – 760-668-0460
F – 951-659-2228
65199 State Hwy. 74
Mountain Center, CA 92561
P.O. Box 391820
Anza, CA 92539

From: THPO Consulting <ACBCI-THPO@aguacaliente.net>
Sent: Tuesday, January 3, 2023 11:17 AM
To: 'ngallardo@crmtech.us'
Subject: RE: NA Scoping Letter for the Proposed Replenish Big Bear Program DEIR Project in the Big Bear Valley, San Bernardino County (CRM TECH #3969)

Greetings,

A records check of the Tribal Historic preservation office's cultural registry revealed that this project is not located within the Tribe's Traditional Use Area. Therefore, we defer to the other tribes in the area. This letter shall conclude our consultation efforts.
Thank you,

Lacy Padilla

THPO Operations Manager
Agua Caliente Band of Cahuilla Indians
5401 Dinah Shore Drive Palm Springs, CA 92264
D: 760-699-6956 I C: 760-333-5222

AUGUSTINE BAND OF CAHUILLA INDIANS
PO Box 846 84-481 Avenue 54 Coachella CA 92236
Telephone: (760) 398-4722
Fax (760) 369-7161
Tribal Chairperson: Amanda Vance
Tribal Vice-Chairperson: Victoria Martin
Tribal Secretary: Geramy Martin

Date: January 13, 2023

RE: Proposed Replenish Big Bear Program DEIR Project Approximately 105 acres and 11.2 Linear Miles of Pipeline Alignment In the Big Bear Valley, San Bernardino County, California CRM TECH Contract #3969

Dear: Nina Gallardo
Project Archaeologist/Native American liaison

Thank you for the opportunity to offer input concerning the development of the above-identified project. We appreciate your sensitivity to the cultural resources that may be impacted by your project and the importance of these cultural resources to the Native American peoples that have occupied the land surrounding the area of your project for thousands of years. Unfortunately, increased development and lack of sensitivity to cultural resources have resulted in many significant cultural resources being destroyed or substantially altered and impacted. Your invitation to consult on this project is greatly appreciated.

At this time, we are unaware of specific cultural resources that may be affected by the proposed project, however, in the event, you should discover any cultural resources during the development of this project please contact our office immediately for further evaluation.

Very truly yours,

Victoria Martin

Victoria Martin, Tribal Vice-Chairperson
Augustine Band of Cahuilla Indians

From: Tribal Historic Preservation Office <thpo@morongo-nsn.gov>
Sent: Wednesday, January 18, 2023 11:26 AM
To: ngallardo@crmtech.us
Cc: Laura Chatterton; Ann Brierty
Subject: RE: NA Scoping Letter for the Proposed Replenish Big Bear Program DEIR Project in the Big Bear Valley, San Bernardino County (CRM TECH #3969)

Dear Ms. Gallardo,

The Morongo Band of Mission Indians (Tribe/MBMI) Tribal Historic Preservation Office is in receipt of your letter regarding the above referenced project. Thank you for reaching out to Tribe at an early stage. The proposed Project (Project) is located within the ancestral territory and traditional use area of the Cahuilla and Serrano people of the Morongo Band of Mission Indians.

Tribal cultural resources are non-renewable resources and therefore of high importance to the Morongo Tribe and tribal participation (a.k.a. tribal monitors) is recommended during the future construction phases(s) of the Project. We look forward to working with the Lead Agency of and your company to protect these irreplaceable resources out of respect for ancestors of the Morongo people who left them there, and for the people of today and for generations to come.

Projects within this area are highly sensitive for cultural resources regardless of the presence or absence of remaining surface artifacts and features. At the appropriate stage of the Project, our office will request government-to-government consultation under Assembly Bill (AB) 52 (California Public Resources Code §21080.3.1) with the Lead Agency. At that time, the following will be requested from the Lead Agency to ensure meaningful consultation:

* A records search conducted at the appropriate California Historical Resources Information System (CHRIS) center with at least a 1.0-mile search radius from the project boundary. If this work has already been done, please furnish copies of the cultural resource documentation (reports and site records) generated through this search so that we can compare and review with our records to begin productive consultation
* Tribal participation (a.k.a. tribal monitors) during the pedestrian survey and testing, if this fieldwork has not already taken place. In the event that archaeological crews have completed this work, our office requests a copy of the current Phase I study or other cultural assessments (including the cultural resources inventory)
* Shape files of the Projects area of effect (APE)
* Geotechnical Report
* Currently proposed Project design and Mass

This letter neither initiates nor concludes consultation. Upon the invitation for consultation from the lead agency and receipt of the requested documents, the MBMI THPO may further provide recommendations and/or mitigation measures.

Please keep in mind that MBMI requests that copies of all cultural data such as reports and confidential data (DPRs) and confidential portions of reports be sent to Tribal THPO. The lead contact for this Project is Bernadette Ann Brierty, Tribal Historic Preservation Officer (THPO).

Cultural Resource Specialist Laura Chatterton will be assisting the Tribe in the review of this project. Should you have any questions, please do not hesitate to contact us at lchatterton@morongo-nsn.gov, thpo@morongo-nsn.gov, ABrierty@morongo-nsn.gov, or (951) 663-2842. The Tribe looks forward to meaningful government-to-government consultation with the Lead Agency.

Respectfully,

Laura Chatterton
Cultural Resource Specialist
Tribal Historic Preservation Office
Morongo Band of Mission Indians
12700 Pumarra Road
Banning, CA 92220
O: (951) 755.5256
C: (951) 663.7570

TELEPHONE LOG

Name	Tribe/Affiliation	Telephone/Email	Note
Patricia Garcia-Plotkin, Tribal Historic Preservation Officer	Agua Caliente Band of Cahuilla Indians	None	Lacy Padilla, THPO Operations Manager, responded on behalf of the tribe by e-mail on January 3, 2023 (copy attached).
Amanda Vance, Chairperson	Augustine Band of Cahuilla Mission Indians	12:15 pm, January 13, 2023	Victoria Martin, Vice-Chairperson, responded on behalf of the tribe in a letter dated January 13, 2023 (copy attached).
Michael Mirelez, Director of Cultural Affairs	Cabazon Band of Mission Indians	12:21 pm, January 13, 2023; 1:42 pm, February 17, 2023	Left messages; no response to date
Bobby Ray Esparza, Cultural Coordinator	Cahuilla Band of Indians	12:27 pm, January 13, 2023; 1:44 pm, February 17, 2023	Left messages; no response to date
Ray Chapparosa, Chairperson	Los Coyotes Band of Cahuilla and Cupeno Indians	12:30 pm, January 13, 2023	Mario Castellano, Administrative Assistant at the Environmental Department, stated that the tribe had no comments regarding this project.
Ann Brierty, Tribal Historic Preservation Officer	Morongo Band of Mission Indians	12:39 pm, January 13, 2023	Laura Chatterton, Cultural Resource Specialist, responded on behalf of the tribe by e-mail on January 18, 2023 (copy attached).
Jill McCormick, Tribal Historic Preservation Officer	Quechan Tribe of the Fort Yuma Reservation	None	Ms. McCormick responded by e-mail on December 30, 2022 (copy attached).
John Gomez, Jr., Cultural Resource Coordinator	Ramona Band of Cahuilla Indians	12:45 pm, January 13, 2023; 1:49 pm, February 17, 2023	Left messages; no response to date
Jessica Mauck, Director of Cultural Resources	Yuhaaviatam of San Manuel Nation (formerly known as the San Manuel Band of Mission Indians)	1:01pm, January 13, 2023; 1:52 pm, February 17, 2023	Ryan Nordness, Cultural Resource Analyst, stated that the tribe was reviewing the letter and communicating with BBARWA about the project. He indicated that the tribe would respond in writing with any comments after reviewing the information. No further response to date.
Vanessa Minott, Tribal Administrator	Santa Rosa Band of Cahuilla Indians	None	Ms. Minott responded by e-mail on January 3, 2022 (copy attached)
Mark Cochrane, Co-Chairperson	Serrano Nation of Mission Indians	1:08 pm, January 13, 2023; 1:53 pm, February 17, 2023	Voicemail not available.

Joseph Ontiveros, Tribal Historic Preservation Officer	Soboba Band of Luiseño Indians	1:09 pm, January 13, 2023	Jessica Valdez, Cultural Resource Specialist, stated that the tribe would defer to the Yuhaaviatam of San Manuel Nation for this project.
Alesia Reed, Cultural Committee	Torres Martinez Desert Cahuilla Indians	1:12 pm, January 13, 2023; 1:56 pm, February 17, 2023	Left messages; no response to date

APPENDIX 3

LOCATIONS OF PREVIOUSLY IDENTIFIED CULTURAL RESOURCES IN OR NEAR THE APE

(Confidential)

APPENDIX 4

CULTURAL RESOURCES IDENTIFIED IN THE APE

Update 12/13

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # P36-002060
HRI #
Trinomial CA-SBR-2060; Update
NRHP Status Code

Other Listings
Review Code **Reviewer** **Date**

***Resource Name or #:** (Assigned by recorder)

P1. **Other Identifier:**

***P2.** **Location:** ***a. County** San Bernardino, CA ☒Not for Publication ☐ Unrestricted
***b. USGS 7.5' Quad** Big Bear City, CA **Date** 1996
T 2 N; **R** 2 E; SE ¼ **of** SW ¼ **of** **Sec** 7; S.B.B.M.
c. Address: None **City** **Zip**
d. UTM **Zone** 11, 517080 **mE/** 3791420 **mN**
e. Other Locational Data (e.g., parcel #, legal description, directions to resource, additional UTMs, etc., when appropriate): The site was observed on an open corner lot northwest of the junction of Shay Rd. and Palomino Rd.

***P3a. Description** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries): The resource has been severely impacted by residential development and new construction has commenced on the only remaining open lot where the site was observed on the surface. The site consists of a lithic scatter, including one obsidian utilized flake, one jasper utilized flake, and one Franciscan chert flake.

Previous site records on file at San Bernardino County Archaeological Information Center: San Bernardino County Museum and Archaeological Site Survey Record (Simpson 9/7/69); State of California Department of Parks and Recreation Archaeological Site Record (J. K. Sander 8/2/96); State of California Department of Parks and Recreation Archaeological Site Record (B. Love, W. Dewitt 3/90); State of California Department of Parks and Recreation Archaeological Site Record (J. A. McKenna 7/25/89).

***P3b. Resource Attributes** (List all attributes and codes): AP 2: Lithic Scatter

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☒ Site ☐ District ☐ Element of District ☐ Other:

P5. Photograph or Drawing: (Photograph required for buildings, structures, and objects.) Not applicable.

***P6. Date Constructed/Age and Source:** ☒ Prehistoric ☐ Historic ☐ Both

***P7. Owner and Address:** Unknown.

***P8. Recorded by** (Name, affiliation, address): G. Zavala, B. Sheets, K. Maeyama, Applied EarthWorks, Inc., 3292 E. Florida Ave., Suite A, Hemet, CA 92544.

P9. Date Recorded: 18 November 2004.

***P10. Type of Survey:** ☐ Intensive ☐ Reconnaissance ☒Other
Describe: Intuitive.

***P11. Report Citation** (Provide full citation or enter "none"): None

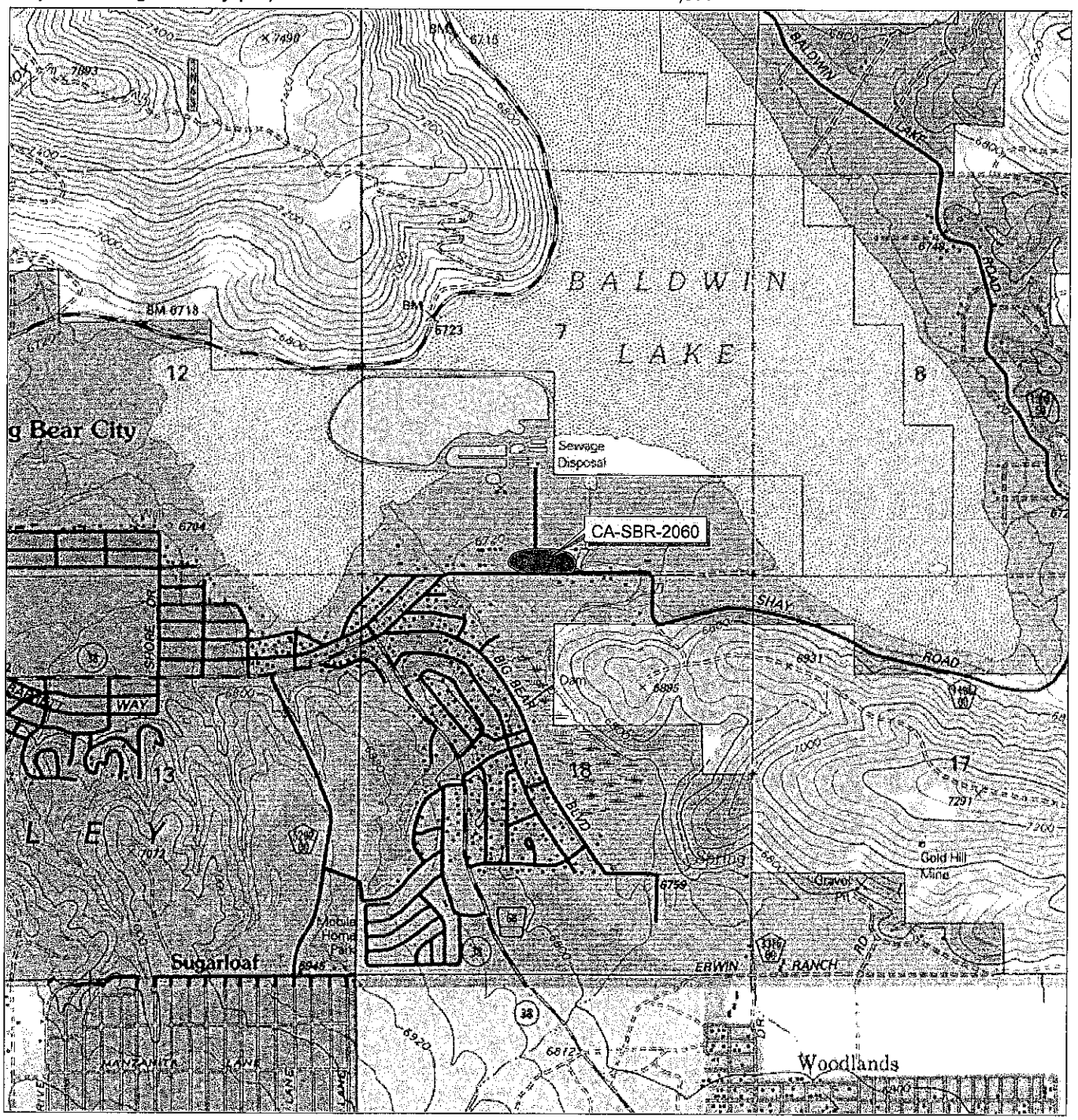
Attachments: ☐ None ☒ Location Map ☐ Sketch Map ☐ Continuation Sheet ☐ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record Other:

The State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

Primary #: P36-002060
HRI #:
Trinomial: CA-SBR-2060; Update

LOCATION MAP SHEET

Temporary Number/Resource Name:
Map Name: Big Bear City (CA) USGS 7.5' Quad Scale: 1:24,000 Date: 2004



0.5 0 0.5 1 Miles

2000 0 2000 4000 Feet

500 0 500 1000 Meters

True North

DPR 523J (1/95)

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHAEOLOGICAL SITE RECORD (Part 1)

Primary # R36-002060
Trinomial CA-SBR-2060

Page 1 of 2

A1. Resource Identifier: CA-SBR-2060

A2. Resource Attributes (List attributes and codes.):

A3. Dimensions: **a. Length** m × **b. Width** m (m²) Uknown

Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☐ Other:

Method of Determination (Check any that apply.): ☒ Artifacts ☐ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☐ Other (Explain):

Reliability of Determination: ☐ High ☐ Low Explain: n/a..

- Limitations (Check any that apply): ☐ Restricted access ☐ Paved/built over ☐ Disturbances ☒ Site limits incompletely defined ☐ Other (Explain):

A4. Depth: At least 110 cm ☐ None ☐ Unknown Method of Determination: Test unit

A5. Human Remains: ☐ Present ☐ Absent ☐ Possible ☒ Unknown (Explain): None observed

A6. Features (Number, briefly describe, indicate size, list associated cultural constituents, and show location of each feature on sketch map.:

None observed

A7. Cultural Constituents (Describe and quantify artifacts, ecofacts, cultural residues, etc., not associated with features.):

Monitoring of trench back dirt and sidewalls revealed 14 flaked quartzite items. Three flakes and 11 tested cores.

A8. Were Specimens Collected? ☒ No ☐ Yes (If yes, attach Artifact Record or catalog and identify where specimens are curated.)

A9. Site Condition: ☐ Good ☒ Fair ☐ Poor (Describe disturbances.): Several structures exist on the site.

USGS Big Bear City 7.5'

8/2/96
SANDAS

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHAEOLOGICAL SITE RECORD (Part 2)

Resource Identifier:
Primary # P36-002060
Trinomial CA-SBR-2060

A10. Nearest Water (Type, distance, and direction.):

A11. Elevation: 6720' above mean sea level (AMSL).

A12. Environmental Setting (Describe vegetation, fauna, soils, geology, landform, slope, aspect, exposure, etc., as appropriate.): Pine, sage. Exposure is open. Loamy soil overlying clay. slope is about one degree.

A13. Historical Information (Note sources and provide full citations in Field A16 below.):

A14. Age: ☒ **Prehistoric** ☐ Pre-Colonial (1500-1769) ☐ Spanish/Mexican (1769-1848) ☐ Early American (1848-1880) ☐ Turn of century (1880-1914) ☐ Early 20th century (1914-1945) ☐ Post WWII (1945+) ☐ Undetermined

Factual or Estimated Dates of Occupation (Explain): Undetermined

A15. Remarks and Interpretations (Discuss scientific, interpretive, ethnic, and other values of site, if known.):
Monitoring of utilities trench excavated at 1521 Shay Rd. revealed 14 flaked quartzite artifacts. This extends the boundry of SBR-2060 onto the north end of the McPherson property.

A16. References (Give full citations including the names and addresses of any persons interviewed, if possible.):

A17. Photographs (List subjects, direction of view, and accession numbers or attach a Photograph Record.):

Original Media/Negatives Kept at: Statistical Research, Inc. 535 West State Street Suite H, Redlands, CA

A18. Form Prepared by: Jay K. Sander Date: August 2, 1996

Affiliation and Address: Statistical Research, Inc. 535 West State Street Suite H, Redlands, CA.

P36-002060
SBK-2060

Shay Rd. Project

PHOTOGRAPHIC RECORD FORM

Roll Number: 1 Film Type: COLOR

Exposure	Date	View	Subject	Initials
1	7.31.96	W	SITE DURING MECH. STRIPING	JKS
2	"	"	"	"
3	"	S	"	"
4	"	S	"	"
5	"	S	UTILITIES TRENCH	"
6	"	S	"	"
7	"	W	NORTHERN FOOTING CUT	"
8	"	W	"	"
9	"	E	SOUTH FOOTING	"
10	"	E	"	"
11	"	W	W. WALL OF UTILITIES TRENCH	"
12	"	W	"	"
13	"	N/E	CONSTRUCTION GUYS	"
14				
15				
16				
17				
18				
19				
20				

P36-002060

State of California—The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHEOLOGICAL SITE RECORD
Page 1 of 4

PERMANENT TRINOMIAL: SBR-2060
OTHER DESIGNATION:

SUPPLEMENT (x)

1. **County:** San Bernardino ()

2. **USGS Quad:** Big Bear City (7.5') 1971 (15') **Photorevised:** 1979 ()

Measurements in items 3,4, and 5 are measurements to surveyed property (see item 32), not to site boundaries. Site boundaries are unknown. For a discussion of site boundaries, see Love, 1990 (item 31). ()

3. **UTM Coordinates: Zone** 11 517160 **Easting** 3791370 **Northing**

4. **Township:** 2N **Range:** 2E; SE 1/4 of SE 1/4 of SW 1/4 of section 7 **Base Mer:** SBM ()

5. **Map Coordinates:** 557 mmS 236 mmE **(from NW corner of map)** 6. **Elevation:** 6720 ft ()

7. **Location:** NE corner of Shay Road and Palomino Dr., Big Bear City, south shore of Baldwin Lake. ()

8. **Prehistoric** (X) **Historic** ( ) **Protohistoric** ( ) 9. **Site Description:** A sparse lithic scatter on the surface with subsurface artifacts at least 110 cm deep. Lithic debitage, burned animal bone, and milling stones suggest an area of resource procurement. ()

10. **Area:** Unknown m(L) X Unknown m(W) NA m^2 **Method of Determination:** NA ()

11. **Depth:** At least 110 cm **Method of Determination:** Test Unit ()

12. **Features** None observed ()

13. **Artifacts:** Lithic debitage, points, utilized flakes, manos, possible metate fragments, and bone needle. ()

14. **Non-Artifactual Constituents and Faunal Remains:** Angular rocks, possibly fire affected. ()

15. **Date Recorded:** March 1990 16. **Recorded by:** Bruce Love & William De Witt ()

17. **Affiliation and Address:** Pyramid Archaeology, 37462 3rd Street East, Palmdale, CA 93550 ()

P36-002060

State of California—The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHEOLOGICAL SITE RECORD
Page 2 of 4

PERMANENT TRINOMIAL: **SBR-2060** MO. Yr.

OTHER DESIGNATIONS:

18. Human Remains: None observed. ( )

19. Site Disturbances: Relatively undisturbed, house and barns are planned for property. ( )

20. Nearest Water (type, distance, and direction: Baldwin Lake .3 miles north. Streams 1/4 miles east and west of property. Marshy area 1/4 mile south. ( )

21. Vegetation Community (site vicinity): Montane Forest **Plant list** ( )

22. Vegetation (on site): Montane Forest ( )

23. Site Soil: Silt and sand ( )

24. Surrounding Soil: Silt and sand ( )

25. Geology: ( )

26. Landform: delta, fan ( )

27. Slope: 0-1 % ( ) **28. Exposure:** Open ( )

29. Landowner(s) (and/or tenants) and Address: Dand, P.O. Box 2516 Big Bear City, CA 92314 ( )

30. Remarks: Surface collection, one test unit, and backhoe trench put in as part of testing program. Results are summarized in Love 1990 (see item 31) ( )

31. References: ( )

Love, 1990. Cultural Resources Evaluation for Assessor's Parcel No. 314-571-59, Big Bear City, San Bernardino County. Ms. on file at Archaeological Information Center, San Bernardino County Museum.

Ornduff, 1974. *Introduction to California Plant Life.* U.C. Press

32. Same as item 31. ( )

33. Type of Investigation: Phase I field survey and Phase II test. ( )

34. Site Accession Number: SBr-2060 **Curated at:** San Bernardino County Museum ( )

35. Photos: 1/2 tones in report ( )

P86-002060

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

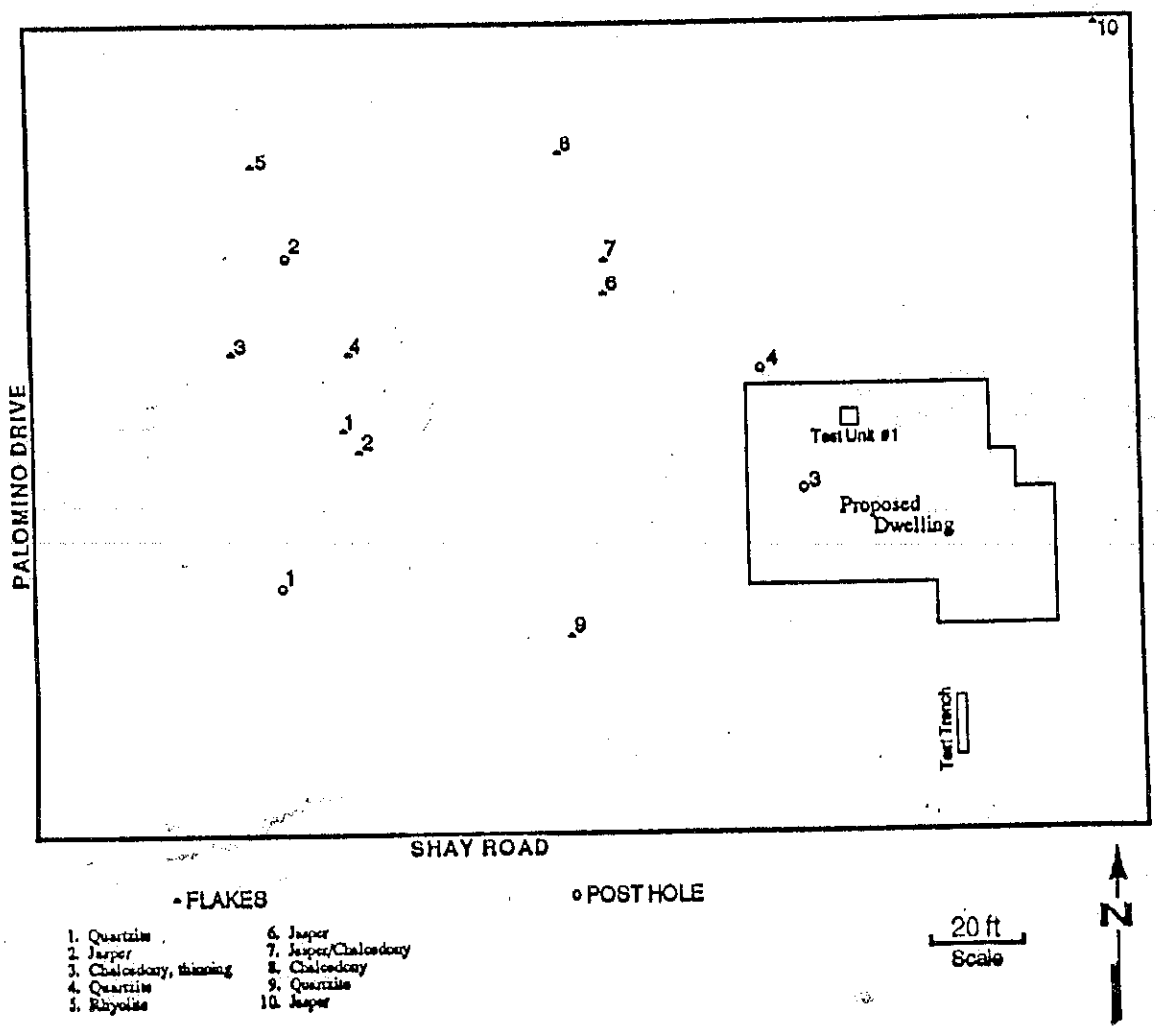
ARCHEOLOGICAL SITE MAP

Page 3 of 4.

Permanent Trinomial: SBR-2060 / ____ (mo. / yr.)

Temporary Number: ____

Agency Designation: ____



PROPERTY SURVEYED, SITE BOUNDARIES UNKNOWN

P86-002060

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

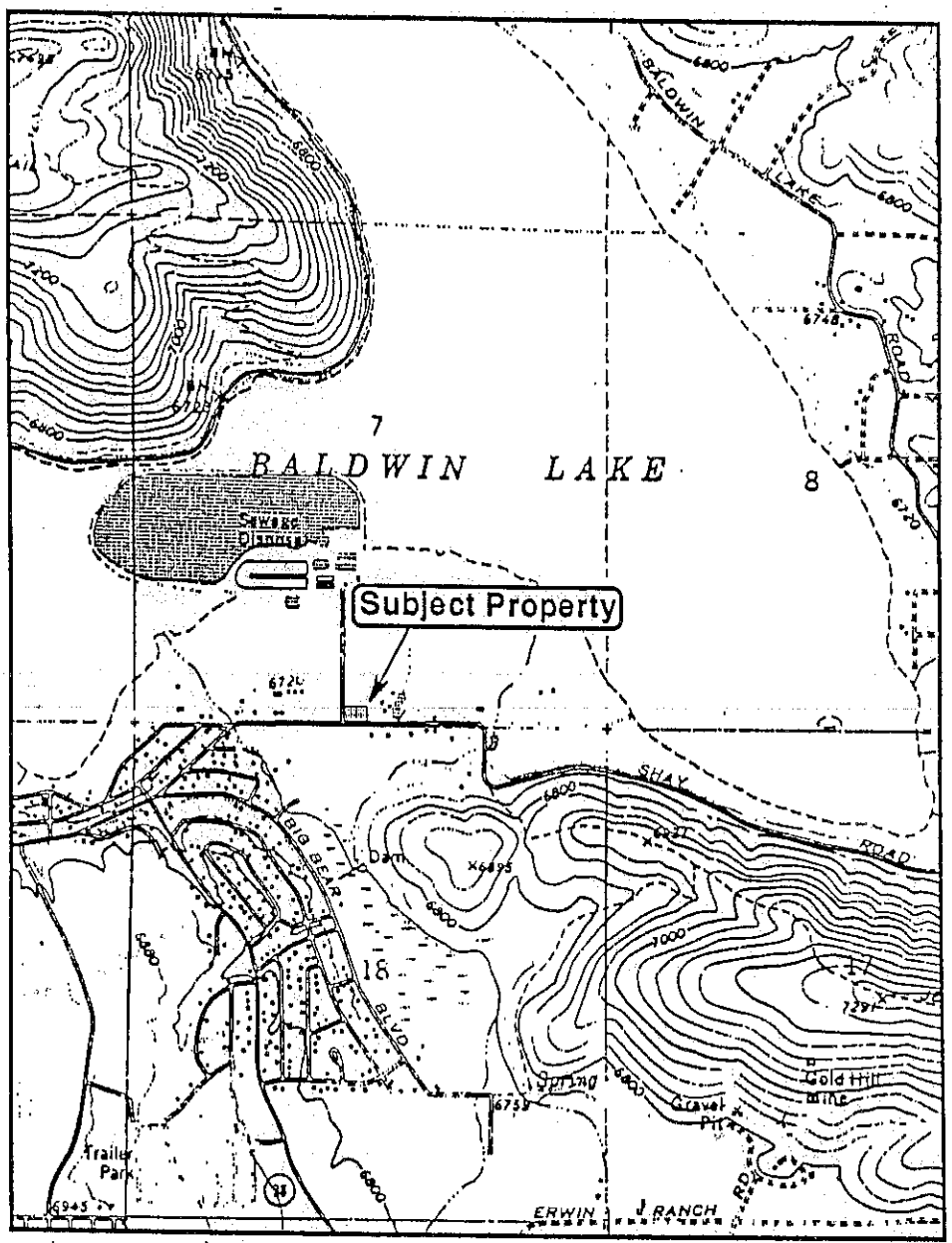
ARCHEOLOGICAL SITE LOCATION MAP

Page 4 of 4 .

Permanent Trinomial: SBR-2060 / mo. yr.

Temporary Number:

Agency Designation:



BIG BEAR CITY, CALIF.
SE/4 LUCERNE VALLEY 15' QUADRANGLE
N3415—W11545/7.5

1971
PHOTOREVISED 1979

CONTOUR INTERVAL 40 FEET

PROPERTY SURVEYED, SITE BOUNDARIES UNKNOWN

DPR 422G (Rev. 8/82)

(1314)

P86-002060

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Permanent Trinomial: CA-SBR-2060 Supplement XX

Temporary Number: SBCM-234 and/or 604

Page 1 of 34.

Agency Designation:

1. County: San Bernardino County

2. USGS Quad: Big Bear City (7.5') XXXXX (15') Photorevised 1979

3. UTM Coordinates: Zone 11 / multiple - see list below Easting / Northing ( )

4. Township 2N Range 2E ~~SE~~ S½ ¼ of SE ¼ of ~~SW~~ SE ¼ of ~~SE~~ SW ¼ of Section 7 Base (Mer.) SBM ( )

5. Map Coordinates: 505 mmS 235 mmN (from NW corner of map) 6. Elevation 6726'

7. Location: Scatter of artifacts noted in the area to the northwest of the intersection of Shay Road and Palomino Drive. Scatter is likely to continue to the east of Palomino Drive, in the undeveloped field, and into the property to the west (see McKenna 1989) ( )

8. Prehistoric XXXX Historic Protohistoric 9. Site Description: Lithic artifacts: small waste flakes, a few scrapers, miscellaneous primary flakes, at least one projectile point noted ont he surface. Area is highly overgrown and mush of the ground is obscured. Other artifacts are likely to be in the subsurface context (see Charles-Fincher 1980) ( )

10. Area: 100 m(length) x 100 m(width) 10,000 m². Method of Determination: pacing. It is likely that this scatter is more widely dispersed than indicated here. ( )

11. Depth: 50cm+ cm Method of Determination: from Charles-Fincher notes ( )

12. Features: not observed, but records of buried living surface at 30cm+ (reported by Charles-Fincher 1980). ( )

13. Artifacts: flakes, scrapers, primary flakes, one projectile point. Point has been tentatively identified as an Elko Eared Projectile Point (Warren et.al. 1984; Binning et.al. 1986). ( )

14. Non-Artifactual Constitutients: Natural growth of pine and sage brush cover property. Likely location for early lumbering industry. ( )

15. Date Recorded: July 25, 1989 16. Recorded By: Jeanette A. McKenna ( )

17. Affiliation and Address: McKenna et.al., Whittier, California (213)696-3852 ( )

DPR 422A (Rev. 8/82)

P36-008060

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD

Permanent Trinomial: CA-SBR-2060 / 7/89 (mo. / yr.)

Temporary Number: SBCM-234 and/or 604

Agency Designation:

18. Human Remains: none observed ( )

19. Site Integrity: some disturbances due to horseback riding, early (historic lumber industry, development of roads, and the 1978 UCLA excavations. Majority of the surface appears to be relatively intact. ( )

20. Nearest Water (type, distance and direction): Baldwin Lake (North) 1/2 mile. ( )

21. Largest Body of Water within 1 km (type, distance and direction): Baldwin Lake ( )

22. Vegetation Community (site vicinity): Woodland [Plant List ( )] ( )

23. Vegetation Community (on site): Woodland/Sage Brush [Plant List ( )] ( )

References for above: Munz 1974; Charles-Fincher 1980 ( )

24. Site Soil: loam ( ) 25. Surrounding Soil: loam ( )

26. Geology: loam/clay ( ) 27. Landform: alluvial fan ( )

28. Slope: less than 1 degree ( ) 29. Exposure: open ( )

30. Landowner(s) (and/or tenants) and Address: Unknown - portion of this site may extend to the property of Wayne Johnson (Orange, California), see McKenna (1989) ( )

31. Remarks: UTM's = A 516700E/3791450N B 517400E/3791450N C 517400E/3791370N D 516700E/3791370N ( )

32. References: See McKenna (1989) - An Intensive Archaeological Survey and Cultural Resources Investigation of the Johnson Property, Big Bear City, San Bernardino County, CA. Ms. on file, SBCM-AIC. ( )

33. Name of Project: Same as above ( )

34. Type of Investigation: Intensive archaeological survey (Phase I study) ( )

35. Site Accession Number: NA Curated At: NA ( )

36. Photos: On file, McKenna et.al. Taken By: Jeanette A. McKenna ( )

37. Photo Accession Number: NA On File At: Whittier, California 90601 ( )

P36-002060

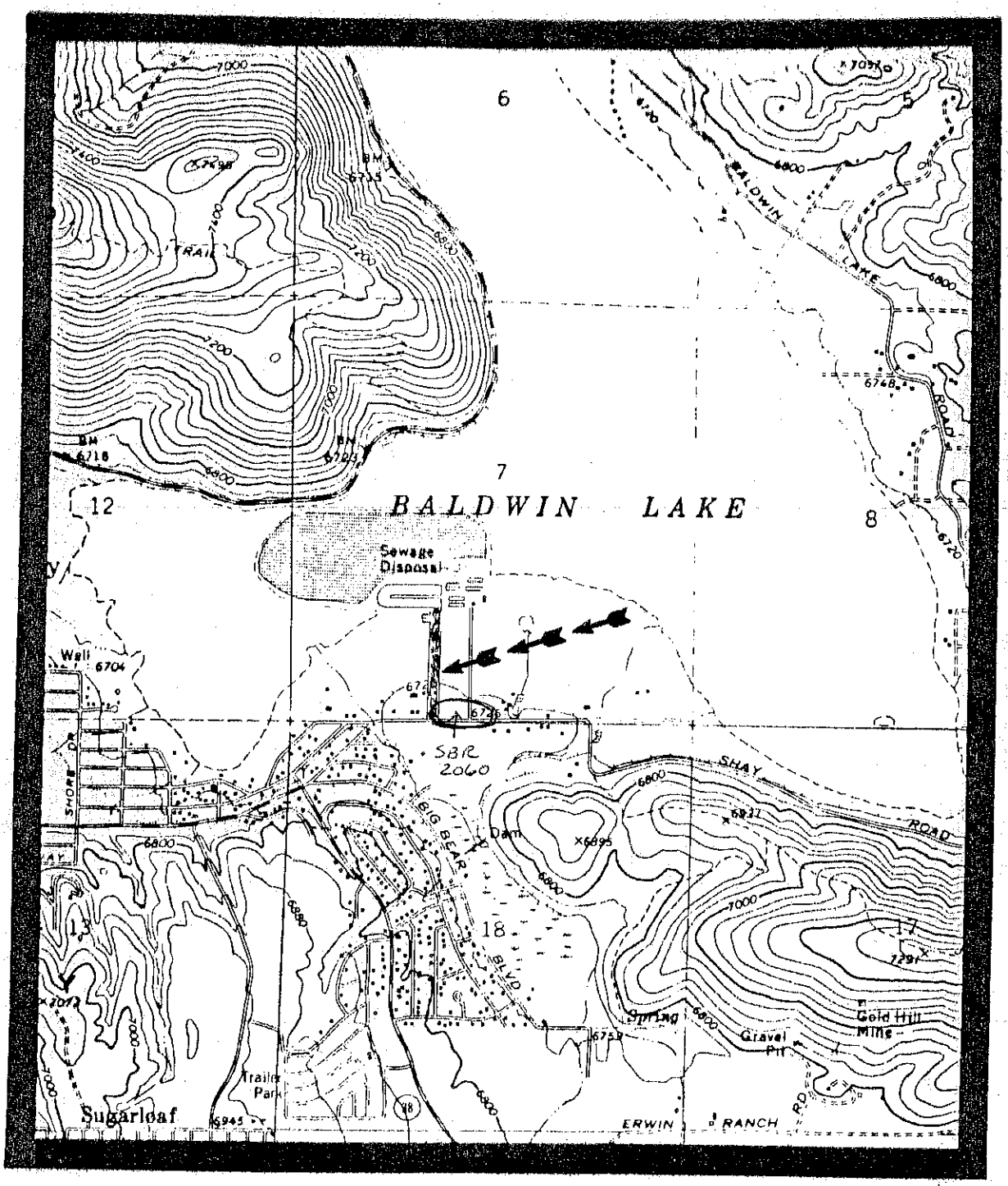
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE MAP

Permanent Trinomial: CA-SBR-2060

7/89
Mo. Yr.

Other Designations:



P56-002060

State of California — The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHEOLOGICAL SITE RECORD
Continuation Sheet

Page ____ of ____ .

Permanent Trinomial: SBR-2060 / ____
mo. yr.

Temporary Number: ____

Agency Designation: ____

Item No.	Continuation
	UTM A 516700 E 3791450 N B 517400 E 3791450 N C 517400 E 3791370 N D 516700 E 3791370 N

DPR 422C (Rev. 8/82)

P36-002060 SBr 2060 ~~also 2064~~

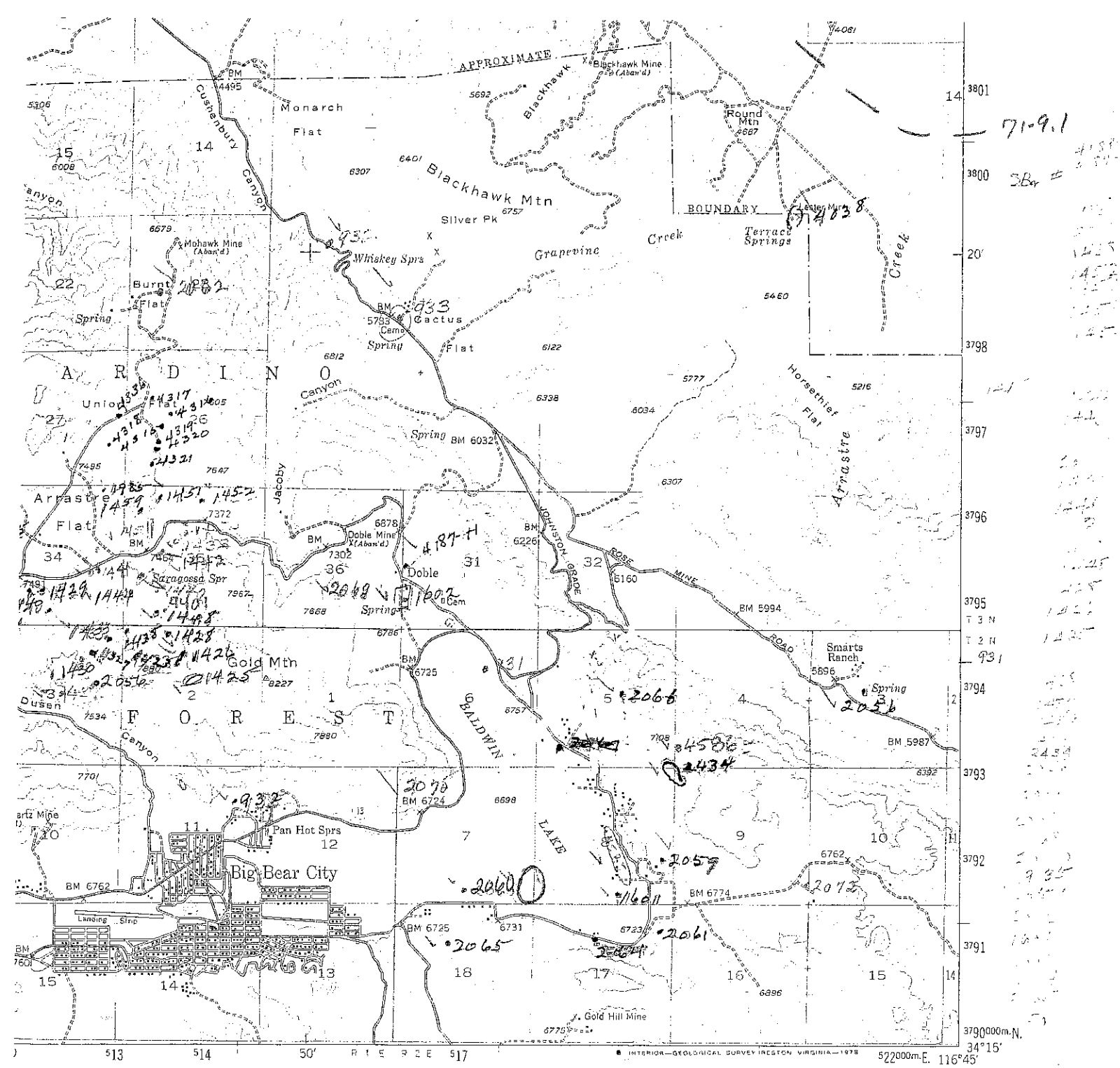
SAN BERNARDINO COUNTY MUSEUM

Archaeological Site Survey Record

SHAY'S ~~also 604~~ Big Bear City - 7.5'

1. Site SBCM 234 2. Map Fuseen Valley 3. Country S. B.
4. Twp. 2N Range 2E So ¼ of NW & SE ¼ of Sec. 7
5. Location Baldwin Side Lake Rd. So. Side. - mostly near creek & in pine area 6. On Contour Elevation
7. Previous designations for site
8. Owner 9. Address
10. Previous owners, dates
11. Present tenant
12. Attitude toward excavation
13. Description of site Bet. road & lake - mostly in pines
14. Area Scattered over 1/2 mi.
15. Depth
16. Height
17. Vegetation Pines & brush 18. Nearest water Creeks
19. Soil of site sandy - fine 20. Surrounding soil type Same
21. Previous excavation
22. Cultivation 23. Erosion Minor
24. Buildings, roads, etc. Small houses, mostly abandoned
25. Possibility of destruction
26. House pits
27. Other features
28. Burials
29. Artifacts Points, flakes (some obsidian), sherds least area along second creek
30. Remarks Check area So. of road for extension soon
31. Published references
32. Other Museum Reference 33. Sketch map
34. Date 9/7/69 35. Recorded by Simpson 36. Photos Slides

~~UTM - 11/3191500N - 517200E~~



71-9.1

(MORONGO VALLEY) 2652 II

2 3 4 MILES

12000 15000 18000 21000 FEET

3 4 5 KILOMETERS

50 FEET
DATUM OF 1929

AP ACCURACY STANDARDS
RADO 80225, OR RESTON, VIRGINIA 22092
YMBOLS IS AVAILABLE ON REQUEST

CALIF
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Med-um-duty — Unimproved dirt
State Route

LUCERNE VALLEY, CALIF.
N3415—W11645/15

1947

AMS 2652 IV—SERIES V795

GENERAL M
80-0.
81-4.

SBR - 9 TO NUMBERS

P36-015097

STATE OF CALIFORNIA--RESOURCES AGENCY
DEPARTMENT OF PARKS AND RECREATION

POINT OF HISTORICAL INTEREST

DO NOT WRITE IN THIS BLOCK
Reg. No. SBr-014
Date 1-31-73
By

County San Bernardino | Name Baldwin Lake

Location The upper (eastern) end of Bear Valley, in the San Bernardino Mountains.

Historical Significance: Shallow and marshy, Baldwin Lake was the only large natural lake in the San Bernardino Mountains when Benjamin Wilson reached it in 1845. Wilson had been sent with a contingent of soldiers by Pio Pico to punish the desert Indians who had been raiding Mexican stock ranches in southern California. Sending most of the soldiers and the supply train via Cajon Pass, Wilson took 22 men up Santa Ana Canyon into the mountains. Reaching the lake, which was swarming with grizzlies, they named it Bear Lake. The Californios killed 11 bears, using their lassoes. Proceding north down into the desert, Wilson met the rest of his party along the Mojave River, attacked the Indians, and killed their leader. Unable to follow the Indians farther, they withdrew and returned to Jurupa Rancho, Wilson and his 22 again via the lake, where they killed 11 more bears.

When Bear Valley Dam was built in the 1880s, the name Bear Lake was transferred to the new reservoir, and the natural lake was renamed Baldwin Lake, after "Lucky" Baldwin, owner of the Gold Mine nearby to the northwest.

THIS POINT OF HISTORICAL INTEREST IS NOT A STATE REGISTERED HISTORICAL LANDMARK.

RECOMMENDED: D. Bruns
Signature—Chairman, County Board of Supervisors

Date December 4, 1972

APPROVED: Kathryn H. Raisz
Signature—Chairman, Historical Landmarks Advisory Committee

Date January 26, 1973

DPR-147 (4-66)

68365-768 4-66 5M TRIP ② OSF

36-015027 BALDWIN LAKE

PROPERTY-NUMBER	PRIMARY-#	STREET.ADDRESS.....	NAMES.....	CITY.NAME.....	OWN	YR-C	OHP-PROG..	PRG-REFERENCE-NUMBER	STAT-DAT	NRS	CRIT
127326	36-019716		SHED - GENERAL STORAGE #536	BARSTOW			HIST.RES.	DOE-36-00-0497-0000	02/16/00	6Y2	
							PROJ.REVW.	USMC000203A	02/16/00	6Y2	
127331	36-019721		GENERAL WHSE - BULK	BARSTOW			HIST.RES.	DOE-36-00-0502-0000	02/16/00	6Y2	
							PROJ.REVW.	USMC000203A	02/16/00	6Y2	
124767	36-019689	33320 I ST	CULT. RES. ASSESSMENTFOR MODIFICAT	BARSTOW	P		PROJ.REVW.	FCC000530B	06/15/00	6Y2	
060850	36-015019	RIVERSIDE DR	CASA DEL DESIERTO; HARVEY HOUSE; H	BARSTOW	P	1911	HIST.RES.	NPS-75000458-0000	04/03/75	1S	AC
							HIST.RES.	SHL-0892-0000	02/20/76	1CS	
080396	36-015020	203 W FREDRICKS ST		BARSTOW	U	1940	PROJ.REVW.	HUD930209D	02/23/93	6Y2	
069885	36-015021	109 W MAIN ST		BARSTOW	U	1925	PROJ.REVW.	HUD900816A	01/15/91	6Y2	
069886	36-015022	113 W MAIN ST		BARSTOW	U	1940	PROJ.REVW.	HUD900816A	01/15/91	6Y2	
060853	36-003831		GALLANT EAGLE 80, DRINKWATER SPRIN	(VIC) BARSTOW	U		HIST.SURV.	2311-0004-0000	01/01/80	2S2	
060855	36-004192		BISMARK, SITE OF BISMARK	(VIC) BARSTOW	U	1880	HIST.SURV.	2311-0006-0000	01/01/80	2S2	
143385			HAWES RADIO RELAY STATION SITE	(VIC) BARSTOW	P		HIST.RES.	DOE-36-03-0028-0000	07/17/03	6Y2	
							PROJ.REVW.	USAF030612A	07/17/03	6Y2	
060854	36-015023	**********	GALLANT EAGLE 80, NELSON LAKE	(VIC) BARSTOW	U		HIST.SURV.	2311-0005-0000	01/01/80	2S2	
084727	36-018754	HARVARD RD	CAMP CADY	(VIC) BARSTOW	S	1860	HIST.RES.	SHL-0963-0001	03/11/94	1CS	
							ST.HS.LDMK	36-0022	02/18/94	7L	
							HIST.RES.	SPHI-SBR-047	05/09/75	7W	
060851	36-015024	SR 58	BR 54-211 / CROW DITCH BRIDGE	(VIC) BARSTOW	S	1929	HIST.RES.	DOE-36-97-0007-0000	11/25/97	6Y2	
							PROJ.REVW.	BLM971119B	11/25/97	6Y2	
							HIST.SURV.	2311-0002-0000		6	
060852	36-015025	SR 58	BR 54-212Y	(VIC) BARSTOW	S	1929	HIST.SURV.	2311-0003-0000		6	
070386	36-015026	921 W SUGARLOAF BLVD		BIG BEAR CITY	U	1941	PROJ.REVW.	HUD910509C	05/29/91	6Y2	
091005	36-015027		BALDWIN LAKE	(VIC) BIG BEAR CI	F		HIST.RES.	SPHI-SBR-014	01/31/73	7L	
091029	36-004187		BAIRDSTOWN	(VIC) BIG BEAR CI	U		HIST.RES.	SPHI-SBR-042	01/17/75	7L	
091011	36-009938	PIONEER PASS RD	ROSE MINE	(VIC) BIG BEAR CI	U		HIST.RES.	SPHI-SBR-022	01/31/73	7L	
060856	36-015028	SR 38	HENRY WASHINGTON SURVEY MARKER	(VIC) BIG BEAR CI	F	1852	HIST.RES.	NPS-75000459-0000	05/12/75	1S	AB
							HIST.RES.	SPHI-SBR-048	05/09/75	7L	
							HIST.SURV.	2314-0001-0000	01/01/75	1S	
070397	36-015029		BIG BEAR SOUTHWEST SHORE CABIN #6	BIG BEAR LAKE	U	0	HIST.RES.	DOE-36-91-0015-0006	05/02/91	2D2	AC
							PROJ.REVW.	FHWA910404A	05/02/91	2D2	A C
091084	36-015030		HAPPY HILL RESORT: THE TIDWELL HOU	BIG BEAR LAKE	U	1912	HIST.RES.	SPHI-SBR-108	12/17/85	7L	
070414	36-015032	0	BIG BEAR SOUTHWEST SHORE CABIN #27	BIG BEAR LAKE	U	0	HIST.RES.	DOE-36-91-0015-0023	05/02/91	2D2	AC
							PROJ.REVW.	FHWA910404A	05/02/91	2D2	A C
070401	36-015031	0	BIG BEAR SOUTHWEST SHORE CABIN #11	BIG BEAR LAKE	U	0	HIST.RES.	DOE-36-91-0015-0010	05/02/91	2D2	AC
							PROJ.REVW.	FHWA910404A	05/02/91	2D2	A C
096187	36-015033	39707 BIG BEAR BLVD	SAN BERNADINO COUNTY-BIG BEAR LAKE	BIG BEAR LAKE	M	1977	HIST.RES.	DSA-36-SPS-3168	06/19/95	6Z3	
096115	36-015034	40906 BIG BEAR BLVD	HEADQUARTERS FIRE STATION	BIG BEAR LAKE	D	1949	HIST.RES.	DSA-36-SPS-3088	04/17/95	6Z3	
							HIST.RES.	DSA-36-SPS-3089	05/24/95	6Z3	
130664		BIG BEAR TRACT	LOT #37, BIG BEAR TRACT	BIG BEAR LAKE		1920	TAX.CERT.	537.9-36-0010	03/27/02	7J	
060870	36-015040	SR 18	CABIN #10	BIG BEAR LAKE	P	1914	HIST.SURV.	2315-0004-0012		4D	
060899	36-015076	SR 18	CABIN #44	BIG BEAR LAKE	P		HIST.SURV.	2315-0004-0041		4D	
060898	36-015077	SR 18	CABIN #43	BIG BEAR LAKE	P	1931	HIST.SURV.	2315-0004-0040		4D	
060860	36-015110	SR 18	CABIN #1	BIG BEAR LAKE	P	1921	HIST.SURV.	2315-0004-0002		4D	
060859	36-015046	SR 18	DAM KEEPERS HOUSE	BIG BEAR LAKE	F	1884	HIST.SURV.	2315-0004-0001		4D	
060858	36-015109	SR 18	BIG BEAR DAM BR, BR 54-310	BIG BEAR LAKE	S	1924	HIST.SURV.	2315-0002-0000		4S	
060932	36-015048	SR 18	CABIN #446	BIG BEAR LAKE	P	1926	HIST.SURV.	2315-0004-0074		4D	
060931	36-015043	SR 18	CABIN #85	BIG BEAR LAKE	P	1935	HIST.SURV.	2315-0004-0073		4D	
060930	36-015044	SR 18	CABIN #84	BIG BEAR LAKE	P	1927	HIST.SURV.	2315-0004-0072		4D	
060929	36-015045	SR 18	CABIN #83	BIG BEAR LAKE	P	1926	HIST.SURV.	2315-0004-0071		4D	
060928	36-015047	SR 18	CABIN #82	BIG BEAR LAKE	P	1930	HIST.SURV.	2315-0004-0070		4D	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # _____
HRI # _____
Trinomial _____
NRHP Status Code _____
Other Listings _____
Review Code _____ Reviewer _____ Date _____

 *Resource Name or #: SRI-9182

P1. Other Identifier: SRI-9182

***P2. Location:** ☑ **Not for Publication** ☐ **Unrestricted** ***a. County:** San Bernardino

***b. USGS Quad:** 7.5' BIG BEAR CITY (2009); T 2N R 1E, SE¼ of NW¼ of Sec. 15; SBBM

c. Address:

d. UTM: Zone 11; 512402 mE/ 3790848 mN NAD27 GPS

e. Other Locational Data:

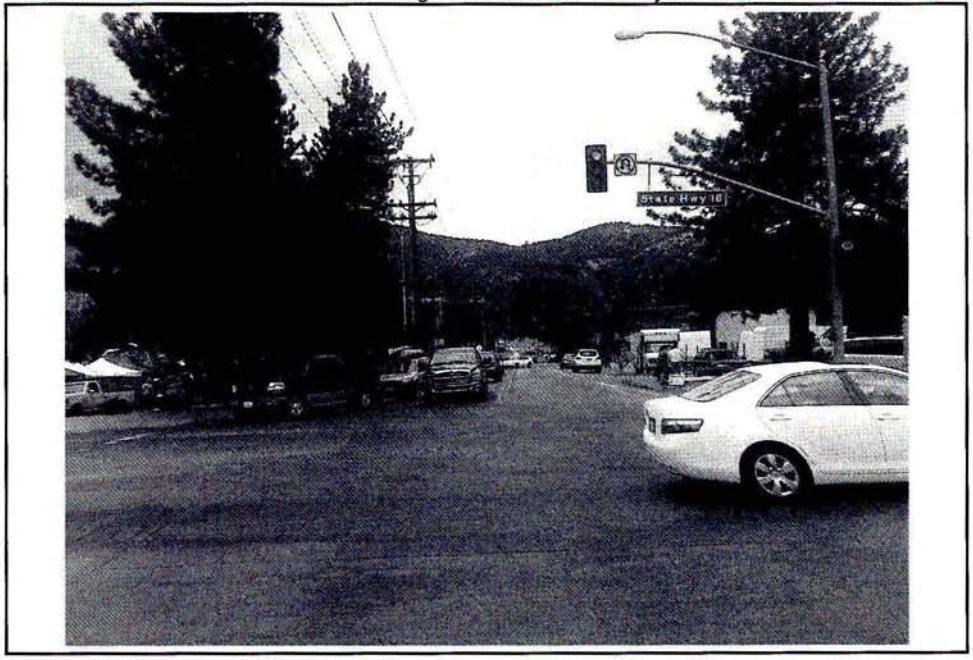
Division Drive lies at the western edge of Big Bear City and the eastern edge of the community of Big Bear Lake. The street intersects Highway 18 at postmile 52.7.

***P3a. Description:**

This site is a paved, historical-period road called Division Drive. This road is paved with asphalt, and the directions of travel are separated by a double yellow line. Each of the two lanes, one in each direction, is slightly wider than a normal residential street, and defined dirt shoulders line the road. At the road's intersection with Highway 18 there is a traffic light. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this site.

***P3b. Resource Attributes:** AH7 Historical-period road, HP37 Historical-period road

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



***P5b. Description of Photo:**
Facing N; 8/11/2011; Division Drive N

***P6. Date Constructed/Age & Sources:**
☑ Historic ☐ Prehistoric ☐ Both

***P7. Owner and Address:**
Owner Unknown, Address Unknown

***P8. Recorded by:**
J. Lev-Tov, SRI

***P9. Date Recorded:** 7/5/2011

***P10. Survey Type:**
Reconnaissance survey of highway right-of-way

***P11. Citation:** Report forthcoming

***Attachments:** ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

 *Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-9182

*A1. Dimensions: a. Length 64 m (N/S) x b. Width 16 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: In addition to the asphalt pavement limit to the east and west, the ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: This is a paved road with clearly defined limits to the east and west. The north and south ...
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:

Feature 9187 is a paved, historical-period road called Division Drive. This road is paved with asphalt, and the directions of travel are separated by a double yellow line. Each of the two lanes, one in each direction, is slightly wider than a normal residential street, and defined dirt shoulders line the road. At the road's intersection with Highway 18 there is a traffic light. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No artifacts were observed.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor

The road is in good condition and has been maintained. It has, however, been imapcted over time by widening, and possibly grading.

*A8. Nearest Water: The nearest water is Big Bear Lake, located approximately 1/4 mile northwest of the site.

*A9. Elevation: 2063 m amsl

A10. Environmental Setting:

The road is situated within Bear Valley and is near Big Bear Lake. The area is a deep depression within the San Bernardino Mountains, where at one time there were two lakes, but now only one is filled with water. Vegetation in the area of the site consists entirely of planted species of trees, mainly conifers but also various deciduous trees and tropical flowers.

A11. Historical Information:

The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

None

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 7/5/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-9182

L1. Historic and/or Common Name: Division Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 9187

L2b. Location of Point or Segment:
Zone 11; 512402 mE/ 3790824 mN NAD27 GPS
Zone 11; 512402 mE/ 3790872 mN NAD27 GPS

L3. Description:
Feature 9187 is a paved, historical-period road called Division Drive. This road is paved with asphalt, and the directions of travel are separated by a double yellow line. Each of the two lanes, one in each direction, is slightly wider than a normal residential street, and defined dirt shoulders line the road. At the road's intersection with Highway 18 there is a traffic light. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

L4. Dimensions:
- **a. Top Width:** 14.00 m
- **b. Bottom Width:** N/A
- **c. Height or Depth:** None
- **d. Length of Segment:** 15.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The road is situated within Bear Valley and is near Big Bear Lake. The area is a deep depression within the San Bernardino Mountains, where at one time there were two lakes, but now only one is filled with water. Vegetation in the area of the site consists entirely of planted species of trees, mainly conifers but also various deciduous trees ...

L7. Integrity Considerations:
The road is in good condition and has been maintained. It has, however, been imapcted over time by widening, and possibly grading.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 7/5/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9182

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
8/11/2011		0	Division Drive N	N	
8/11/2011		0	Division Drive S	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

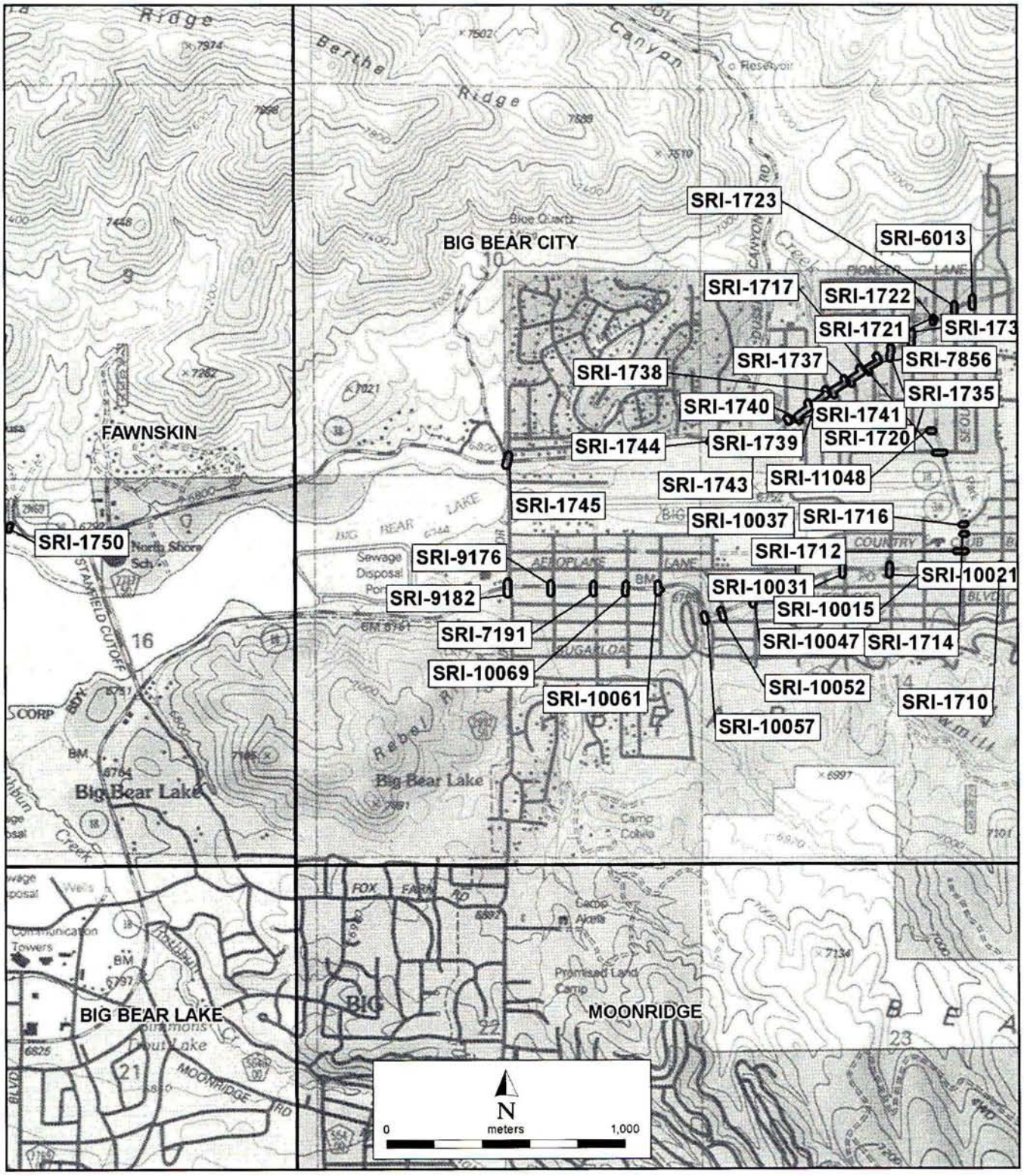
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9182

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

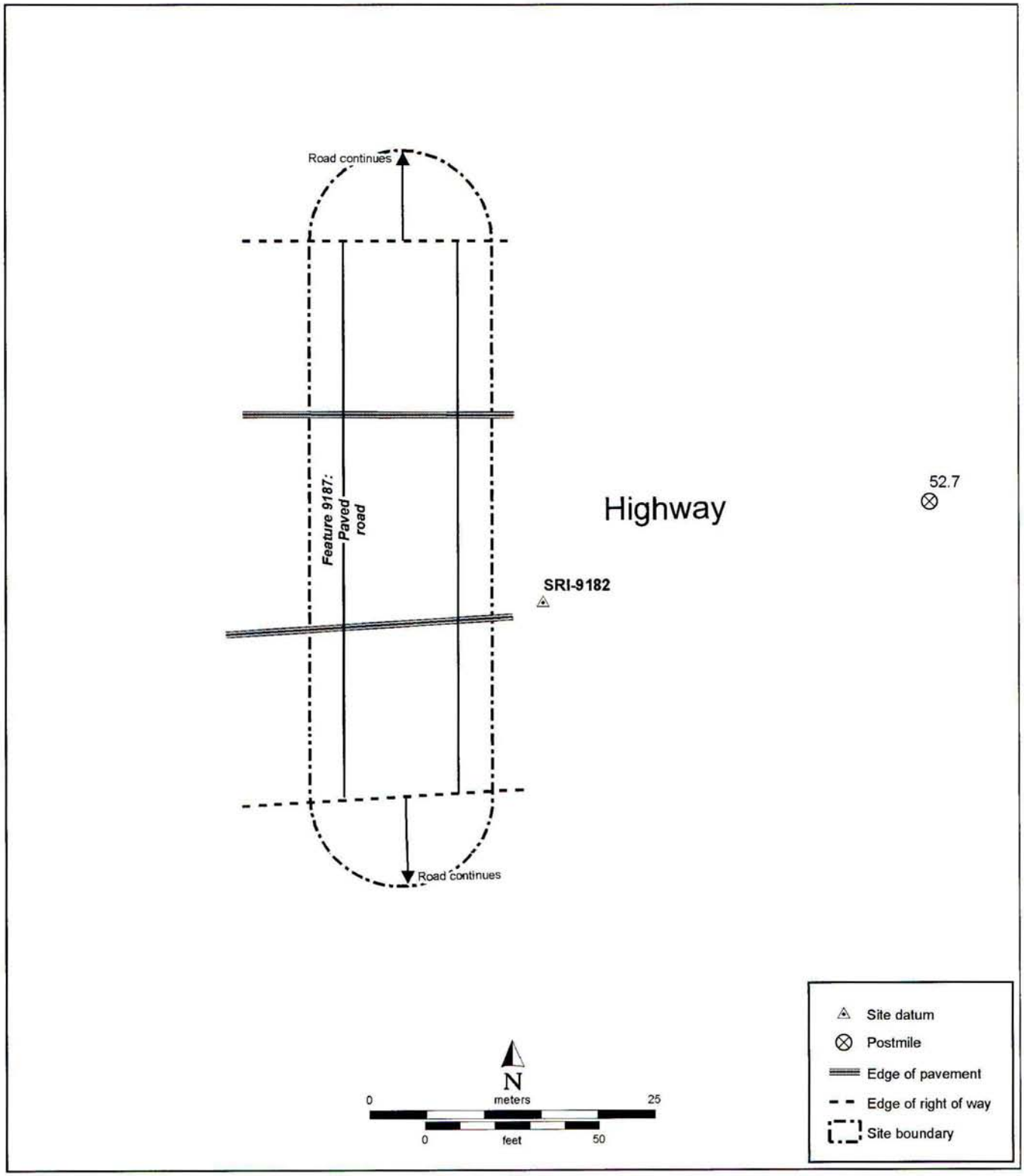
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9182

*Drawn By: J. Lev-Tov

*Date: 07/05/2011



*Required Information

P2b. Legal description
T 2N R 1E; SW¼ of NE¼ of Sec 15; SBBM

P2d. UTM
Zone 11; 512402 mE/ 3790872 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
site boundary was further defined by the 15 meter Caltrans right-of-way, measured from the edge of the pavement.

A1. Reliability of determination
extents are defined by the 15 meter right-of-way.

L6. Setting
and tropical flowers.

3/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H
NRHP Status Code
Other Listings
Review Code Reviewer Date

 *Resource Name or #: SRI-1745

P1. Other Identifier: SRI-1745
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SE¼ of SW¼ of Sec. 10; SBBM
c. Address:
d. UTM: Zone 11; 512402 mE/ 3791377 mN NAD27 GPS
e. Other Locational Data:
A segment of the site is located on the north and south side of Highway 38 in Big Bear City, near postmile 50.7. The site is also located at the western edge of Big Bear City and the eastern edge of the community of Big Bear Lake, intersecting Highway 18 at postmile 52.7.

*P3a. Description:
This site consists of two segments of asphalt-paved, two-lane historical road, known as Division Drive, that runs roughly north to south on both sides of Highways 18 and 38. The center line of the northern segment on Highway 38 is offset 13 feet to the east of the southern segment. The northern segment is unmarked, whereas the southern segment is marked with a double yellow line.

The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way to the north and south for several hundred meters, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing N; 4/8/2011; Division Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
CUDDIGAN, DONALD S, P O BOX 3430
BIG BEAR LAKE CA

*P8. Recorded by:
Joshua Trampier, SRI

*P9. Date Recorded: 5/27/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

 *Required Information

ARCHAEOLOGICAL SITE RECORD

*A1. Dimensions: a. Length 59 m (N/S) x b. Width 18 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The road is clearly distinguishable from surrounding vegetation and topography.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:

This site consists of two segments of asphalt-paved, two-lane historical road, known as Division Drive, that runs roughly north to south on both sides of Highways 18 and 38. The center line of the northern segment on Highway 38 is offset 13 feet to the east of the southern segment. The northern segment is unmarked, whereas the southern segment is marked with a double yellow line. The segment that intersects Highway 18 was recorded as feature 9187 while the segment intersection Highway 38 was recorded as Feature 7895.

The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way to the north and south for several hundred meters, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No artifacts were located.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor

No disturbances noted.

*A8. Nearest Water: Big Bear Lake is located 50 m to the south of the intersection with Highway 38.

*A9. Elevation: 2065 m amsl

A10. Environmental Setting:

The site is bordered by a built urban/rural environment paved with concrete, gravel, and asphalt, and populated by managed greenery and grasses. Soil around the site is a loosely compacted, poorly sorted, sandy gravel. Vegetation consists of mixed pine forest, oak woodland, and various grasses. The site is located on a slope that slopes downward at an angle of 5 degrees to the south

A11. Historical Information:

The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

None

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: Joshua Trampier Date: 5/27/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

 *Resource Name or #: SRI-1745

L1. Historic and/or Common Name: Division Dr

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 7895

L2b. Location of Point or Segment:

Zone 11; 512397 mE/ 3791357 mN NAD27 GPS
Zone 11; 512402 mE/ 3790824 mN NAD27 GPS
Zone 11; 512402 mE/ 3790872 mN NAD27 GPS
Zone 11; 512407 mE/ 3791397 mN NAD27 GPS

L3. Description:

This site consists of two segments of asphalt-paved, two-lane historical road, known as Division Drive, that runs roughly north to south on both sides of Highways 18 and 38. The center line of the northern segment on Highway 38 is offset 13 feet to the east of the southern segment. The northern segment is unmarked, whereas the southern segment is marked with a double yellow line. The segment that intersects Highway 18 was recorded as feature 9187 while the segment intersection Highway 38 was recorded as Feature 7895.

The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way to the north and south for several hundred meters, ...

L4. Dimensions:

a. Top Width: 12.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 50.00 m

L5. Associated Resources:

None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:

The site is bordered by a built urban/rural environment paved with concrete, gravel, and asphalt, and populated by managed greenery and grasses. Soil around the site is a loosely compacted, poorly sorted, sandy gravel. Vegetation consists of mixed pine forest, oak woodland, and various grasses. The site is located on a slope that slopes ...

L7. Integrity Considerations:

No disturbances noted.

L8b. Description of Photo, Map, or Drawing

See sketch map

L9. Remarks:

None

L10. Form Prepared By:

Joshua Trampier

L11. Date: 5/27/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

 ***Resource Name or #:** SRI-1745

L1. Historic and/or Common Name: Division Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 9187

L2b. Location of Point or Segment:

Zone 11; 512397 mE/ 3791357 mN NAD27 GPS
Zone 11; 512402 mE/ 3790824 mN NAD27 GPS
Zone 11; 512402 mE/ 3790872 mN NAD27 GPS
Zone 11; 512407 mE/ 3791397 mN NAD27 GPS

L3. Description:

This site consists of two segments of asphalt-paved, two-lane historical road, known as Division Drive, that runs roughly north to south on both sides of Highways 18 and 38. The center line of the northern segment on Highway 38 is offset 13 feet to the east of the southern segment. The northern segment is unmarked, whereas the southern segment is marked with a double yellow line. The segment that intersects Highway 18 was recorded as feature 9187 while the segment intersection Highway 38 was recorded as Feature 7895.

The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way to the north and south for several hundred meters, ...

L4. Dimensions:

a. Top Width: 14.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 15.00 m

L5. Associated Resources:

None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:

The site is bordered by a built urban/rural environment paved with concrete, gravel, and asphalt, and populated by managed greenery and grasses. Soil around the site is a loosely compacted, poorly sorted, sandy gravel. Vegetation consists of mixed pine forest, oak woodland, and various grasses. The site is located on a slope that slopes ...

L7. Integrity Considerations:

No disturbances noted.

L8b. Description of Photo, Map, or Drawing

See sketch map

L9. Remarks:

None

L10. Form Prepared By:

Joshua Trampier

L11. Date: 5/27/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

***Resource Name or #:** SRI-1745

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3280	Division Drive	N	
4/8/2011		3281	Division Drive	S	
5/27/2011		28	Division Drive	N	
5/27/2011		29	Road	S	
8/11/2011		0	Division Drive north	N	
8/11/2011		0	Division Drive south	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

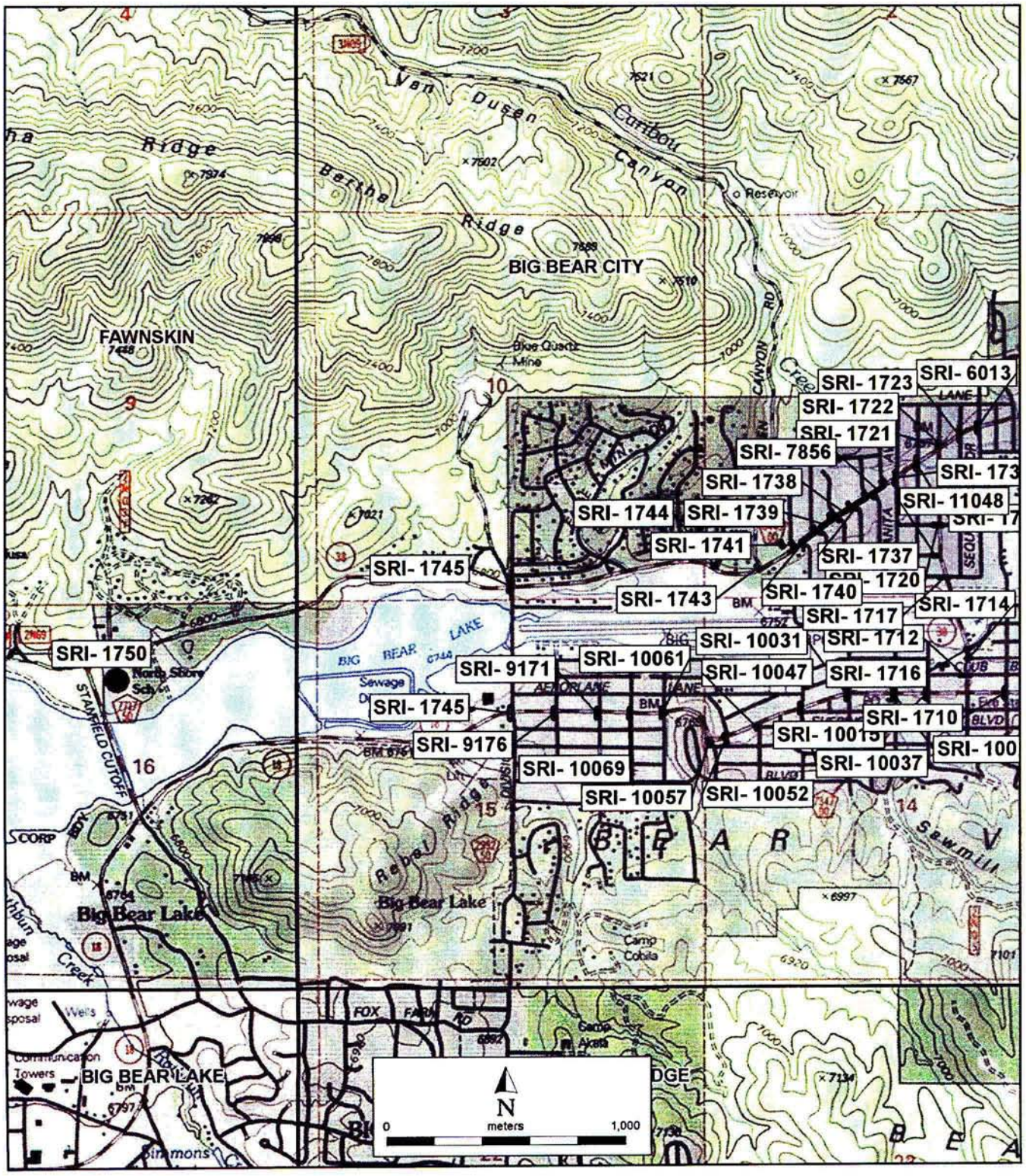
LOCATION MAP

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

*Resource Name or #: SRI-1745

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

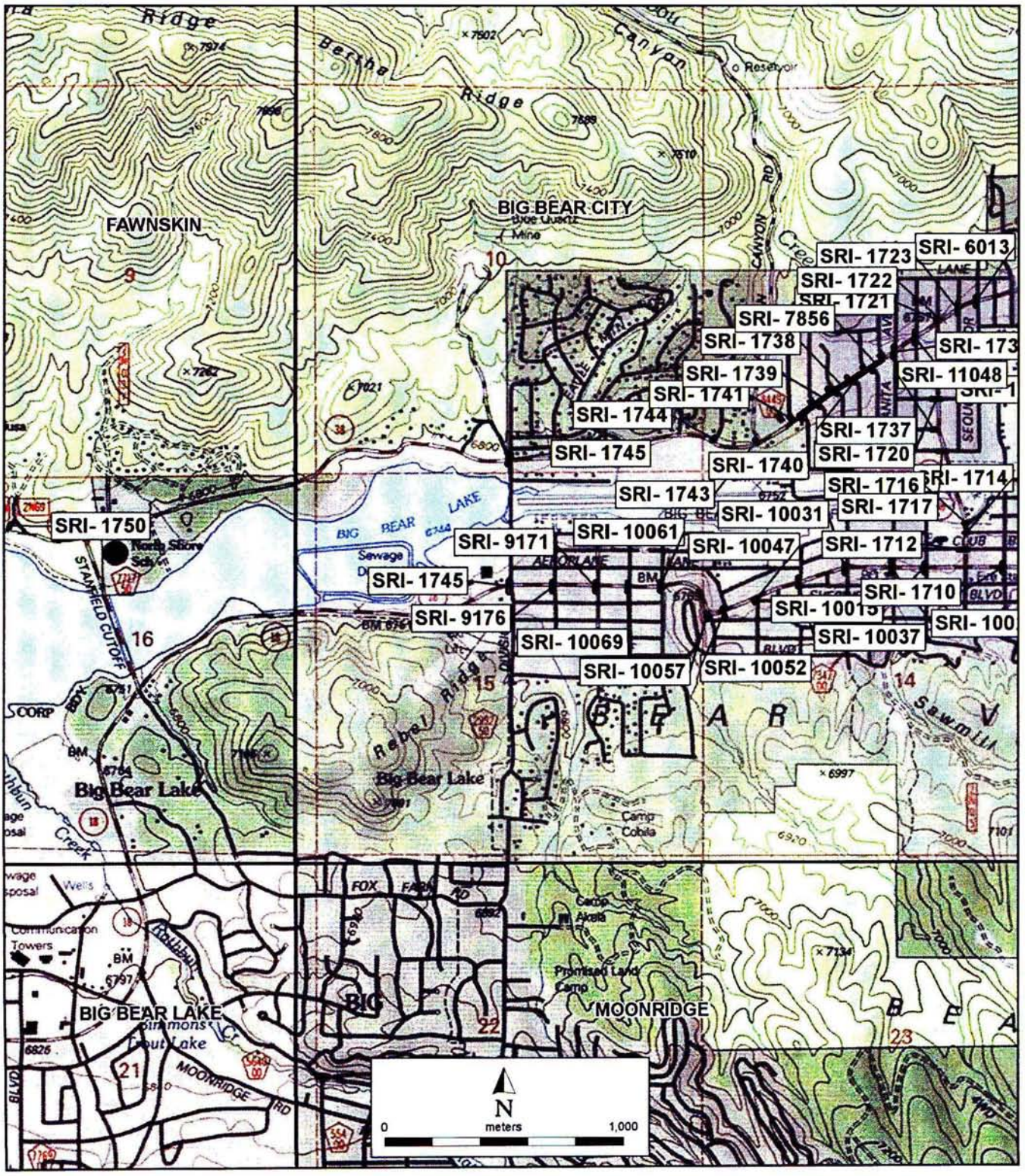
LOCATION MAP

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

*Resource Name or #: SRI-1745

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

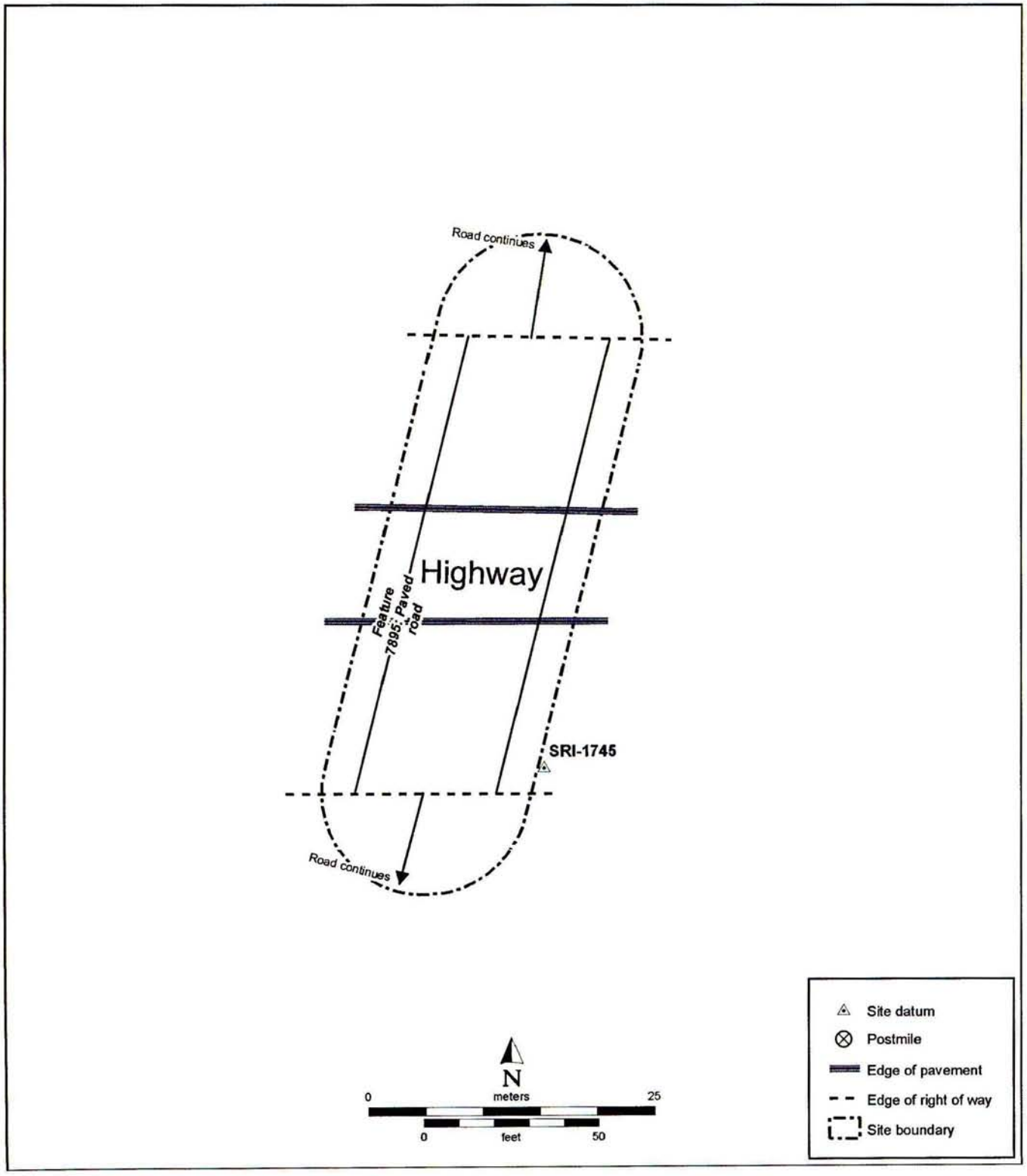
SKETCH MAP

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

*Resource Name or #: SRI-1745

*Drawn By: Joshua Trampier

*Date: 05/27/2011



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

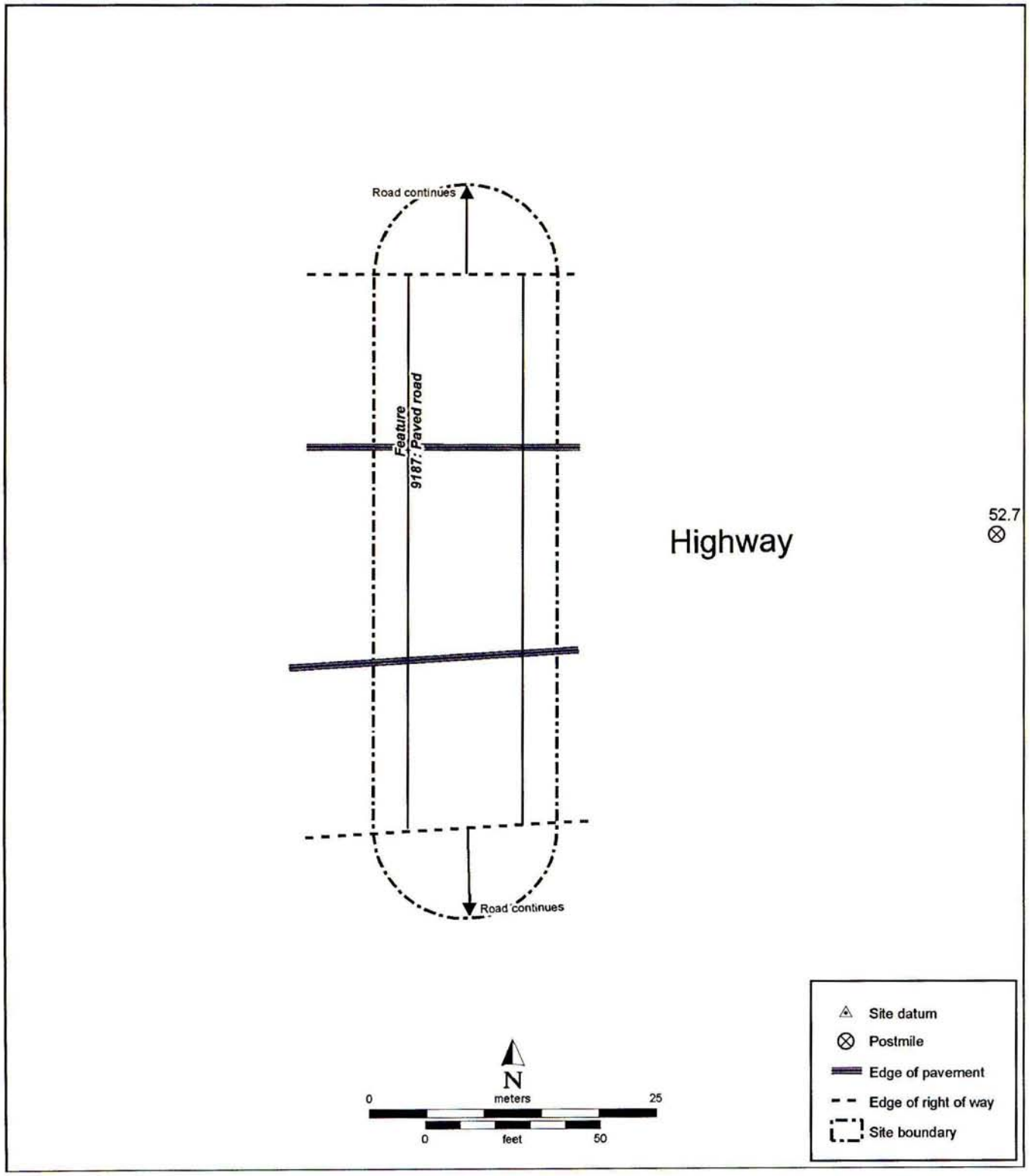
SKETCH MAP

Primary # P-36-024007
HRI #
Trinomial CA-SBR-15192H

*Resource Name or #: SRI-1745

*Drawn By: Joshua Trampier

*Date: 05/27/2011



*Required Information

P2b. Legal description
T 2N R 1E; SW¼ of SE¼ of Sec 10; SBBM

P2d. UTM
Zone 11; 512402 mE/ 3790824 mN NAD27 GPS
Zone 11; 512402 mE/ 3790872 mN NAD27 GPS
Zone 11; 512407 mE/ 3791397 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

GOVERNMENT PROPERTY
ADDRESS UNKNOWN

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. This site was identified on the 15-minute Lucerne Valley (1947) USGS topographic quad.

L3. Description
but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.
but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

L6. Setting
downward at an angle of 5 degrees to the south
downward at an angle of 5 degrees to the south

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State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # 36-024051
HRI #
Trinomial CA-SBR-15236 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

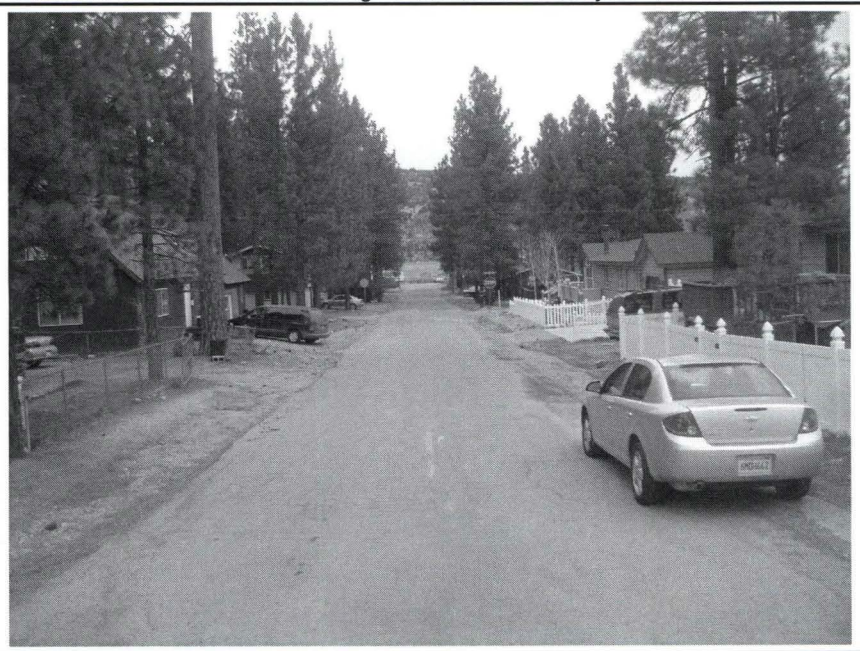
 *Resource Name or #: SRI-1704

P1. Other Identifier: SRI-1704
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NW¼ of NE¼ of Sec. 13; SBBM
c. Address:
d. UTM: Zone 11; 515966 mE/ 3790950 mN NAD27 GPS
e. Other Locational Data:
The site is located in Big Bear City on the north side of Highway 38, at postmile 48.5.

*P3a. Description:
This site consists of an asphalt-paved road (Feature 8625). The road, known as Bufflehead Drive, is oriented north to south but only intersects Highway 38 from the north. The road has one lane each way, with traffic lanes divided by a painted double yellow line, in many places faded, eroded or completely gone.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 4/8/2011; bufflehead drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
PACHECO, ANTONIO SILVA, P.O. BOX 3080
BIG BEAR LAKE, CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 5/3/2011

*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-1704

*A1. Dimensions: a. Length 27 m (N/S) x b. Width 12 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way (ROW) ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: Because the site was well-maintained with proper signage, the site boundaries were readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☑ Present ☐ Absent ☐ Possible ☐ Unknown

*A4. Features:
The only feature associated with this site consists of an asphalt-paved road (Feature 8625). The road, known as Bufflehead Drive, is oriented north to south but only intersects Highway 38 from the north. The road has one lane each way, with traffic lanes divided by a painted double yellow line, in many places faded, eroded or completely gone.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No cultural material is associated with this feature.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☐ Good ☑ Fair ☐ Poor
This site is likely a formerly unpaved street. The asphalt pavement of this site is somewhat deterioted and cracked.

*A8. Nearest Water: The nearest water to thiils site is Big Bear Lake, located approximately 2 miles to the ...

*A9. Elevation: 2055 m amsl

A10. Environmental Setting:
This site is set within Bear Valley. Immediately to the south of the site a hill rises steeply up, while the site itself slopes to the north downward. Vegetation consists of grass, scrub plants and pines.

A11. Historical Information:
The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
None

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 5/3/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

***Resource Name or #:** SRI-1704

L1. Historic and/or Common Name: Bufflehead Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 8625

L2b. Location of Point or Segment:
Zone 11; 515966 mE/ 3790943 mN NAD27 GPS
Zone 11; 515966 mE/ 3790958 mN NAD27 GPS

L3. Description:
The only feature associated with this site consists of an asphalt-paved road (Feature 8625). The road, known as Bufflehead Drive, is oriented north to south but only intersects Highway 38 from the north. The road has one lane each way, with traffic lanes divided by a painted double yellow line, in many places faded, eroded or completely gone.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 6.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 15.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
This site is set within Bear Valley. Immediately to the south of the site a hill rises steeply up, while the site itself slopes to the north downward. Vegetation consists of grass, scrub plants and pines.

L7. Integrity Considerations:
This site is likely a formerly unpaved street. The asphalt pavement of this site is somewhat deterioted and cracked.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 5/3/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1704

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3235	bufflehead drive	N	
5/13/2011		1082	bufflehead dr	N	
5/13/2011		1082	bufflehead dr	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

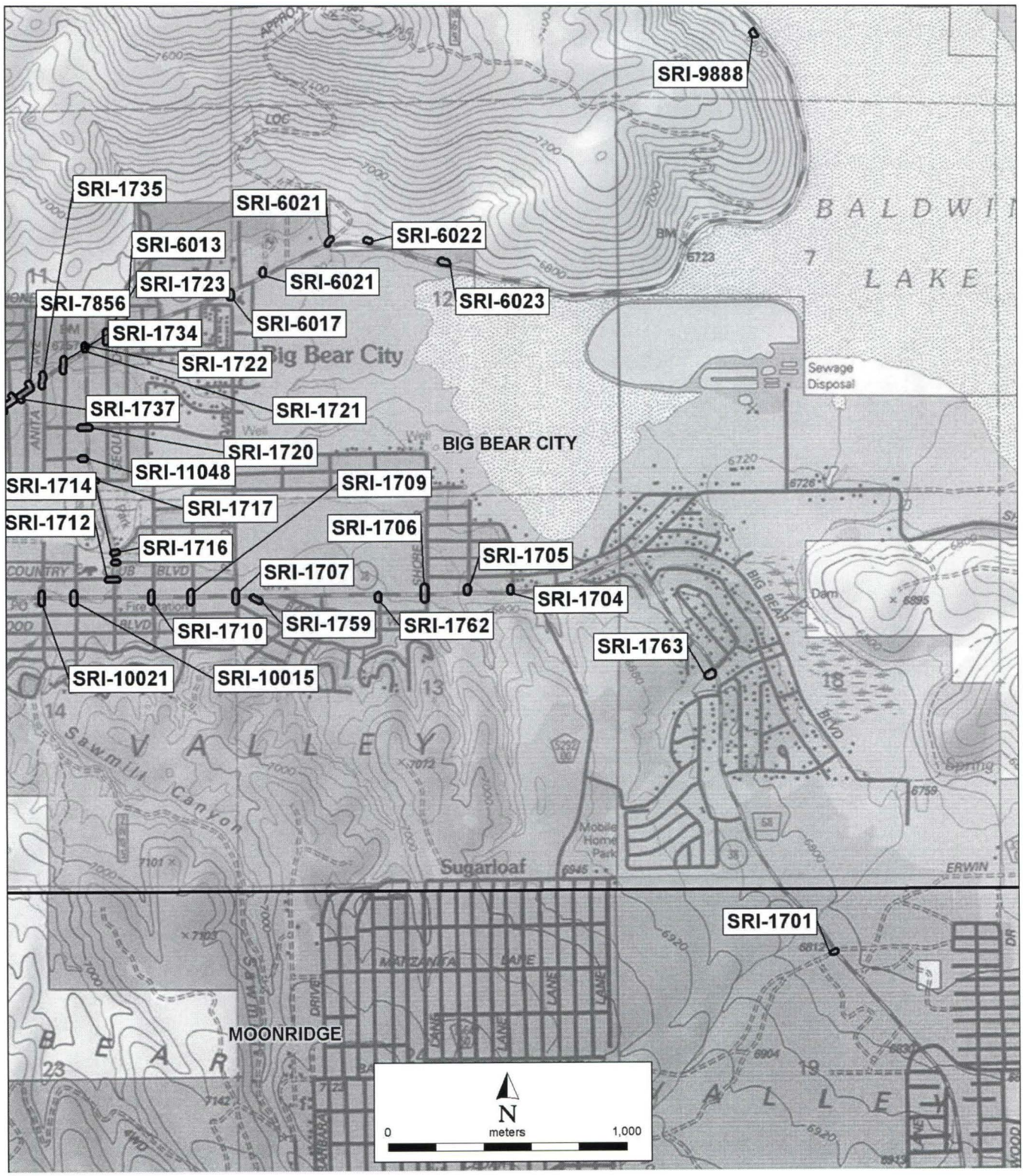
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1704

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

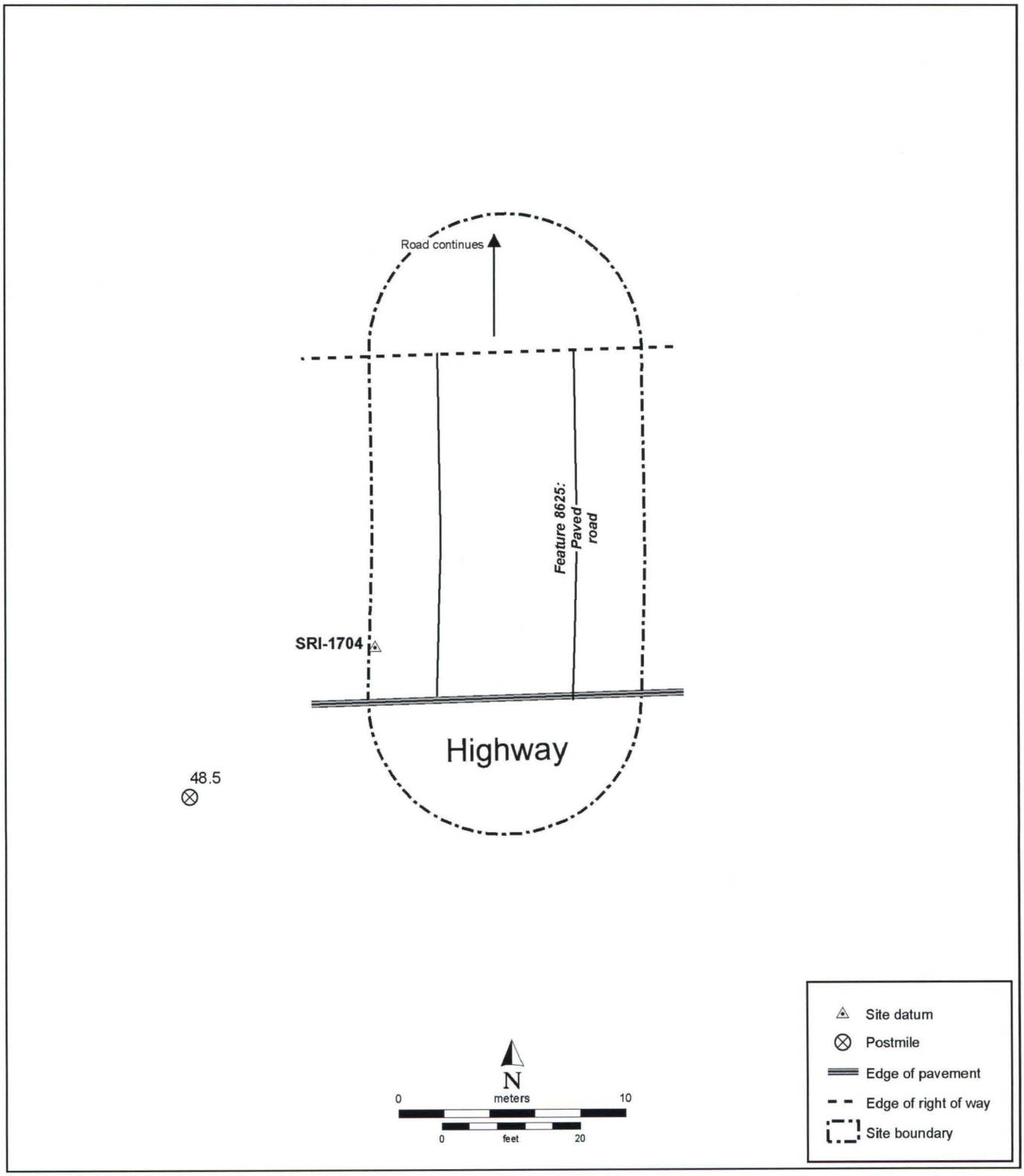
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1704

*Drawn By: J. Lev-Tov

*Date: 05/03/2011



*Required Information

P2b. Legal description
T 2N R 1E; SW¼ of NE¼ of Sec 13; SBBM

P2d. UTM
Zone 11; 515966 mE/ 3790958 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

RCK PROPERTIES INC
P O BOX 1287
NORTHBROOK, IL

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

A8. Nearest water
northwest of the site.

3/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # 36-024052
HRI #
Trinomial CA-SBR-15237H
NRHP Status Code
Other Listings
Review Code Reviewer Date

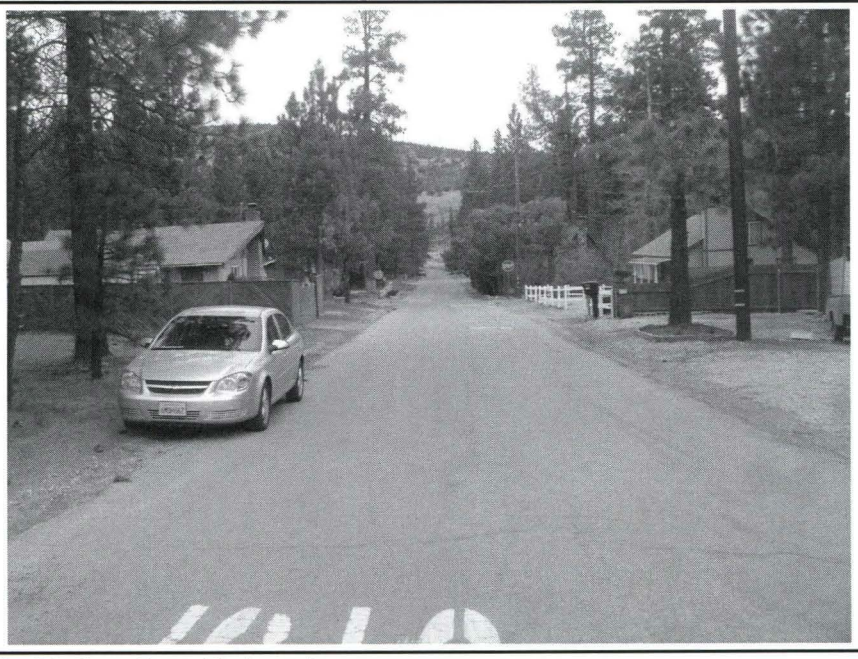
*Resource Name or #: SRI-1705

P1. Other Identifier: SRI-1705
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NW¼ of NE¼ of Sec. 13; SBBM
c. Address:
d. UTM: Zone 11; 515785 mE/ 3790951 mN NAD27 GPS
e. Other Locational Data:
Teal Drive is located in Big Bear City along Highway 38 at postmile 48.6.

*P3a. Description:
This site is an asphalt-paved, historical-period road wide enough for a single lane of traffic to pass in each direction. The pavement is unmarked by paint, but the intersection is marked, outside the right-of-way, by a stop sign and street name sign. The road, known as Teal Drive is a north-to-south-oriented residential street which intersects Highway 38 from the north.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐Building ☐Structure ☐Object ☑Site ☐District ☐Element of District ☐Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 4/8/2011; teal drive

*P6. Date Constructed/Age & Sources:
☑Historic ☐Prehistoric ☐Both

*P7. Owner and Address:
CRANDELL, ROBERT L, 905 E BIG BEAR BLVD
BIG BEAR CITY CA 92314

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 5/3/2011

*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-1705

*A1. Dimensions: a. Length 31 m (N/S) x b. Width 16 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way (ROW) ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: Because the site was well-maintained with proper signage, the site boundaries were readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☑ Present ☐ Absent ☐ Possible ☐ Unknown

*A4. Features:

The only feature associated with this site is an asphalt-paved, historical-period road (Feature 8628) wide enough for a single lane of traffic to pass in each direction. The pavement is unmarked by paint, but the intersection is marked, outside the right-of-way, by a stop sign and street name sign. The road, known as Teal Drive is a north-to-south-oriented residential street which intersects Highway 38 from the north.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No cultural material is associated with this feature.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☐ Good ☑ Fair ☐ Poor

This site likely was once a dirt road and has since been paved and graded. In addition, the pavement now shows signs of weathering, being cracked and faded.

*A8. Nearest Water: The nearest water source to Teal Drive is Big Bear Lake, located approximately 2 miles away to ...

*A9. Elevation: 2057 m amsl

A10. Environmental Setting:

The site is set within Bear Valley, a deep valley in the San Bernardino Mountains. The site is positioned just south of a steep but short rise and along a gentle slope down to the north. Surrounding vegetation conists of pine trees, scrub brush and grasses, but the area generally has a semi-desert-like feel.

A11. Historical Information:

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

None

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 5/3/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-1705

L1. Historic and/or Common Name: Teal Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 8628

L2b. Location of Point or Segment:
Zone 11; 515785 mE/ 3790944 mN NAD27 GPS
Zone 11; 515786 mE/ 3790959 mN NAD27 GPS

L3. Description:
The only feature associated with this site is an asphalt-paved, historical-period road (Feature 8628) wide enough for a single lane of traffic to pass in each direction. The pavement is unmarked by paint, but the intersection is marked, outside the right-of-way, by a stop sign and street name sign. The road, known as Teal Drive is a north-to-south-oriented residential street which intersects Highway 38 from the north.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-

L4. Dimensions:
- **a. Top Width:** 10.00 m
- **b. Bottom Width:** N/A
- **c. Height or Depth:** None
- **d. Length of Segment:** 15.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The site is set within Bear Valley, a deep valley in the San Bernardino Mountains. The site is positioned just south of a steep but short rise and along a gentle slope down to the north. Surrounding vegetation conists of pine trees, scrub brush and grasses, but the area generally has a semi-desert-like feel.

L7. Integrity Considerations:
This site likely was once a dirt road and has since been paved and graded. In addition, the pavement now shows signs of weathering, being cracked and faded.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 5/3/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1705

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3236	teal drive	N	
5/13/2011		1083	teal dr	N	
5/13/2011		1083	teal dr	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

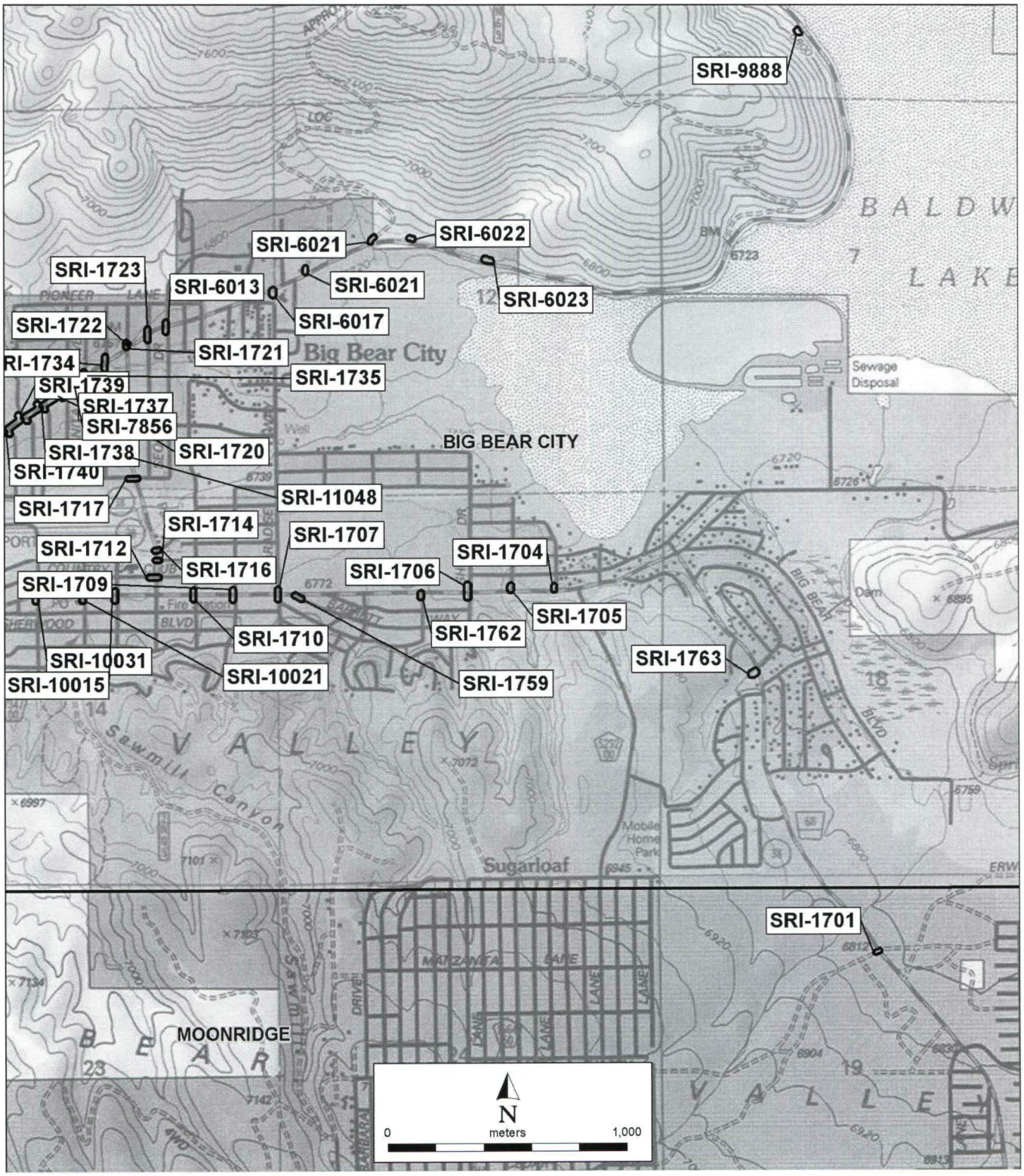
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1705

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

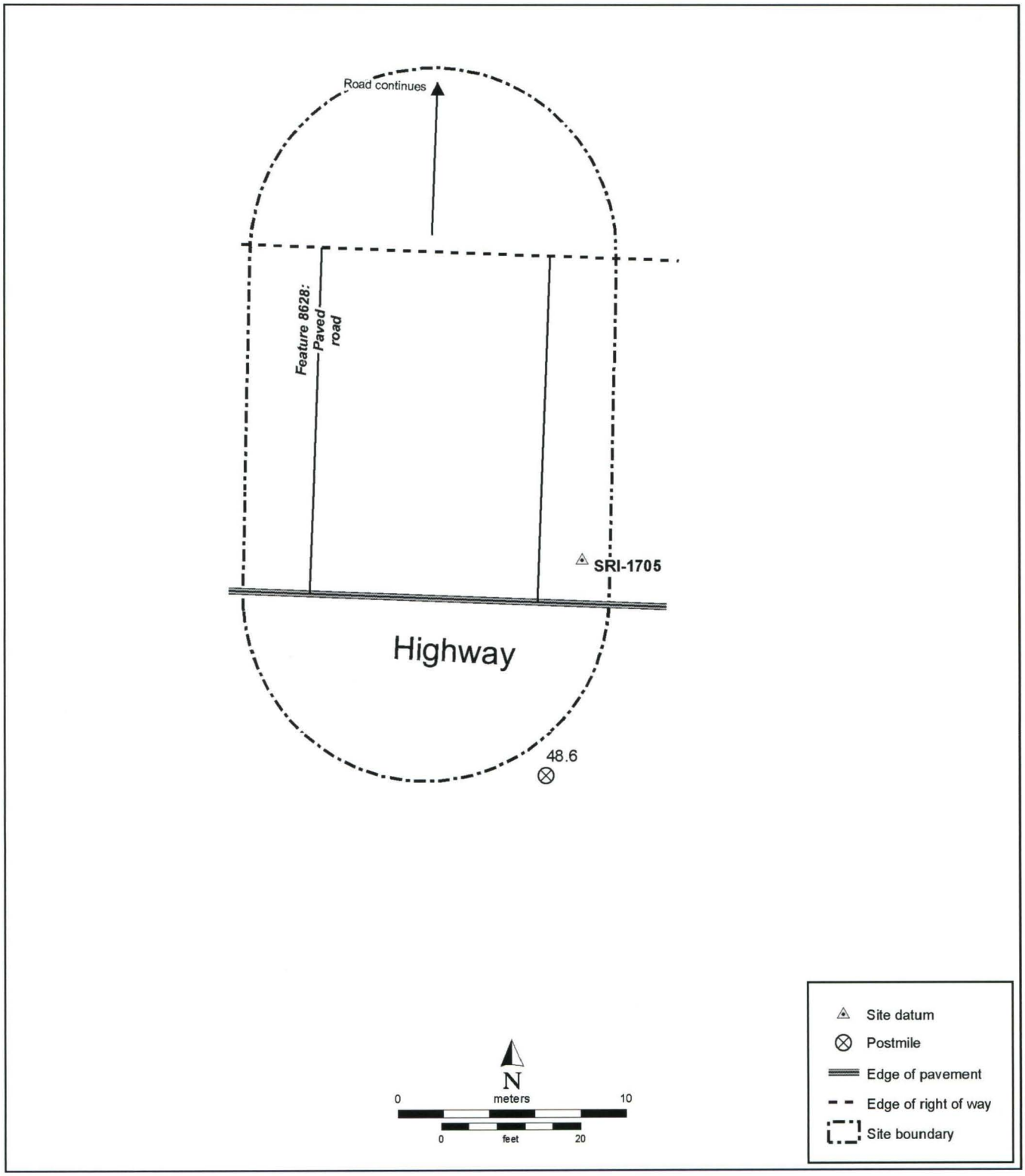
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1705

*Drawn By: J. Lev-Tov

*Date: 05/03/2011



*Required Information

P2b. Legal description
T 2N R 1E; SW¼ of NE¼ of Sec 13; SBBM

P2d. UTM
Zone 11; 515786 mE/ 3790959 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

RCK PROPERTIES INC
P O BOX 1287
NORTHBROOK, IL

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

SYZONENKO, PAUL
P O BOX 2127
HEMET CA

A1. Method of determination
established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

A8. Nearest water
the west.

L3. Description
associated with this feature.

3/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 36-024053
HRI #
Trinomial CA-SBR-15238H
NRHP Status Code
Other Listings
Review Code Reviewer Date

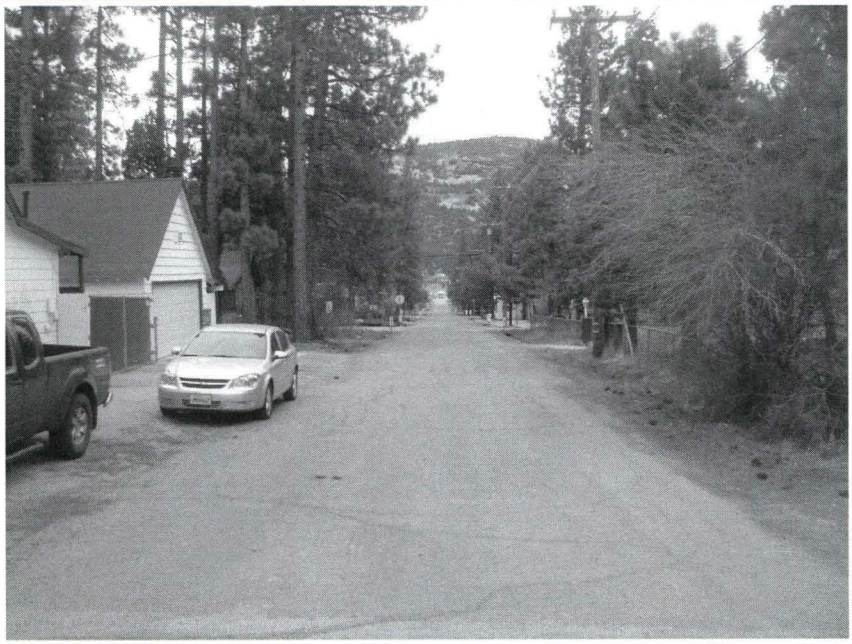
 *Resource Name or #: SRI-1709

P1. Other Identifier: SRI-1709
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NE¼ of NE¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 514625 mE/ 3790924 mN NAD27 GPS
e. Other Locational Data:
The road crosses Highway 38 at postmile 49.3. Gold Mountain Drive slopes down to the north, toward the former Baldwin Lake in Big Bear City.

*P3a. Description:
This site is a two-lane, asphalt-paved, historical-period road (Feature 8647) that travels through a residential area in Big Bear City. The road, known as Gold Mountain Drive, is oriented north to south and intersects Highway 38 from both sides. The intersection with Highway 38 is marked by asphalt painting and the eroded word "STOP". Near to the road's northwestern and southeastern corners are stop signs. The southeastern stop sign stands next to a road sign on a metal post, reading "Gold Mountain Drive" and "SH38/Big Bear Boulevard". The northeastern corner of the site is near to a yellow-painted fire hydrant demarcated by two brightly colored posts.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 4/8/2011; gold mountain drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
KAUFFMAN, TERRY, P O BOX 2739
BIG BEAR CITY, CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 5/3/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Primary # _____
Trinomial _____

ARCHAEOLOGICAL SITE RECORD

 *Resource Name or #: SRI-1709

*A1. Dimensions: a. Length 54 m (N/S) x b. Width 14 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way (ROW) ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: Because the site was well-maintained with proper signage, the site boundaries were readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☑ Present ☐ Absent ☐ Possible ☐ Unknown

*A4. Features:

The only feature associated with this site is a two-lane, asphalt-paved, historical-period road (Feature 8647) that travels through a residential area in Big Bear City. The road, known as Gold Mountain Drive, is oriented north to south and intersects Highway 38 from both sides. The intersection with Highway 38 is marked by asphalt painting and the eroded word "STOP". Near to the road's northwestern and southeastern corners are stop signs. The southeastern stop sign stands next to a road sign on a metal post, reading "Gold Mountain Drive" and "SH38/Big Bear Boulevard". The northeastern corner of the site is near to a yellow-painted fire hydrant demarcated by two brightly colored posts.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No cultural material is associated with this feature.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☐ Good ☑ Fair ☐ Poor

This site may originally have been a dirt road, but is now paved with asphalt. Paving would have disturbed the original road surface to some extent, althought the current surface does not appear to sit on a grade or fill.

*A8. Nearest Water: The nearest water to this site is Big Bear Lake, located approximately 1 mile to the northwest ...

*A9. Elevation: 2068 m amsl

A10. Environmental Setting:

This road sits within Bear Valley, a deep valley of the San Bernardino Mountains, in Big Bear City. The valley floor was originally a large lake, but is now made up of one dry lakebed, Lake Baldwin, and Big Bear Lake. The surrounding vegetation is pine trees, other conifers, and smaller scrub type plants, as well as sparse grass.

A11. Historical Information:

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

None

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 5/3/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

***Resource Name or #:** SRI-1709

L1. Historic and/or Common Name: Gold Mountain Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 8647

L2b. Location of Point or Segment:

Zone 11; 514625 mE/ 3790904 mN NAD27 GPS
Zone 11; 514625 mE/ 3790944 mN NAD27 GPS

L3. Description:

The only feature associated with this site is a two-lane, asphalt-paved, historical-period road (Feature 8647) that travels through a residential area in Big Bear City. The road, known as Gold Mountain Drive, is oriented north to south and intersects Highway 38 from both sides. The intersection with Highway 38 is marked by asphalt painting and the eroded word "STOP". Near to the road's northwestern and southeastern corners are stop signs. The southeastern stop sign stands next to a road sign on a metal post, reading "Gold Mountain Drive" and "SH38/Big Bear Boulevard". The northeastern corner of the site is near to a yellow-painted fire hydrant demarcated by two brightly colored posts.

L4. Dimensions:

a. Top Width: 12.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 35.00 m

L5. Associated Resources:

None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:

This road sits within Bear Valley, a deep valley of the San Bernardino Mountains, in Big Bear City. The valley floor was originally a large lake, but is now made up of one dry lakebed, Lake Baldwin, and Big Bear Lake. The surrounding vegetation is pine trees, other conifers, and smaller scrub type plants, as well as sparse grass.

L7. Integrity Considerations:

This site may originally have been a dirt road, but is now paved with asphalt. Paving would have disturbed the original road surface to some extent, althought the current surface does not appear ...

L8b. Description of Photo, Map, or Drawing

See sketch map

L9. Remarks:

None

L10. Form Prepared By:

J. Lev-Tov

L11. Date: 5/3/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1709

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3239	gold mountain drive	N	
5/13/2011		1089	gold mtn rd	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

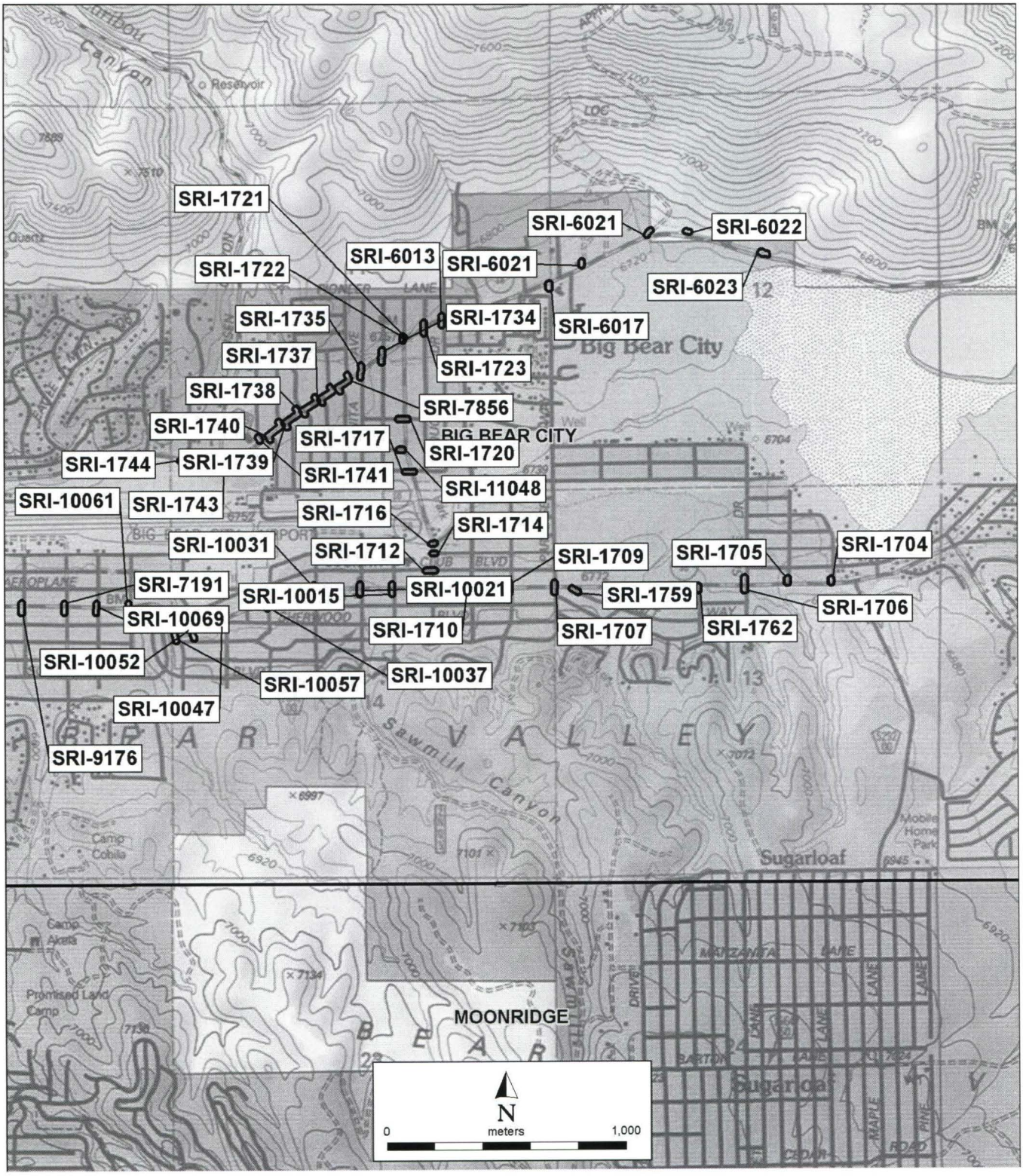
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1709

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

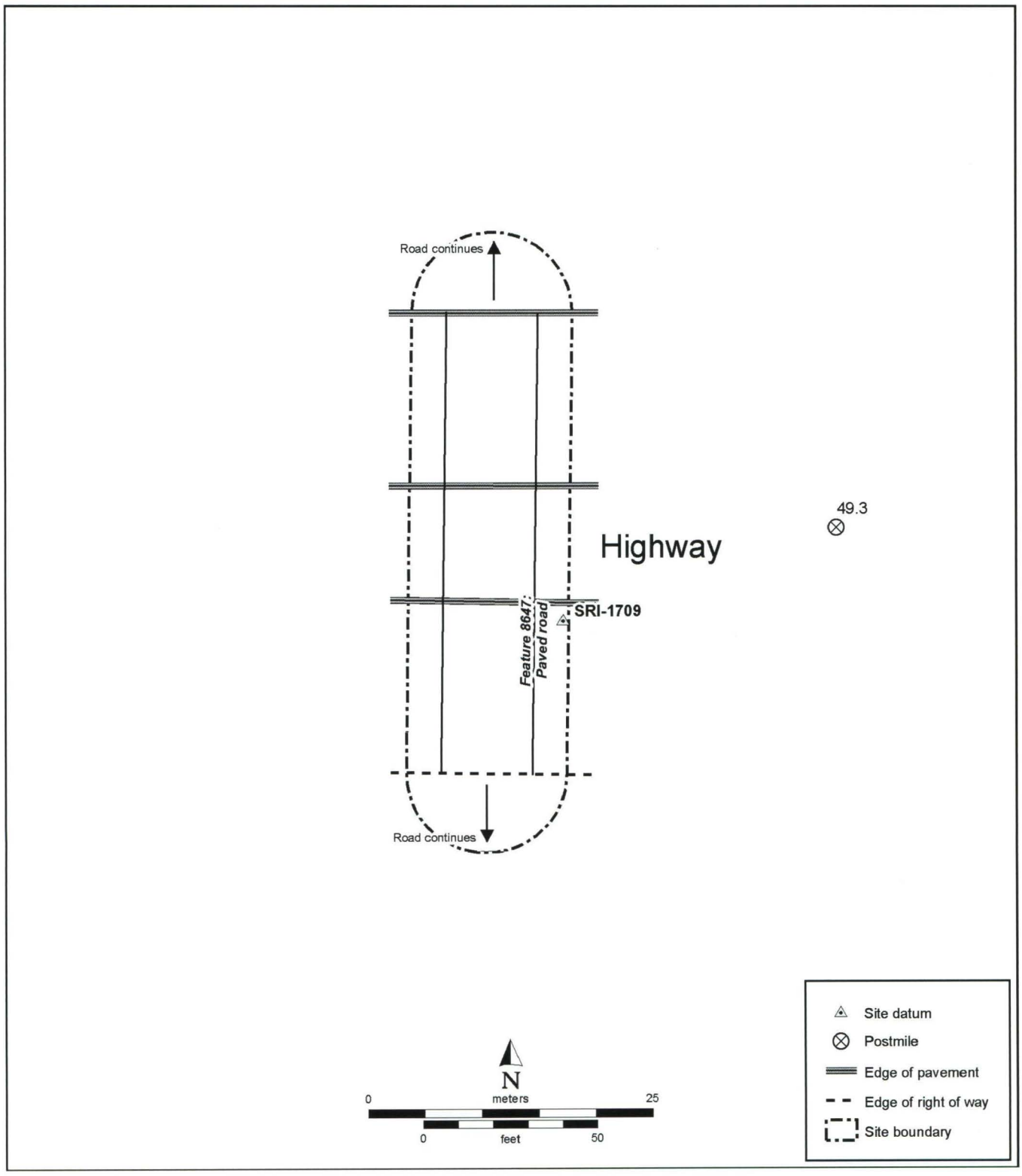
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1709

*Drawn By: J. Lev-Tov

*Date: 05/03/2011



*Required Information

P2b. Legal description
T 2N R 1E; SE¼ of NE¼ of Sec 14; SBBM

P2d. UTM
Zone 11; 514625 mE/ 3790944 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

PALMER, KELLEY D TRUST 9/14/05
2809 PACIFIC VIEW TR
HOLLYWOOD CA 90068

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

A8. Nearest water
of this site.

L3. Description
(1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

L7. Integrity considerations
to sit on a grade or fill.

3/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

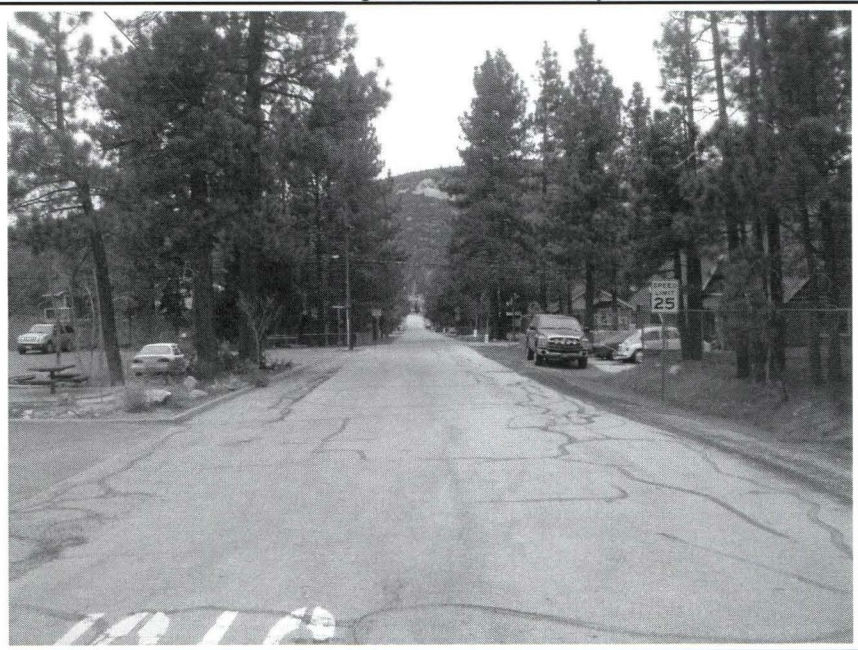
Primary # 36-024054
HRI #
Trinomial CA-SBR-15239 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

 *Resource Name or #: SRI-1710

P1. Other Identifier: SRI-1710
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NE¼ of NE¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 514459 mE/ 3790924 mN NAD27 GPS
e. Other Locational Data:
Mount Doble Drive crosses Highway 38 in Big Bear City, at postmile 49.4.

*P3a. Description:
This site is an asphalt-paved, historical-period road. The road, known as Mount Doble Drive, is oriented north to south on both sides of Highway 38. The road is still in use as a residential road and wide enough for one lane of traffic to pass in either direction. At the road's intersection with the highway, the asphalt is painted with (now faded) white stop lines and the (faded) word "STOP". Stop signs stand at either side of the road at its highway intersection. The site boundary is determined in part by the right-of-way established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley 15-minute topographic quad map. No artifacts were associated with the site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 4/8/2011; mount doble drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
BIG BEAR CITY COMMUNITY SERVICES DIS, PO BOX 558
BIG BEAR CITY CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 7/8/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

 *Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Primary # _____
Trinomial _____

ARCHAEOLOGICAL SITE RECORD

 *Resource Name or #: SRI-1710

*A1. Dimensions: a. Length 49 m (N/S) x b. Width 11 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundaries were determined by the limits of the asphalt ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The edges of the pavement and the Caltrans right-of-way make the boundaries certain.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The only feature associated with this site is an asphalt-paved, historical-period road (Feature 9245). The road, known as Mount Doble Drive, is oriented north to south on both sides of Highway 38. The road is still in use as a residential road and wide enough for one lane of traffic to pass in either direction. At the road's intersection with the highway, the asphalt is painted with (now faded) white stop lines and the (faded) word "STOP". Stop signs stand at either side of the road at its highway intersection. The site boundary is determined in part by the right-of-way established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley 15-minute topographic quad map. No artifacts were associated with the site.

*A5. Cultural Constituents:
No artifacts were associated with the site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
No site disturbances were noted, apart from moderate pavement cracking due to vehicular traffic combined with weather effects.

*A8. Nearest Water: The nearest water is Big Bear Lake, located approximately 2 miles away.

*A9. Elevation: 2067 m amsl

A10. Environmental Setting:
The site is set within Bear Valley in the San Bernardino Mountains. Vegetation is primiarily various species of coniferous trees. A great variety of other plants are present, mostly planted on private property, however.

A11. Historical Information:
The site appears on the USGS 1947 Lucerne Valley 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☑ Undetermined

A13. Interpretations:
Mount Doble Drive crosses Highway 38 in Big Bear City. It serves as a residential road, as well as a way to enter the parking lot for the Big Bear City Community Services District building.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 7/8/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

***Resource Name or #:** SRI-1710

L1. Historic and/or Common Name: Mount Doble Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 9245

L2b. Location of Point or Segment:
Zone 11; 514459 mE/ 3790905 mN NAD27 GPS
Zone 11; 514460 mE/ 3790943 mN NAD27 GPS

L3. Description:
The only feature associated with this site is an asphalt-paved, historical-period road (Feature 9245). The road, known as Mount Doble Drive, is oriented north to south on both sides of Highway 38. The road is still in use as a residential road and wide enough for one lane of traffic to pass in either direction. At the road's intersection with the highway, the asphalt is painted with (now faded) white stop lines and the (faded) word "STOP". Stop signs stand at either side of the road at its highway intersection. The site boundary is determined in part by the right-of-way established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. ...

L4. Dimensions:
a. Top Width: 5.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 36.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The site is set within Bear Valley in the San Bernardino Mountains. Vegetation is primiarily various species of coniferous trees. A great variety of other plants are present, mostly planted on private property, however.

L7. Integrity Considerations:
No site disturbances were noted, apart from moderate pavement cracking due to vehicular traffic combined with weather effects.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 7/8/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1710

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3240	mount doble drive	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

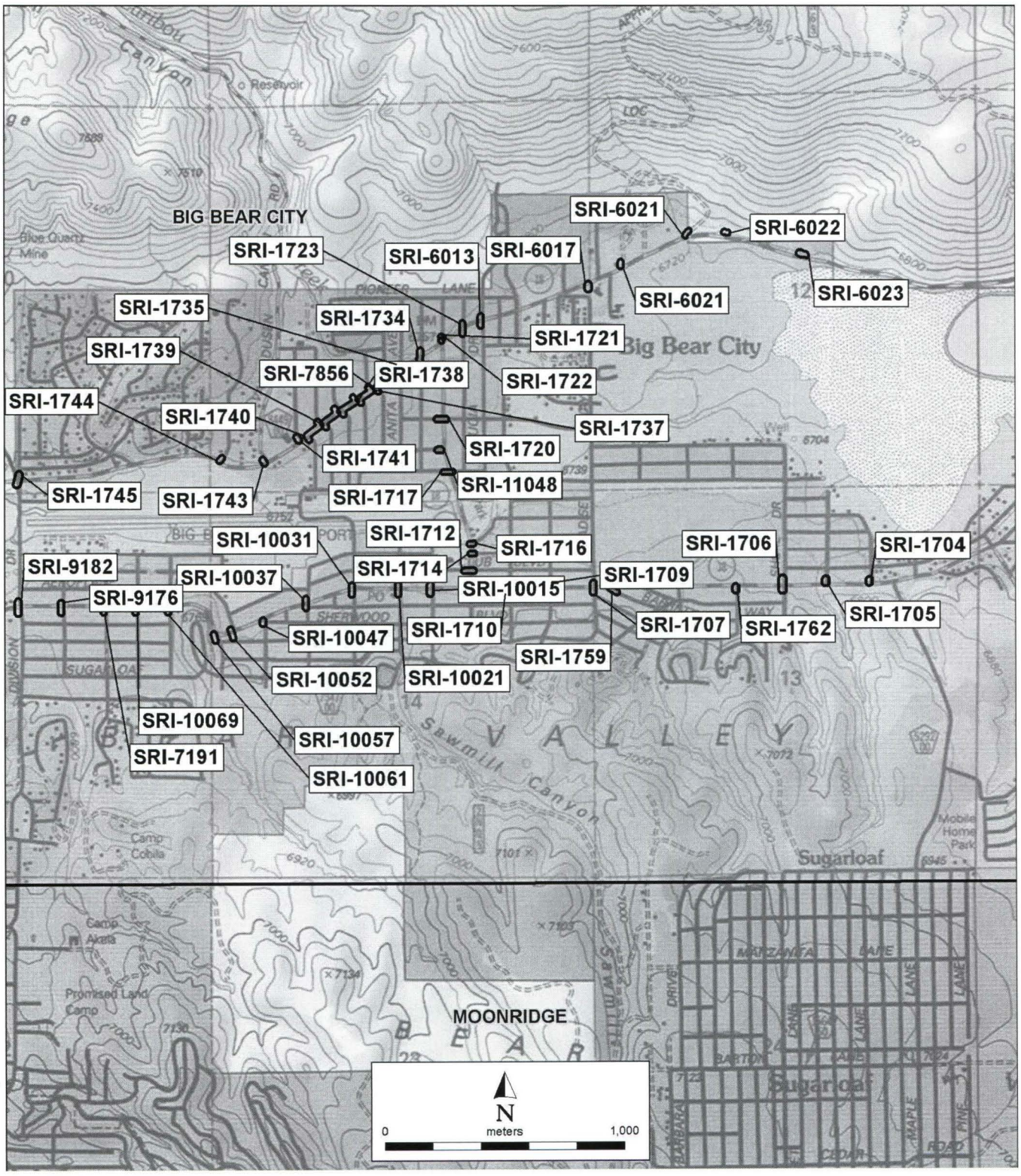
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1710

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

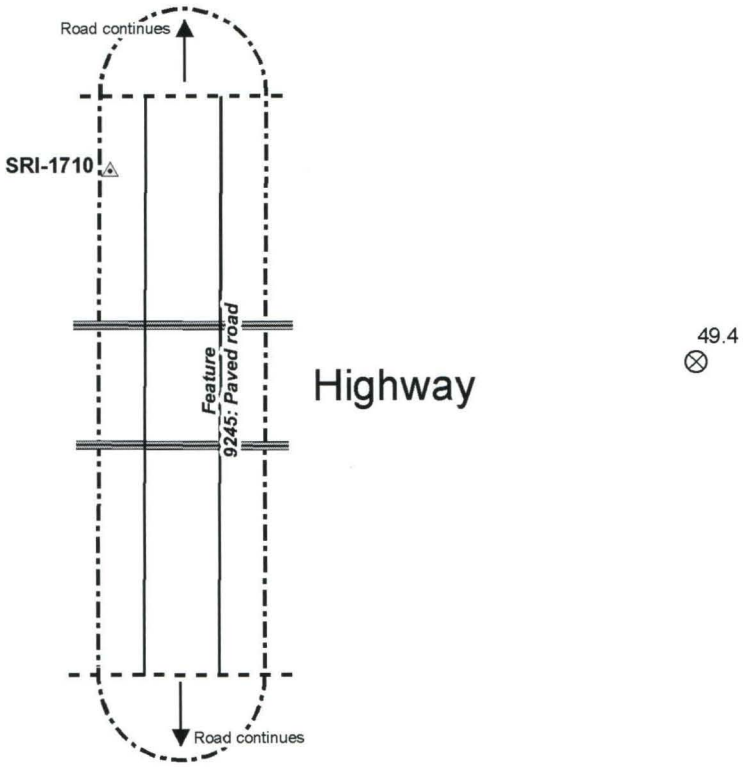
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1710

*Drawn By: J. Lev-Tov

*Date: 07/08/2011



*Required Information

P2b. Legal description
T 2N R 1E; SE¼ of NE¼ of Sec 14; SBBM

P2d. UTM
Zone 11; 514460 mE/ 3790943 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

SCHAFER FAMILY TRUST (07-13-04)
3617 N BELLFLOWER BLVD
LONG BEACH, CA

A1. Method of determination
pavement for Mount Doble Drive. The site boundary is also determined in part by the right-of-way established by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded.

L3. Description
The site appears on the 1947 Lucerne Valley 15-minute topographic quad map. No artifacts were associated with the site.

3/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

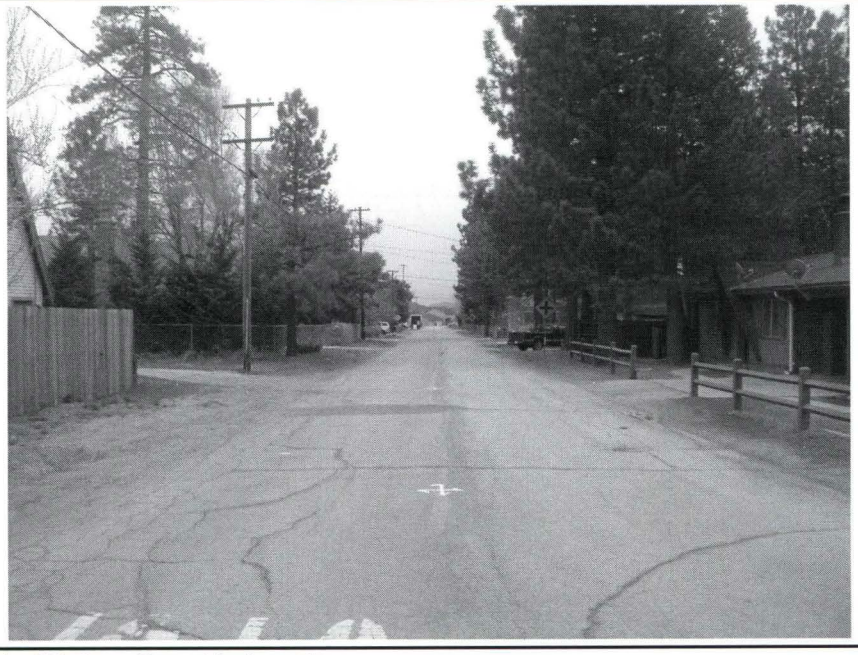
Primary # 36-024059
HRI #
Trinomial CA-SBR-15244 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

 *Resource Name or #: SRI-1720

P1. Other Identifier: SRI-1720
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SW¼ of SE¼ of Sec. 11; SBBM
c. Address:
d. UTM: Zone 11; 514182 mE/ 3791625 mN NAD27 GPS
e. Other Locational Data:
Arbor Lane meets and crosses Highway 38 near postmile 54.35 within Big Bear City's northern section.

*P3a. Description:
This site is a two-lane, asphalt-paved street oriented east to west called Arbor Lane. This road intersects Highway 38 from both sides. At this intersection, the road features white painted stop lines and the word "STOP" on the asphalt. The shoulders are sandy/dirty on both sides of the road at its intersection with Highway 38. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded.The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No artifacts were encountered associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



*P5b. Description of Photo:
Facing E; 4/8/2011; arbor lane

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
ANDERSON, ARTHUR J, PO BOX 2317
BIG BEAR CITY CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 7/8/2011

*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-1720

*A1. Dimensions: a. Length 53 m (E/W) x b. Width 14 m (N/S)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The measured boundary and limits of pavement created highly reliable boundaries.
Limitations: ☐ Restricted access ☐ Paved/built over ☐ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The only feature is a two-lane, asphalt-paved street (Feature 9266) oriented east to west called Arbor Lane. This road intersects Highway 38 from both sides. At this intersection, the road features white painted stop lines and the word "STOP" on the asphalt. The shoulders are sandy/dirty on both sides of the road at its intersection with Highway 38. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded.The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No artifacts were encountered associated with this site.

*A5. Cultural Constituents:
No artifacts were encountered associated with this site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☐ Good ☑ Fair ☐ Poor
The pavement has been adversely affected by weathering, which has cracked it extensively. Also, a repair necesssitated by uilities trenching has left a scar down the road's southern side.

*A8. Nearest Water: The nearest water to this site is Big Bear Lake, located approximately 2 miles from the road.

*A9. Elevation: 2058 m amsl

A10. Environmental Setting:
The site is within Bear Valley in the San Bernardino Mountains. The topography is mainly flat, and vegetation consists of a mix of planted conifers, hardwoods, grass and vines.

A11. Historical Information:
The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☑ Undetermined

A13. Interpretations:
Arbor Lane is strcitly a residential road, with modest homes lining both sides of it.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 7/8/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1720

L1. Historic and/or Common Name: Arbor Lane

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 9266

L2b. Location of Point or Segment:
Zone 11; 514162 mE/ 3791625 mN NAD27 GPS
Zone 11; 514201 mE/ 3791625 mN NAD27 GPS

L3. Description:
The only feature is a two-lane, asphalt-paved street (Feature 9266) oriented east to west called Arbor Lane. This road intersects Highway 38 from both sides. At this intersection, the road features white painted stop lines and the word "STOP" on the asphalt. The shoulders are sandy/dirty on both sides of the road at its intersection with Highway 38. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded.The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No artifacts were encountered associated with this site.

L4. Dimensions:
a. Top Width: 8.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 35.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The site is within Bear Valley in the San Bernardino Mountains. The topography is mainly flat, and vegetation consists of a mix of planted conifers, hardwoods, grass and vines.

L7. Integrity Considerations:
The pavement has been adversely affected by weathering, which has cracked it extensively. Also, a repair necesssitated by uilities trenching has left a scar down the road's southern side.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 7/8/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1720

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
4/8/2011		3250	arbor lane	E	
4/8/2011		3251	arbor lane	W	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

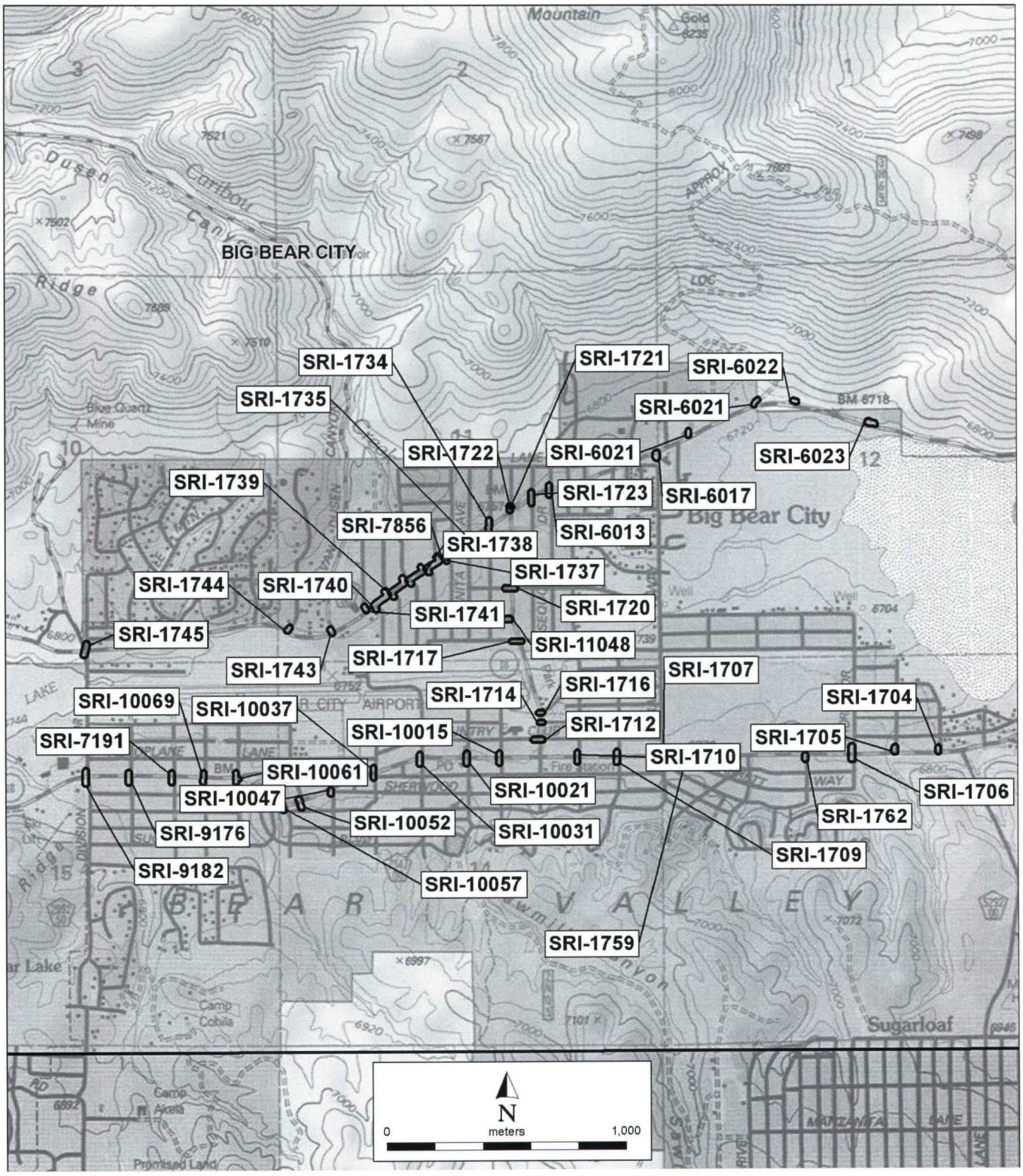
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1720

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

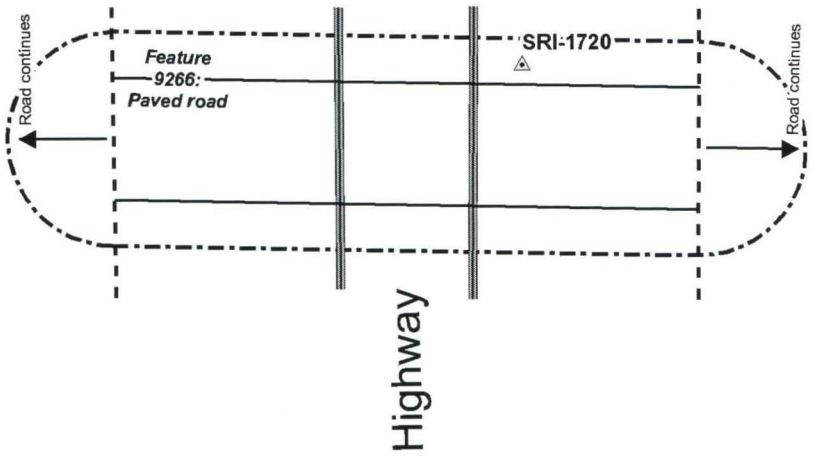
SKETCH MAP

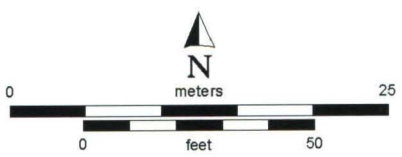
Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1720

*Drawn By: J. Lev-Tov

*Date: 07/08/2011





Site datum
Postmile
Edge of pavement
Edge of right of way
Site boundary

*Required Information

P2d. UTM
Zone 11; 514201 mE/ 3791625 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

MUNOZ, RONALD A
P.O. BOX 302
FAWNSKIN, CA

ROWE, STEPHEN C
P O BOX 244
SURFSIDE, CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

7/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 36-024547
HRI #
Trinomial CA-SBR-13588 H
NRHP Status Code
Other Listings
Review Code _____ Reviewer _____ Date _____

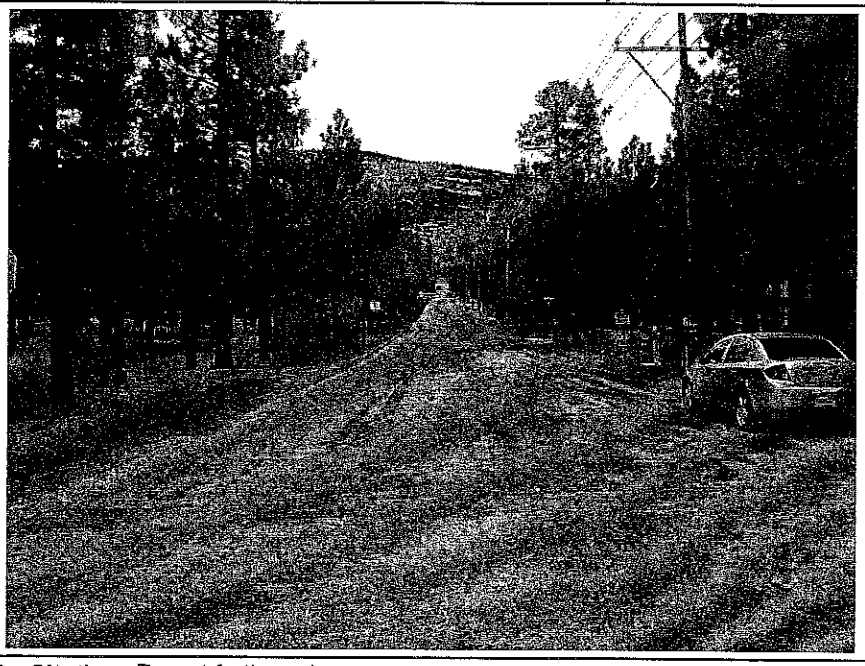
 *Resource Name or #: SRI-1706

P1. Other Identifier: SRI-1706
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NW¼ of NE¼ of Sec. 13; SBBM
c. Address:
d. UTM: Zone 11; 515606 mE/ 3790938 mN NAD27 GPS
e. Other Locational Data:
Shore Drive is located in Big Bear City, at postmile 48.7 along Highway 38.

*P3a. Description:
The only feature associated with this site consists of an asphalt-paved, historical-period road that is wide enough for a single lane of traffic to pass in each direction. White paint on the asphalt at the junction with the highway delinates the stop point. The asphalt is generally in good condition, although a few cracks are apparent, and the pavement has faded as well. The road, known as Shore Drive, is a north-to-south-oriented residential street in Big Bear City, which leads from Highway 38 to the shore of the former (now largely dry) Lake Baldwin. Shore Drive is located on both sides of Highway 38.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐Building ☐Structure ☐Object ☑Site ☐District ☐Element of District ☐Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 4/8/2011; Shore Drive

*P6. Date Constructed/Age & Sources:
☑Historic ☐Prehistoric ☐Both

*P7. Owner and Address:
ADAMS, CAROL A SEPARATE PROP
TR 3/2/, 14681 SWEETAN ST
IRVINE CA 92604

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 5/3/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Primary # _____
Trinomial _____

ARCHAEOLOGICAL SITE RECORD

*Resource Name or #: SRI-1706

*A1. Dimensions: a. Length 65 m (N/S) x b. Width 18 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: Because the site was well-maintained with proper signage, the site boundaries were readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:

The only feature associated with this site consists of an asphalt-paved, historical-period road (Feature 8631) wide enough for a single lane of traffic to pass in each direction. White paint on the asphalt at the junction with the highway delineates the stop point. The asphalt is generally in good condition, although a few cracks are apparent, and the pavement has faded as well. The road, known as Shore Drive, is a north-to-south-oriented residential street in Big Bear City, which leads from Highway 38 to the shore of the former (now largely dry) Lake Baldwin. Shore Drive is located on both sides of Highway 38.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No cultural material is associated with this site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☐ Good ☑ Fair ☐ Poor

The effects of weathering are, however, apparent in that a few cracks are visible in the asphalt.

*A8. Nearest Water: Big Bear Lake, the nearest water source, is located approximately 2 miles from this road.

*A9. Elevation: 2060 m amsl

A10. Environmental Setting:

This site is set within the Bear Valley, a deep valley in the San Bernardino Mountains. The road slopes to the north, while to its south, across the highway, a hill rises up. To the site's immediate west is a wooded area with numerous pine trees, grass, and shrubs.

A11. Historical Information:

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

None

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 5/3/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1706

L1. Historic and/or Common Name: Shore Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 8631

L2b. Location of Point or Segment:
Zone 11; 515606 mE/ 3790914 mN NAD27 GPS
Zone 11; 515606 mE/ 3790961 mN NAD27 GPS

L3. Description:
The only feature associated with this site consists of an asphalt-paved, historical-period road (Feature 8631) wide enough for a single lane of traffic to pass in each direction. White paint on the asphalt at the junction with the highway delineates the stop point. The asphalt is generally in good condition, although a few cracks are apparent, and the pavement has faded as well. The road, known as Shore Drive, is a north-to-south-oriented residential street in Big Bear City, which leads from Highway 38 to the shore of the former (now largely dry) Lake Baldwin. Shore Drive is located on both sides of Highway 38.

The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad. The current project only examines the

L4. Dimensions:
- **a. Top Width:** 12.00 m
- **b. Bottom Width:** N/A
- **c. Height or Depth:** None
- **d. Length of Segment:** 50.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
This site is set within the Bear Valley, a deep valley in the San Bernardino Mountains. The road slopes to the north, while to its south, across the highway, a hill rises up. To the site's immediate west is a wooded area with numerous pine trees, grass, and shrubs.

L7. Integrity Considerations:
The effects of weathering are, however, apparent in that a few cracks are visible in the asphalt.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 5/3/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1706

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
5/13/2011		1085	Shore Drive	S	
5/13/2011		1084	Shore Drive	N	
4/8/2011		3237	Shore Drive	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

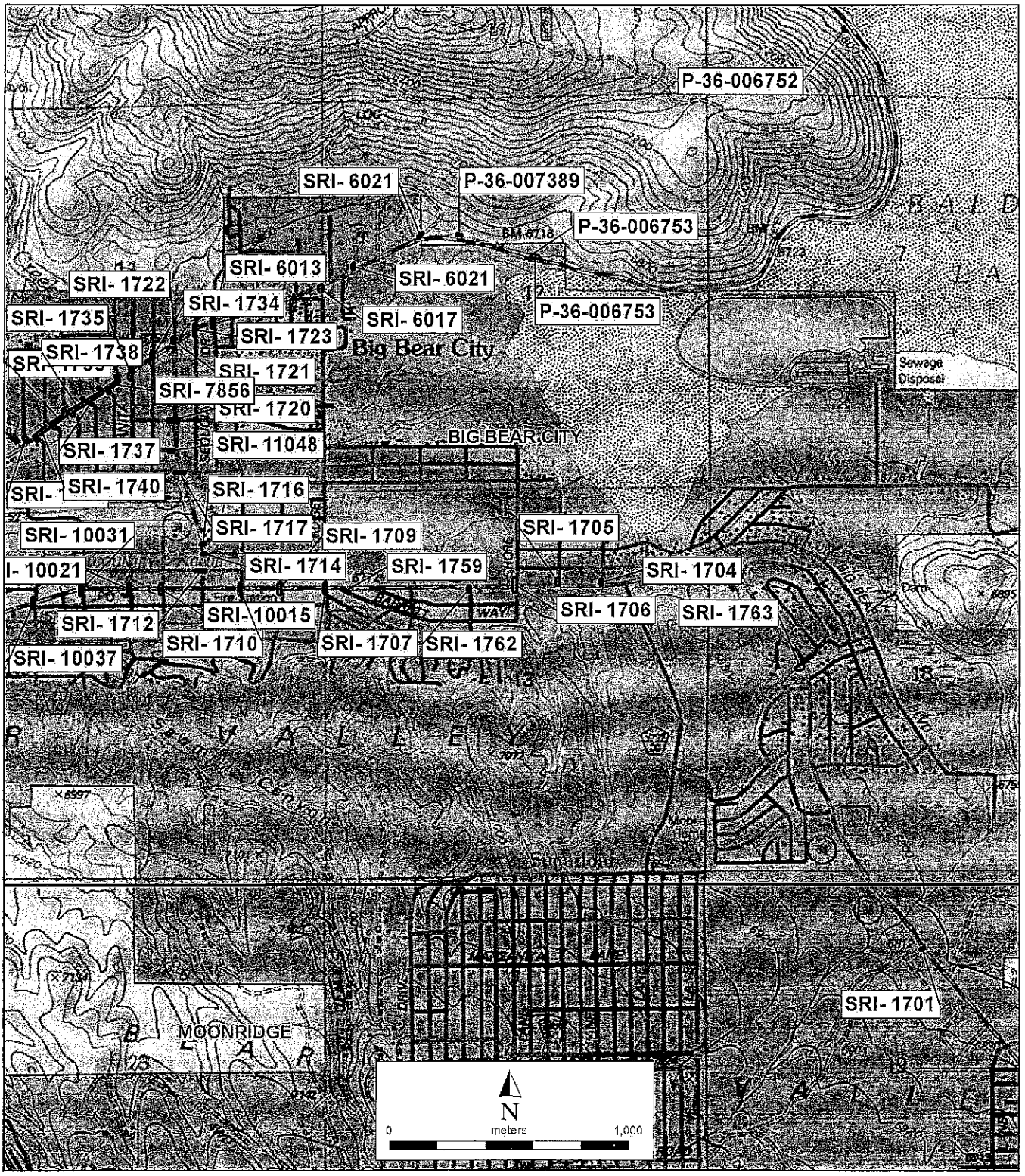
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1706

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

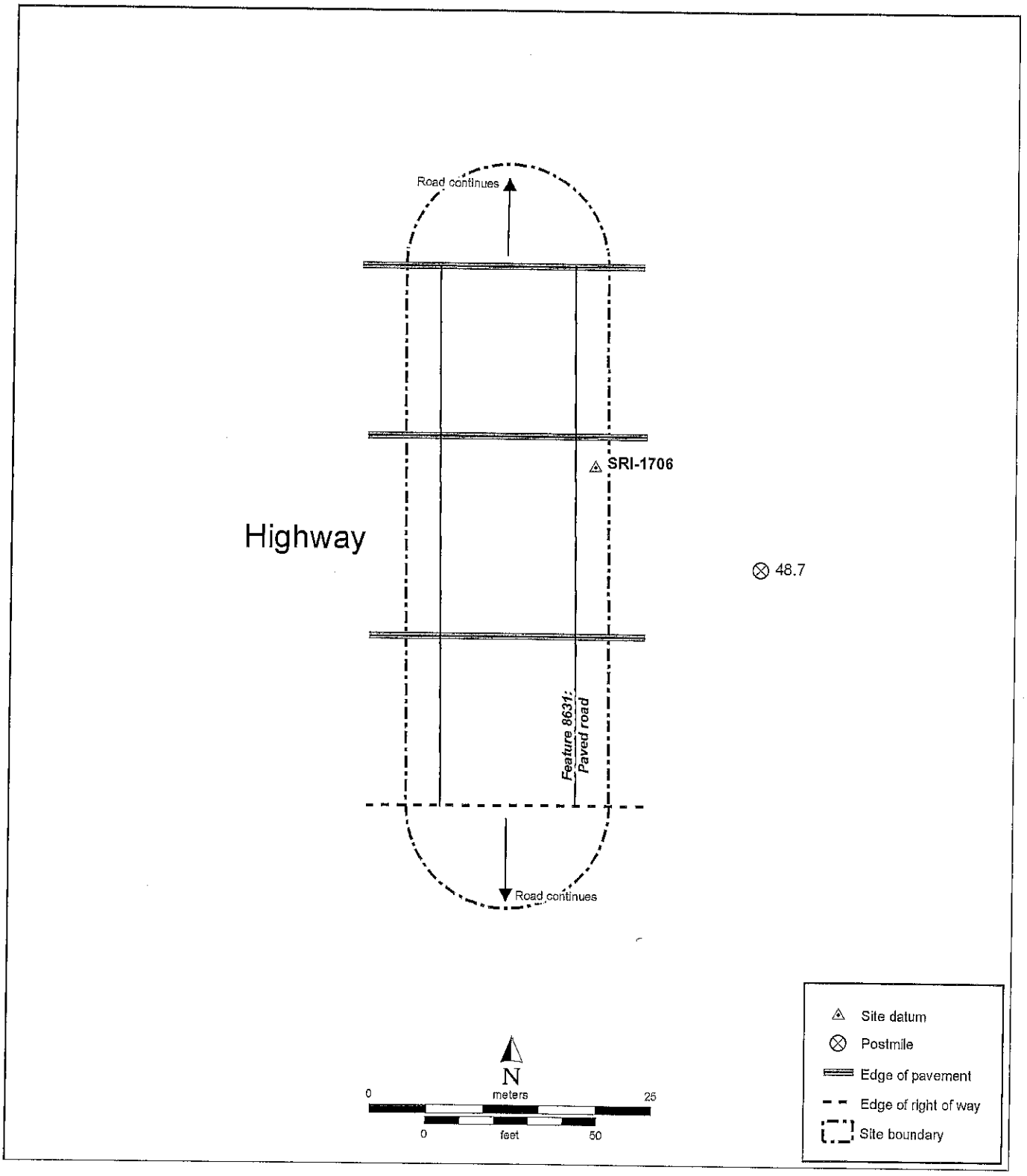
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-1706

*Drawn By: J. Lev-Tov

*Date: 05/03/2011



*Required Information

P2b. Legal description
T 2N R 1E; SW¼ of NE¼ of Sec 13; SBBM

P2d. UTM
Zone 11; 515606 mE/ 3790961 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

RCK PROPERTIES INC
P O BOX 1287
NORTHBROOK, IL

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

STASSI REV FAMILY TRUST 09/18/05
6246 MONITA ST
LONG BEACH CA 90803

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site was identified on the Lucerne Valley (1947) 15-minute USGS topographic quad.

L3. Description
first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

7/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 36-024556
HRI #
Trinomial CA-SBR-15597H
NRHP Status Code
Other Listings
Review Code _____ Reviewer _____ Date _____

 *Resource Name or #: SRI-9176

P1. Other Identifier: SRI-9176
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SW¼ of NE¼ of Sec. 15; SBBM
c. Address:
d. UTM: Zone 11; 512582 mE/ 3790846 mN NAD27 GPS
e. Other Locational Data:
This road is located within Big Bear City at postmile 52.8.

*P3a. Description:
This site is a two-lane, paved, historical-period road called Gildart Drive. The road intersects with Highway 18. Although no center lines are painted on the road surface, the word "Stop" and a line appears in white at both the north and southbound intersections with Highway 18. This site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing S; 8/11/2011; Gildart Drive S

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
DE BOER REV FAM TR 7-19-88, P O BOX 3440
BIG BEAR CITY CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 7/5/2011

*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

 *Required Information

ARCHAEOLOGICAL SITE RECORD

*A1. Dimensions: a. Length 53 m (N/S) x b. Width 14 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: In addtion to the limits of the asphalt pavement, the boundaries were ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The site is easily discernable because road is paved and well maintained.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The only feature associated with this site is a two-lane, paved, historical-period road called Gildart Drive (Feature 9181). The road intersects with Highway 18. Although no center lines are painted on the road surface, the word "Stop" and a line appears in white at both the north and southbound intersections with Highway 18. This site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No artifacts were observed.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
The site does not appear to have been disturbed other than by repaving, which covered or destroyed historical-period road surfaces.

*A8. Nearest Water: The nearest water is a small drainage ditch on Gildart Drive's eastern side, parallel to the road.

*A9. Elevation: 2064 m amsl

A10. Environmental Setting:
The road is situated in the Bear Valley depression within the San Bernardino Mountains. Vegetation is mainly planted coniferous trees such as Ponderosa pines, along with nonnative grass. The topography consists of a gentle slope running down to the north.

A11. Historical Information:
This road appears on the Lucerne Valley 1947 USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
This is a short and primarily residential road used to access full-time homes and seasonal cabins, as well as a few businesses located at or near to the juncition with Highway 18.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 7/5/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-9176

L1. Historic and/or Common Name: Gildart Drive'

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 9181

L2b. Location of Point or Segment:
Zone 11; 512582 mE/ 3790866 mN NAD27 GPS
Zone 11; 512583 mE/ 3790826 mN NAD27 GPS

L3. Description:
The only feature associated with this site is a two-lane, paved, historical-period road called Gildart Drive (Feature 9181). The road intersects with Highway 18. Although no center lines are painted on the road surface, the word "Stop" and a line appears in white at both the north and southbound intersections with Highway 18. This site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 9.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 15.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The road is situated in the Bear Valley depression within the San Bernardino Mountains. Vegetation is mainly planted coniferous trees such as Ponderosa pines, along with nonnative grass. The topography consists of a gentle slope running down to the north.

L7. Integrity Considerations:
The site does not appear to have been disturbed other than by repaving, which covered or destroyed historical-period road surfaces.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 7/5/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9176

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
8/11/2011		0	Gildart Drive N	N	
8/11/2011		0	Gildart Drive S	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

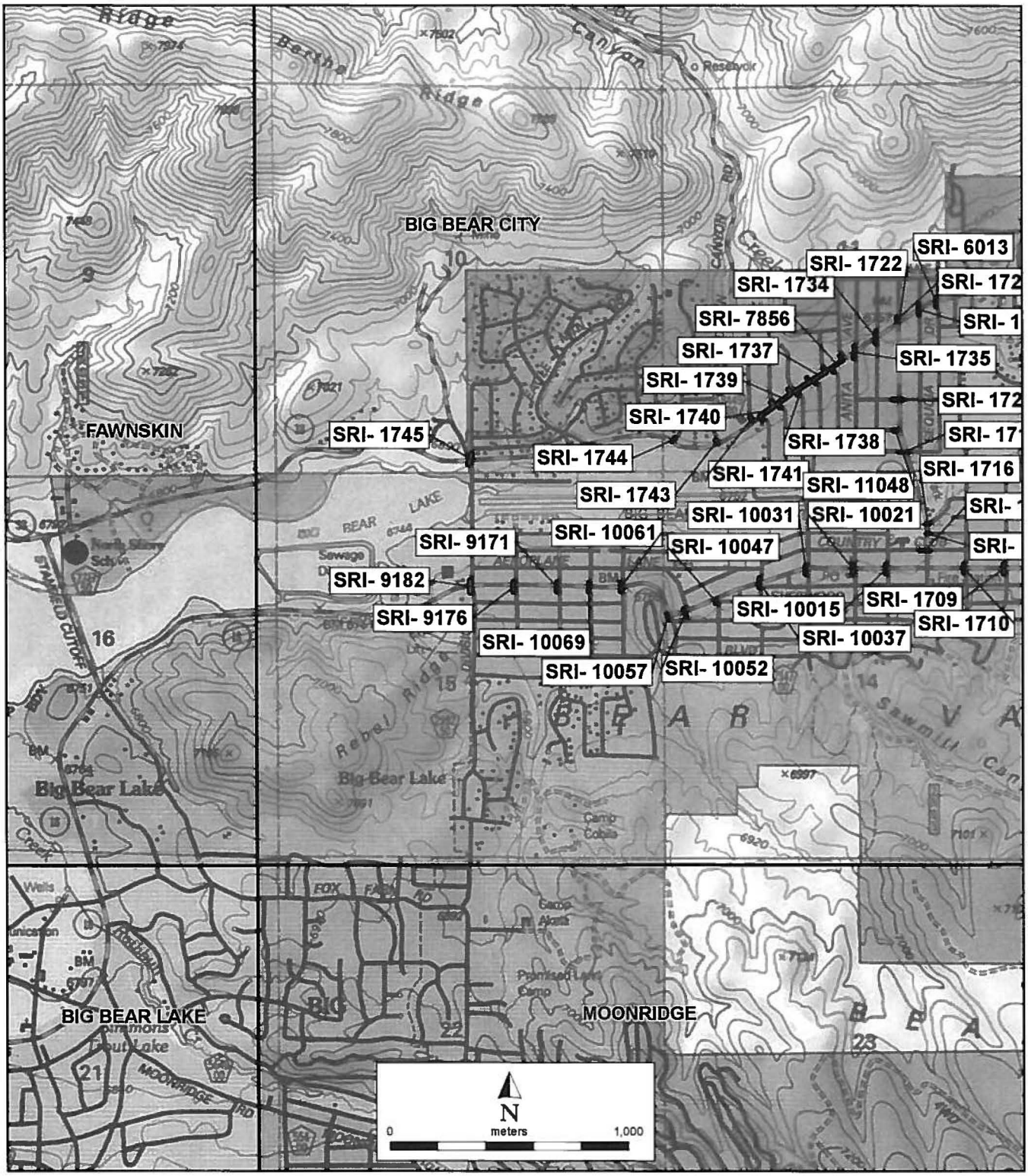
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9176

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

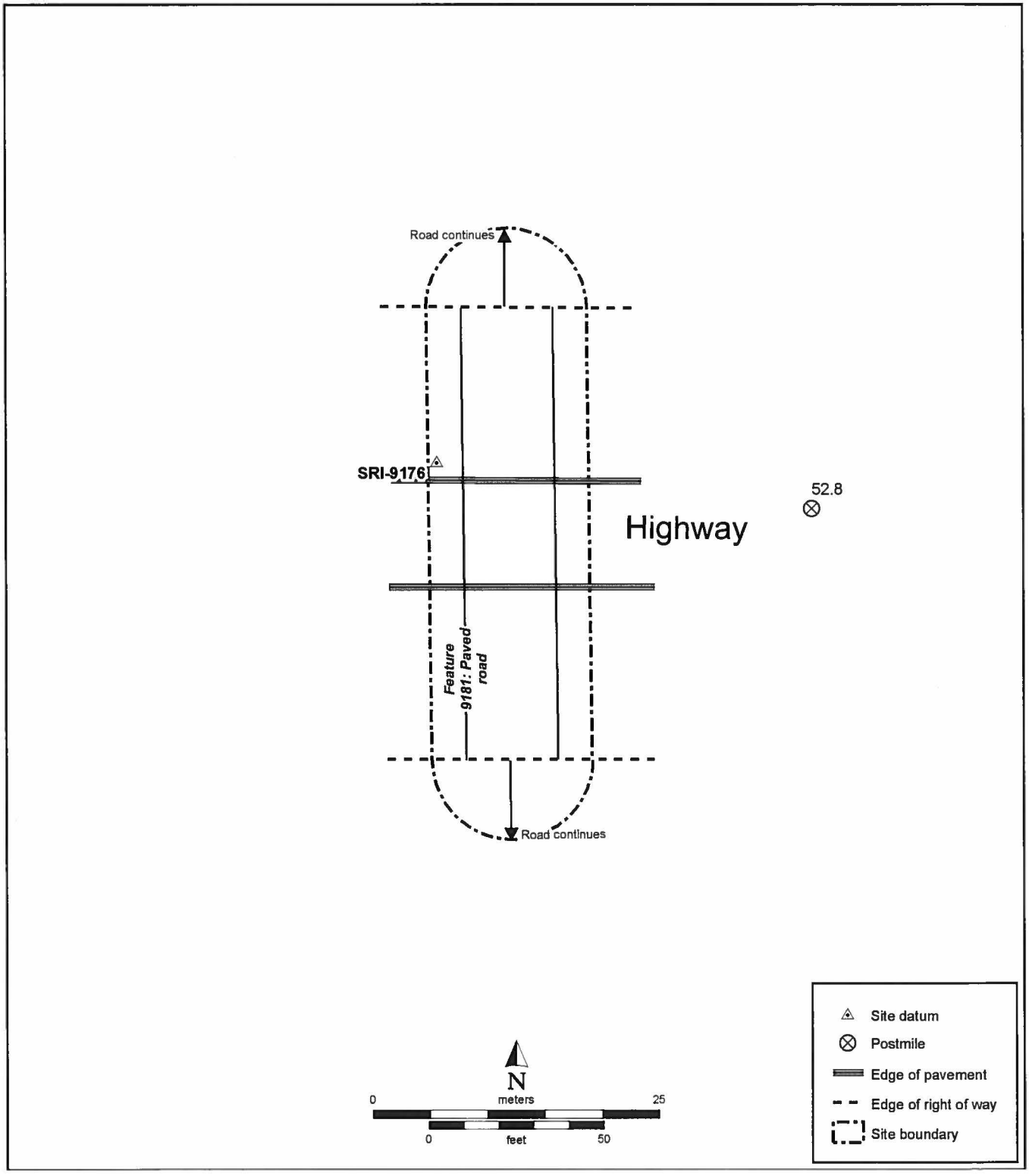
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-9176

*Drawn By: J. Lev-Tov

*Date: 07/05/2011



*Required Information

P2d. UTM
Zone 11; 512583 mE/ 3790826 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

FISHER, KEN
PO BOX 7127
BIG BEAR LAKE CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
determined by the 15-meter Caltrans right-of-way from the edge of the pavement.

36-024557

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # 36-024557
HRI #
Trinomial CA-SBR-15598H
NRHP Status Code
Other Listings
Review Code Reviewer Date

*Resource Name or #: SRI-10015

P1. Other Identifier: SRI-10015
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NW¼ of NE¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 514133 mE/ 3790921 mN NAD27 GPS
e. Other Locational Data:
This road intersects Highway 18 in Big Bear City at postmile 53.81, and exists on both sides of the highway.

*P3a. Description:
The site consists of a paved, two-lane road called Rose Hill Drive. This road is oriented north to south and intersects Highway 38 from both sides. Although there are not center lines on the road surface, the word "Stop" is painted in white at the intersection of the road and Highway 18. The road provides access to several modest residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way,but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing N; 6/9/2011; Rose Hill Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
LARSON, CLARDON E, P O BOX 621
BIG BEAR CITY CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Primary # _____
Trinomial _____

ARCHAEOLOGICAL SITE RECORD

 *Resource Name or #: SRI-10015

*A1. Dimensions: a. Length 51 m (N/S) x b. Width 13 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: As a paved road, the boudnaries of this site were clear and discernable from surroundings.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The site consists of a paved, two-lane road called Rose Hill Drive (Feature 10016). This road is oriented north to south and intersects Highway 38 from both sides. Although there are not center lines on the road surface, the word "Stop" is painted in white at the intersection of the road and Highway 18. The road provides access to several modest residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way,but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No cultural material is associated with this site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
No disturbances are readily apparent.

*A8. Nearest Water: The nearest water to this site is Big Bear Lake, located approximately 1800 meters west of the site.

*A9. Elevation: 2061 m amsl

A10. Environmental Setting:
The setting of this site is within a large basin in the San Bernardino Mountains, which features two natural lakes. The environment is more like high desert than mountain forest, however. This is due to the fact that the basin of Bear Valley sits on the northern side of the mountains, in a rain shadow. Vegetation in this urban area is entirely planted, and consists of conifers, grass and birch trees.

A11. Historical Information:
The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
Rose HIll Drive is a residential street leading to modest homes in Big Bear City. The houses visible from Highway 18 do not appear older than the 1950's or, at earliest, 1940's.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 ***Resource Name or #:** SRI-10015

L1. Historic and/or Common Name: Rose Hill Drive
L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10016
L2b. Location of Point or Segment:
Zone 11; 514133 mE/ 3790902 mN NAD27 GPS
Zone 11; 514133 mE/ 3790940 mN NAD27 GPS

L3. Description:
The site consists of a paved, two-lane road called Rose Hill Drive (Feature 10016). This road is oriented north to south and intersects Highway 38 from both sides. Although there are not center lines on the road surface, the word "Stop" is painted in white at the intersection of the road and Highway 18. The road provides access to several modest residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way,but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 8.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m
L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The setting of this site is within a large basin in the San Bernardino Mountains, which features two natural lakes. The environment is more like high desert than mountain forest, however. This is due to the fact that the basin of Bear Valley sits on the northern side of the mountains, in a rain shadow. Vegetation in this urban area is entirely ...

L7. Integrity Considerations:
No disturbances are readily apparent.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10015

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/9/2011		3644	Rose Hill Drive	N	
6/9/2011		3645	Rose Hill Drive	S	

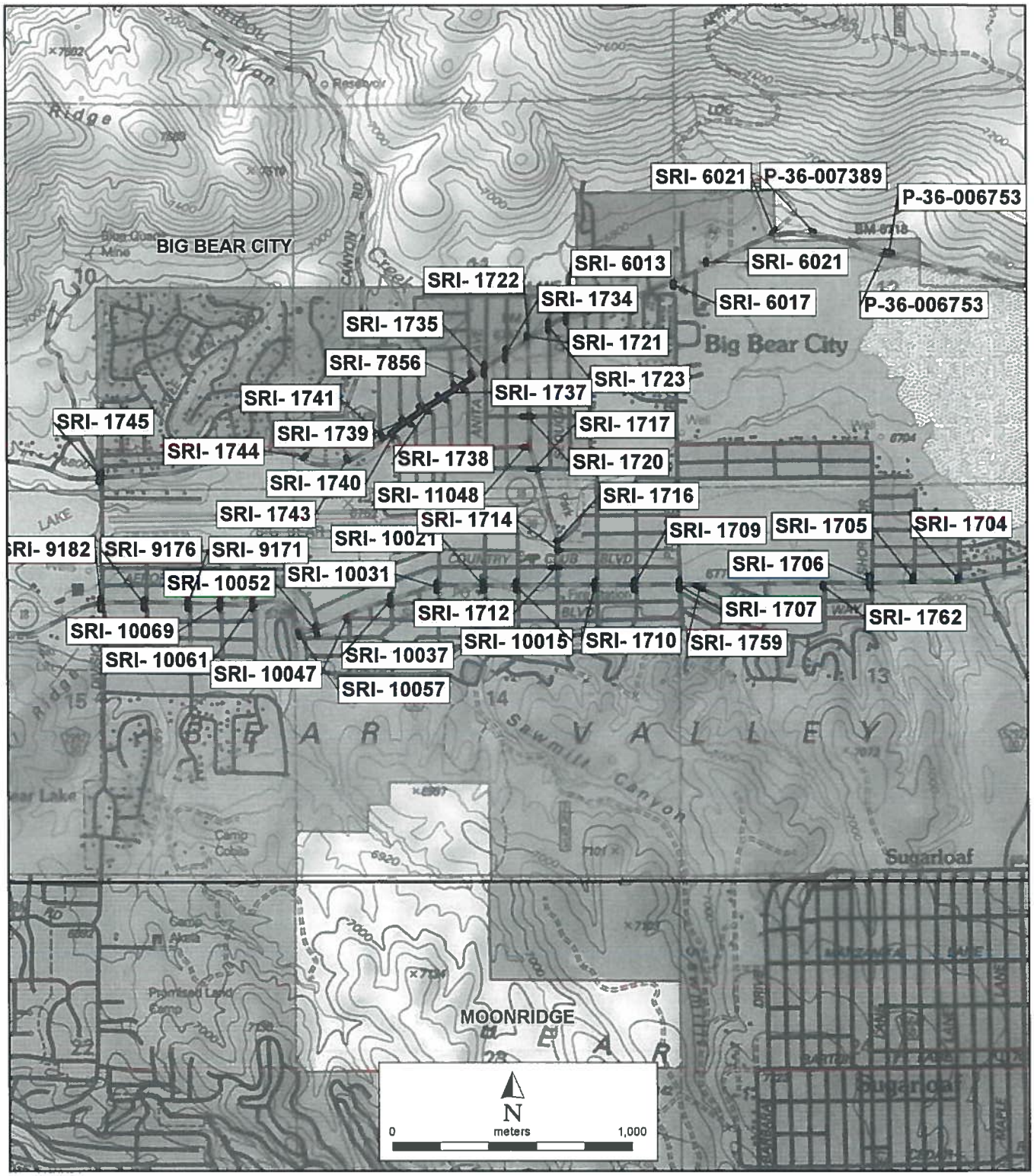
State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10015

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



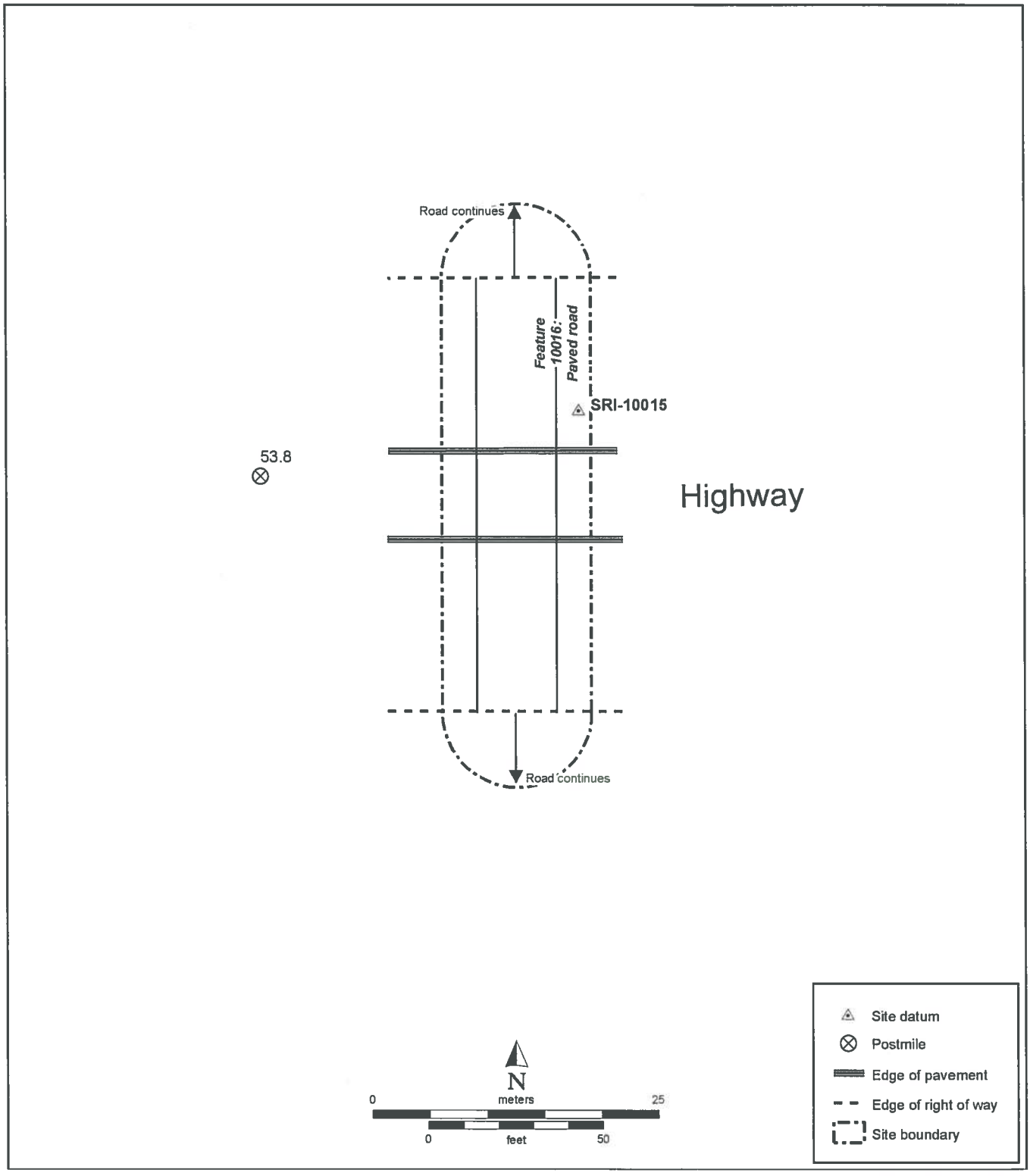
*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10015

*Drawn By: J. Lev-Tov *Date: 06/09/2011



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # _____
HRI # _____
Trinomial _____

 ***Resource Name or #:** SRI-10015

***Recorded By:** J. Lev-Tov ***Date:** 6/9/2011 ☑ Continuation ☐ Update

P2b. Legal description
T 2N R 1E; SW¼ of NE¼ of Sec 14; SBBM

P2d. UTM
Zone 11; 514133 mE/ 3790940 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

MORGAN FAMILY TRUST 6/4/05
3711 N HARBOR BLVD #A-1
FULLERTON CA 92835

RACHELS, KAREN S LV TR 12-13-05
P O BOX 894
BIG BEAR CITY CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

L6. Setting
planted, and consists of conifers, grass and birch trees.

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 36-024558
HRI #
Trinomial CA-SBR-15594 H
NRHP Status Code
Other Listings
Review Code _____ Reviewer _____ Date _____

 *Resource Name or #: SRI-10021

P1. Other Identifier: SRI-10021
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NE¼ of NW¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 513998 mE/ 3790920 mN NAD27 GPS
e. Other Locational Data:
Saw Mill Road intersects both sides of Highway 18 in Big Bear City, at postmile 53.7.

*P3a. Description:
The site consists of a two-lane paved road called Saw Mill Drive. The road is oriented north to south and intersects Highway 18 from both sides. The road is wider at its southern portion than its northern one, no doubt in order to accommodate fire engines from the Big Bear City Fire Department facility on the northwest corner of Saw Mill Drive and Highway 18. Although no traffic lines appear on the road, the intersection of Saw Mill Drive and Highway 18 features a white painted stop line and the word "Stop." The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing S; 6/9/2011; Saw Mill Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
BELL GARDENS FINANCIAL GROUP, LLC, P O BOX 79542
LOS ANGELES CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-10021

*A1. Dimensions: a. Length 52 m (N/S) x b. Width 14 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: This paved road, in addition to the Caltrans boundary, made for clear site boundaries.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The site consists of a two-lane paved road called Saw Mill Drive (Feature 10022). The road is oriented north to south and intersects Highway 18 from both sides. The road is wider at its southern portion than its northern one, no doubt in order to accommodate fire engines from the Big Bear City Fire Department facility on the northwest corner of Saw Mill Drive and Highway 18. Although no traffic lines appear on the road, the intersection of Saw Mill Drive and Highway 18 features a white painted stop line and the word "Stop." The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No cultural material is associated with this site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
No disturbances were readily apparent.

*A8. Nearest Water: The nearest water to this site is Big Bear Lake, located approximately 1800 meters west of the site.

*A9. Elevation: 2063 m amsl

A10. Environmental Setting:
The environment of this road is the Bear Valley, a mountain basin in the San Bernardino Mountains. The environment is dry, however, due to the valley's location on the north sie of the mountains, in a rain shadow. Vegetation is planted, and consists of numerous imported and local shrubs and trees, including Ponderosa pine trees.

A11. Historical Information:
The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
None

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10021

L1. Historic and/or Common Name: Saw Mill Road
L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10022
L2b. Location of Point or Segment:
Zone 11; 513998 mE/ 3790901 mN NAD27 GPS
Zone 11; 513998 mE/ 3790939 mN NAD27 GPS

L3. Description:
The site consists of a two-lane paved road called Saw Mill Drive (Feature 10022). The road is oriented north to south and intersects Highway 18 from both sides. The road is wider at its southern portion than its northern one, no doubt in order to accommodate fire engines from the Big Bear City Fire Department facility on the northwest corner of Saw Mill Drive and Highway 18. Although no traffic lines appear on the road, the intersection of Saw Mill Drive and Highway 18 features a white painted stop line and the word "Stop." The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The site ...

L4. Dimensions:
a. Top Width: 9.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m
L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The environment of this road is the Bear Valley, a mountain basin in the San Bernardino Mountains. The environment is dry, however, due to the valley's location on the north sie of the mountains, in a rain shadow. Vegetation is planted, and consists of numerous imported and local shrubs and trees, including Ponderosa pine trees.

L7. Integrity Considerations:
No disturbances were readily apparent.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10021

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

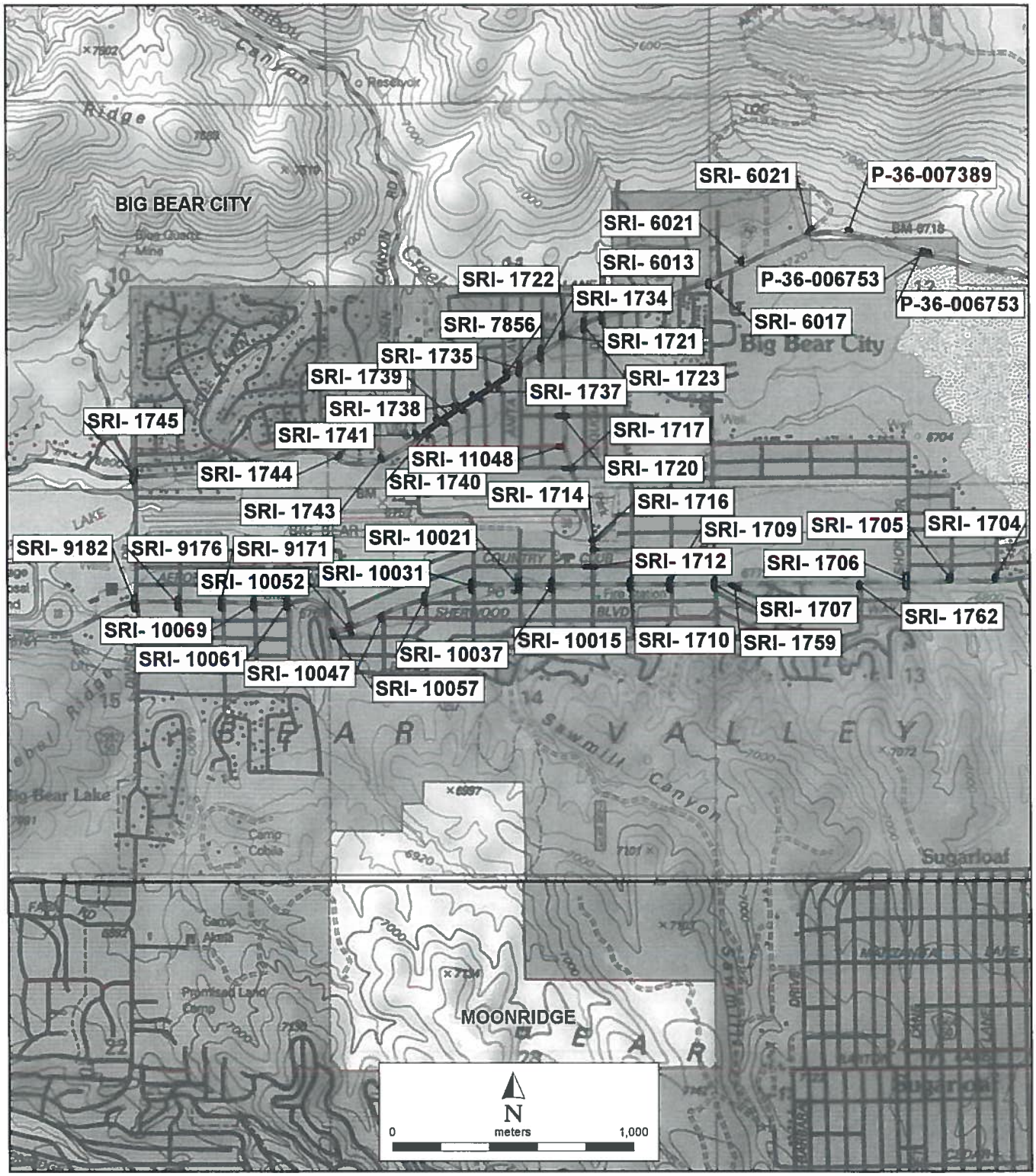
Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/9/2011		3647	Saw Mill Drive	N	
6/9/2011		3646	Saw Mill Drive	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10021

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000 *Year: 2009



 *Required Information

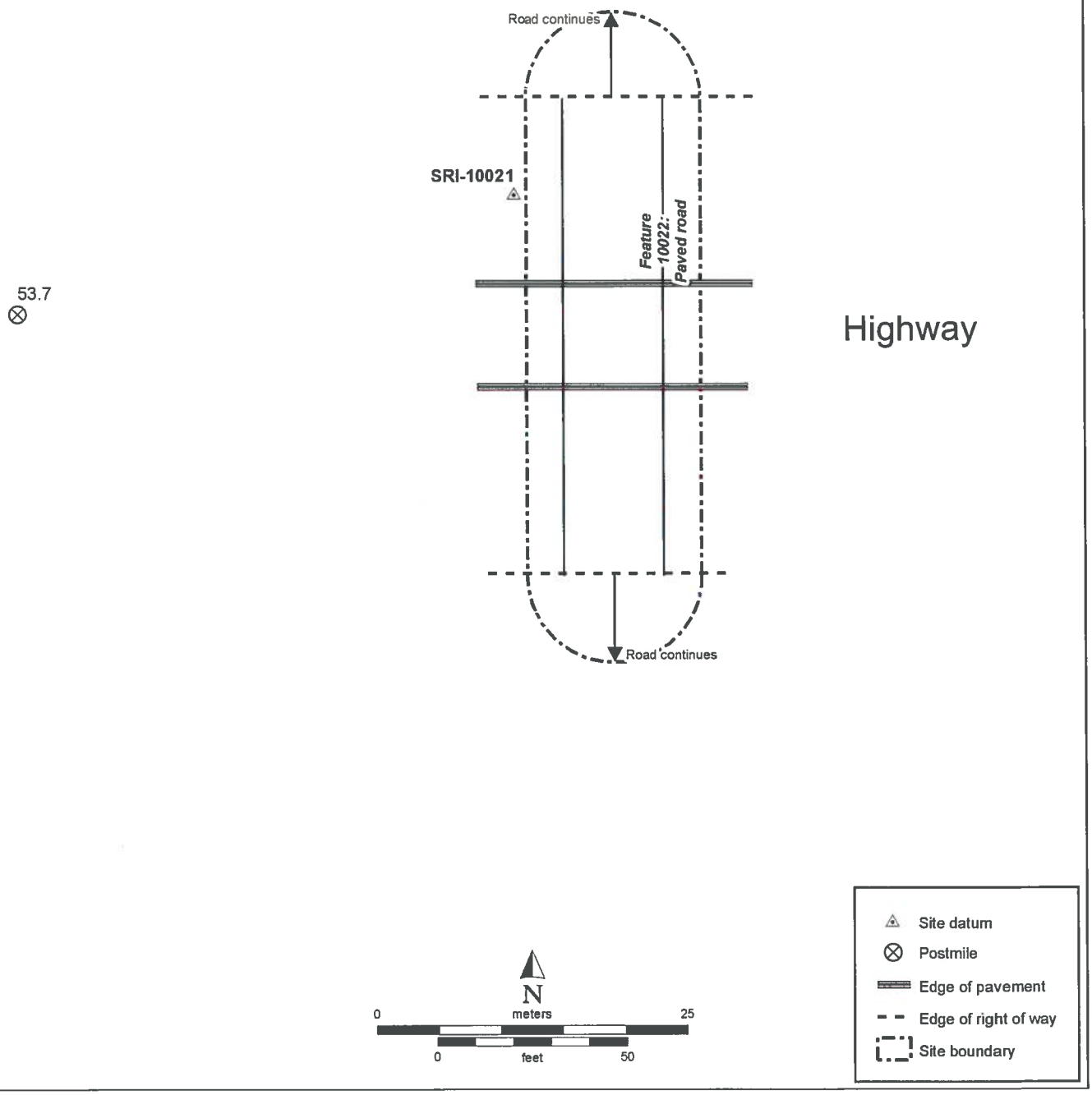
State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10021

*Drawn By: J. Lev-Tov

*Date: 06/09/2011



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10021

*Recorded By: J. Lev-Tov *Date: 6/9/2011 ☑ Continuation ☐ Update

P2b. Legal description
T 2N R 1E; NW¼ of NE¼ of Sec 14; SBBM
T 2N R 1E; SE¼ of NW¼ of Sec 14; SBBM
T 2N R 1E; SW¼ of NE¼ of Sec 14; SBBM

P2d. UTM
Zone 11; 513998 mE/ 3790939 mN NAD27 GPS

P7. Owner and Address

BIG BEAR CITY COMMUNITY SERVICES DIS
P O BOX 558
BIG BEAR CITY CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

L3. Description
appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

36-024559 1/2

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # 36-024559
HRI #
Trinomial CA-SBR-15600 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

*Resource Name or #: SRI-10031

P1. Other Identifier: SRI-10031
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, NE¼ of NW¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 513802 mE/ 3790918 mN NAD27 GPS
e. Other Locational Data:
This road is located within Big Bear City on both sides of Highway 18 at postmile 53.6.

*P3a. Description:
The site consists of a two-lane, paved road called Pinon Drive. This road is oriented north to south and intersects Highway 18 from both sides. Although no traffic lines appear on the pavement, the word "Stop" and a white line are painted on each side of the road's intersection with Highway 18. The road provides access to several residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing N; 6/9/2011; Pinon Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
ALFAJORA, FRANCISCO, P O BOX 6419
BIG BEAR LAKE, CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
Primary # _____
Trinomial _____

ARCHAEOLOGICAL SITE RECORD

 *Resource Name or #: SRI-10031

*A1. Dimensions: a. Length 50 m (N/S) x b. Width 12 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The boundaries of the site are clear and readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The site consists of a two-lane, paved road called Pinon Drive (Feature 10032). This road is oriented north to south and intersects Highway 18 from both sides. Although no traffic lines appear on the pavement, the word "Stop" and a white line are painted on each side of the road's intersection with Highway 18. The road provides access to several residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No artifacts were encountered.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
No disturbances were observed.

*A8. Nearest Water: The nearest water is Big Bear Lake, located approximately 1500 meters west of the site.

*A9. Elevation: 2061 m amsl

A10. Environmental Setting:
The site is located in Bear Valley in the San Bernardino Mountains. Vegetation is planted in pine trees predominately along with grasses and shrubs.

A11. Historical Information:
The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
Pinon Drive is a resitdential road, primarily, running north and south within Big Bear City.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 ***Resource Name or #:** SRI-10031

L1. Historic and/or Common Name: Pinon Drive
L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10032
L2b. Location of Point or Segment:
Zone 11; 513802 mE/ 3790899 mN NAD27 GPS
Zone 11; 513802 mE/ 3790937 mN NAD27 GPS

L3. Description:
The site consists of a two-lane, paved road called Pinon Drive (Feature 10032). This road is oriented north to south and intersects Highway 18 from both sides. Although no traffic lines appear on the pavement, the word "Stop" and a white line are painted on each side of the road's intersection with Highway 18. The road provides access to several residences in Big Bear City. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 8.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m
L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The site is located in Bear Valley in the San Bernardino Mountains. Vegetation is planted in pine trees predominately along with grasses and shrubs.

L7. Integrity Considerations:
No disturbances were observed.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10031

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/9/2011		3650	Pinon Drive	N	
6/9/2011		3651	Pinon Drive	S	

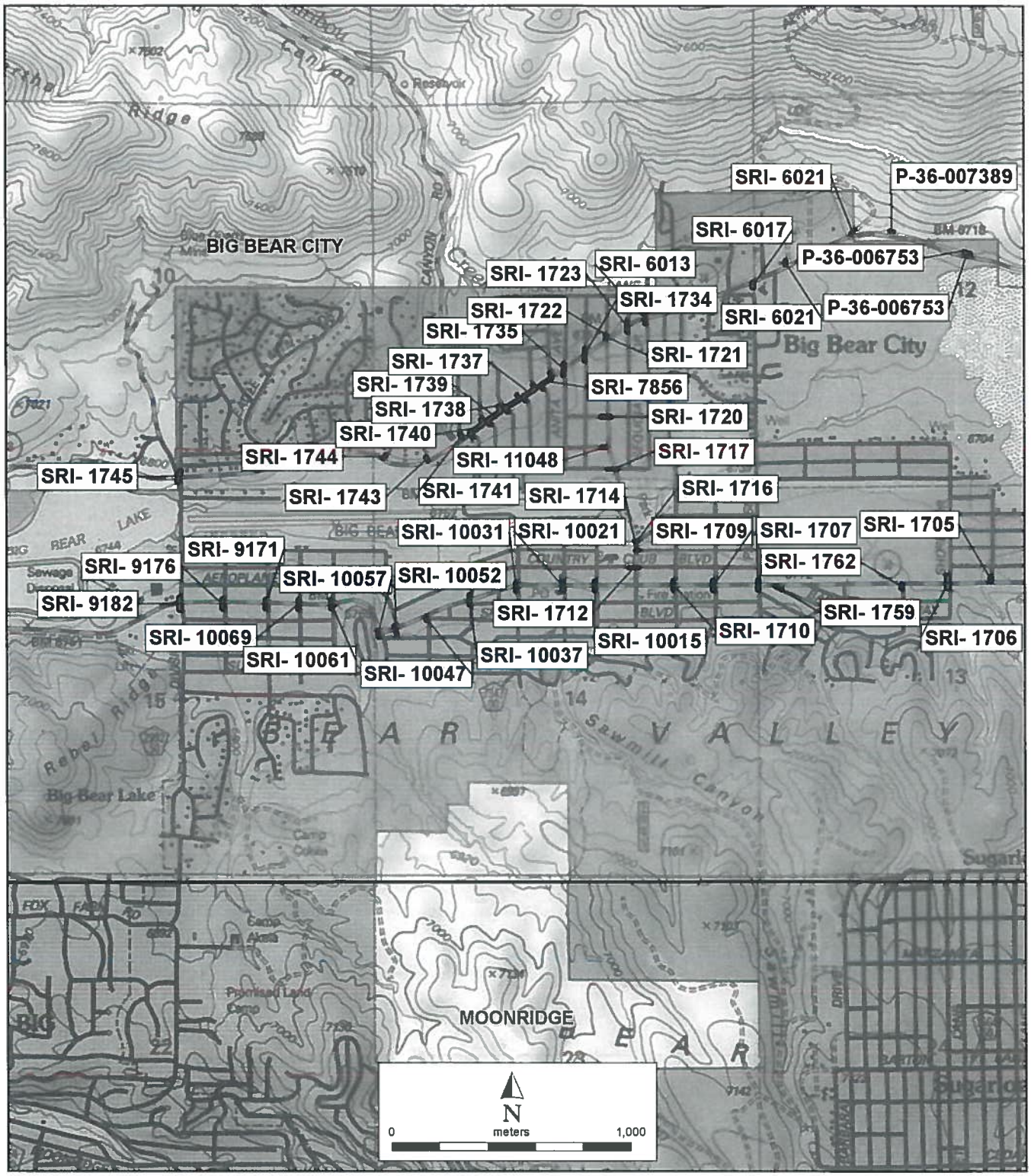
State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10031

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

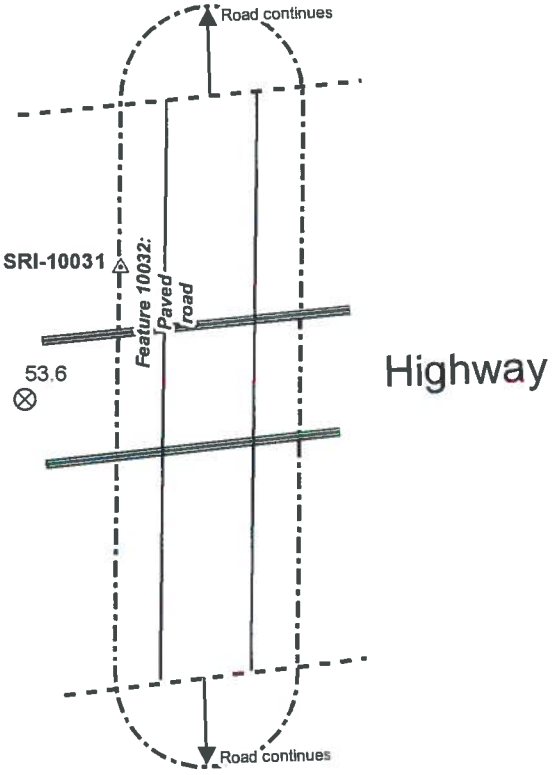
State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10031

*Drawn By: J. Lev-Tov

*Date: 06/09/2011



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10031

*Recorded By: J. Lev-Tov *Date: 6/9/2011 ☑ Continuation ☐ Update

P2b. Legal description
T 2N R 1E; SE¼ of NW¼ of Sec 14; SBBM

P2d. UTM
Zone 11; 513802 mE/ 3790937 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

PARRY, PETER
PO BOX 953
BIG BEAR LAKE CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

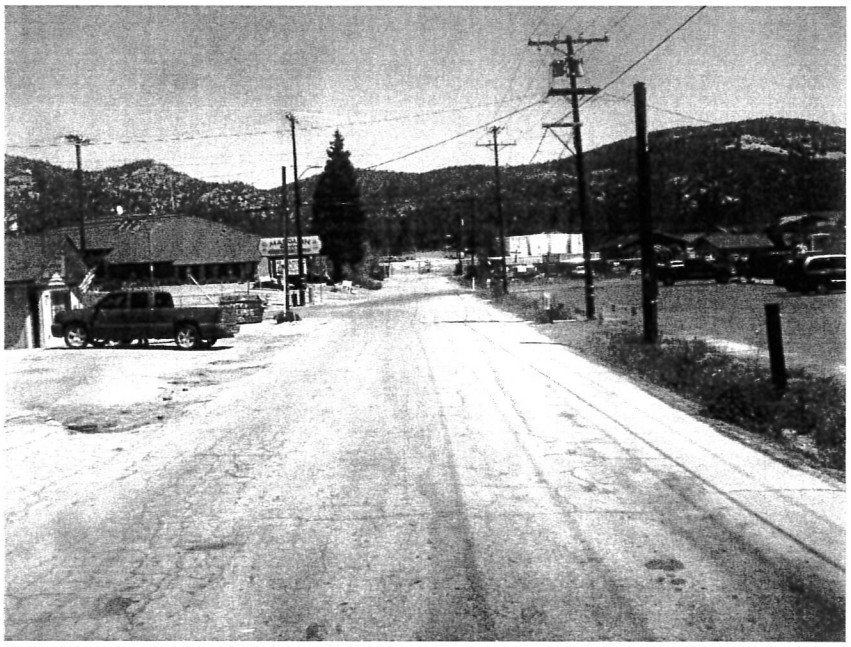
Primary # 36-024560
HRI #
Trinomial CA-SBR-15601
NRHP Status Code
Other Listings
Review Code _____ Reviewer _____ Date _____

 *Resource Name or #: SRI-10037

P1. Other Identifier: SRI-10037
*P2. Location: ✓ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SE¼ of NW¼ of Sec. 14; SBBM
c. Address:
d. UTM: Zone 11; 513608 mE/ 3790863 mN NAD27 GPS
e. Other Locational Data:
The road insects both sides of HIghway 18 at postmile 53.5 in Big Bear City.

*P3a. Description:
This site consists of a paved, two-lane road called Big Tree Drive. The road is oriented north to south and intersects Highway 18 from both sides. furthermore, this road appears to have been filled and graded in order to meet the current level of the highway. The road does not feature traffic lines. The word "Stop" and a stop line appear in faded white paint at the intersection with Highway 18. The road provides access to residences, as well as the Big Bear City Airport to the north. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ✓ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)



*P5b. Description of Photo:
Facing N; 6/9/2011; Big Tree Drive

*P6. Date Constructed/Age & Sources:
✓ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
ALLEN, JAMES & JOANN
REVOCABLE LIV T, P O BOX 484
BIG BEAR CITY CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ✓ Location Map ✓ Sketch Map ✓ Continuation Sheet ☐ Building, Structure, and Object Record
✓ Archaeological Record ☐ District Record ✓ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ✓ Photograph Record ☐ Other:

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
ARCHAEOLOGICAL SITE RECORD

Primary # _____
Trinomial _____

 *Resource Name or #: SRI-10037

*A1. Dimensions: a. Length 51 m (N/S) x b. Width 12 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The site boundaries were clear and readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
This site consists of a paved, two-lane road called Big Tree Drive (Feature 10037). The road is oriented north to south and intersects Highway 18 from both sides. furthermore, this road appears to have been filled and graded in order to meet the current level of the highway. The road does not feature traffic lines. The word "Stop" and a stop line appear in faded white paint at the intersection with Highway 18. The road provides access to residences, as well as the Big Bear City Airport to the north. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No artifacts were encountered.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
No site disturbances were observed. It is possible, however, that the road was not originally paved, in which case the pavement would be a disturbance.

*A8. Nearest Water: The nearest water is Big Bear Lake, located approximately 1400 meters west of the site.

*A9. Elevation: 2060 m amsl

A10. Environmental Setting:
The site is set in the Bear Valley of the San Bernardino Mountains. The valley is relatively dry, despite the presence of one lake. The climate and soils are more like that of the high desert to the north than the south face of the mountains, which are cooler and wetter. Vegetation consists primarily of coniferous trees and various non-native plants.

A11. Historical Information:
The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
This road is residential and provides access to the city's airport, located at the road's northern terminus.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10037

L1. Historic and/or Common Name: Big Tree Drive

L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10038

L2b. Location of Point or Segment:
Zone 11; 513608 mE/ 3790883 mN NAD27 GPS
Zone 11; 513609 mE/ 3790843 mN NAD27 GPS

L3. Description:
This site consists of a paved, two-lane road called Big Tree Drive (Feature 10037). The road is oriented north to south and intersects Highway 18 from both sides. furthermore, this road appears to have been filled and graded in order to meet the current level of the highway. The road does not feature traffic lines. The word "Stop" and a stop line appear in faded white paint at the intersection with Highway 18. The road provides access to residences, as well as the Big Bear City Airport to the north. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 ...

L4. Dimensions:
a. Top Width: 9.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m

L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
The site is set in the Bear Valley of the San Bernardino Mountains. The valley is relatively dry, despite the presence of one lake. The climate and soils are more like that of the high desert to the north than the south face of the mountains, which are cooler and wetter. Vegetation consists primarily of coniferous trees and various non-native ...

L7. Integrity Considerations:
No site disturbances were observed. It is possible, however, that the road was not originally paved, in which case the pavement would be a disturbance.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10037

Camera Format:
Film Type and Speed: Digital

Lens Size:
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/9/2011		3652	Big Tree Drive	N	
6/9/2011		3653	Big Tree Drive	S	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

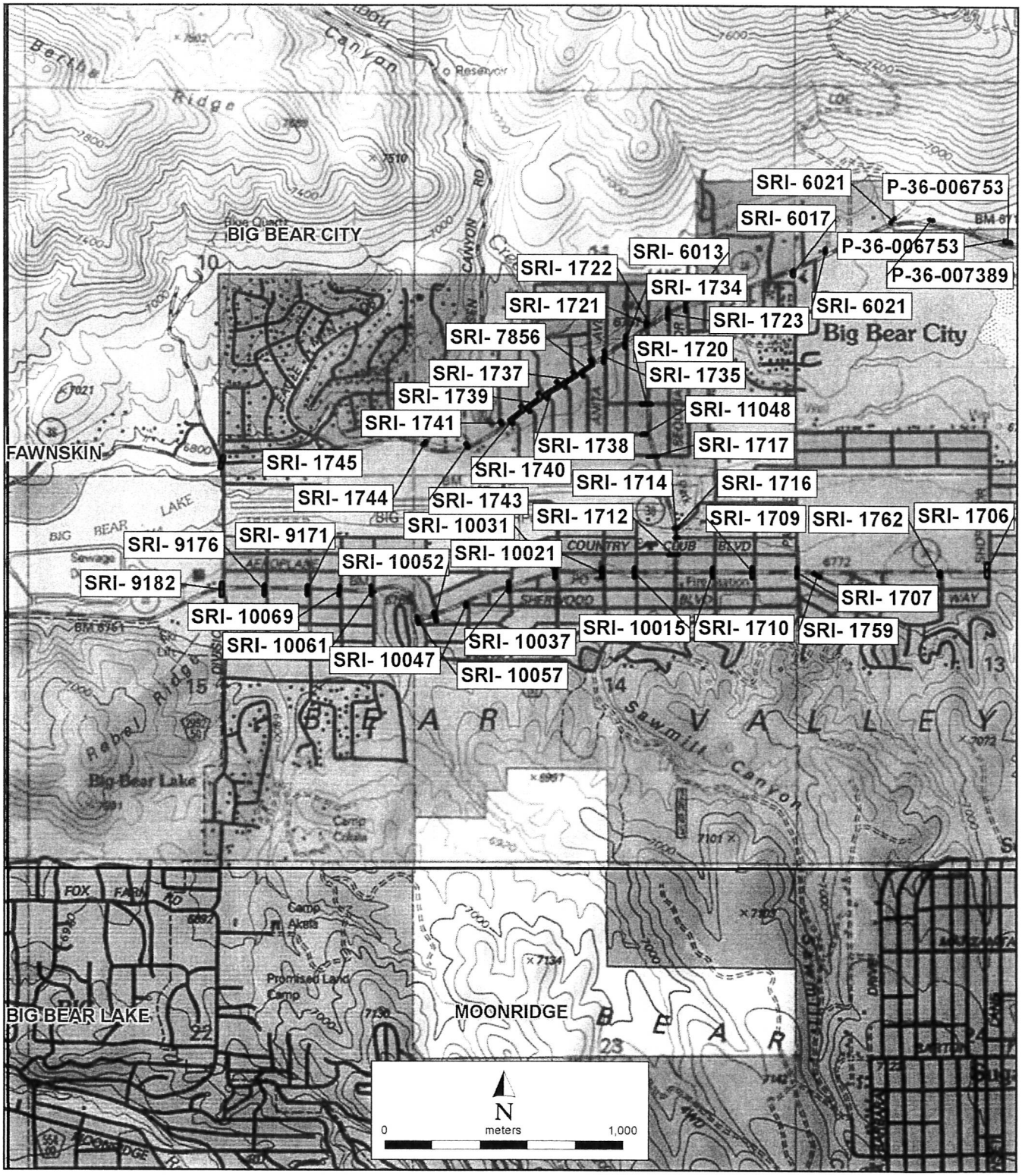
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10037

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

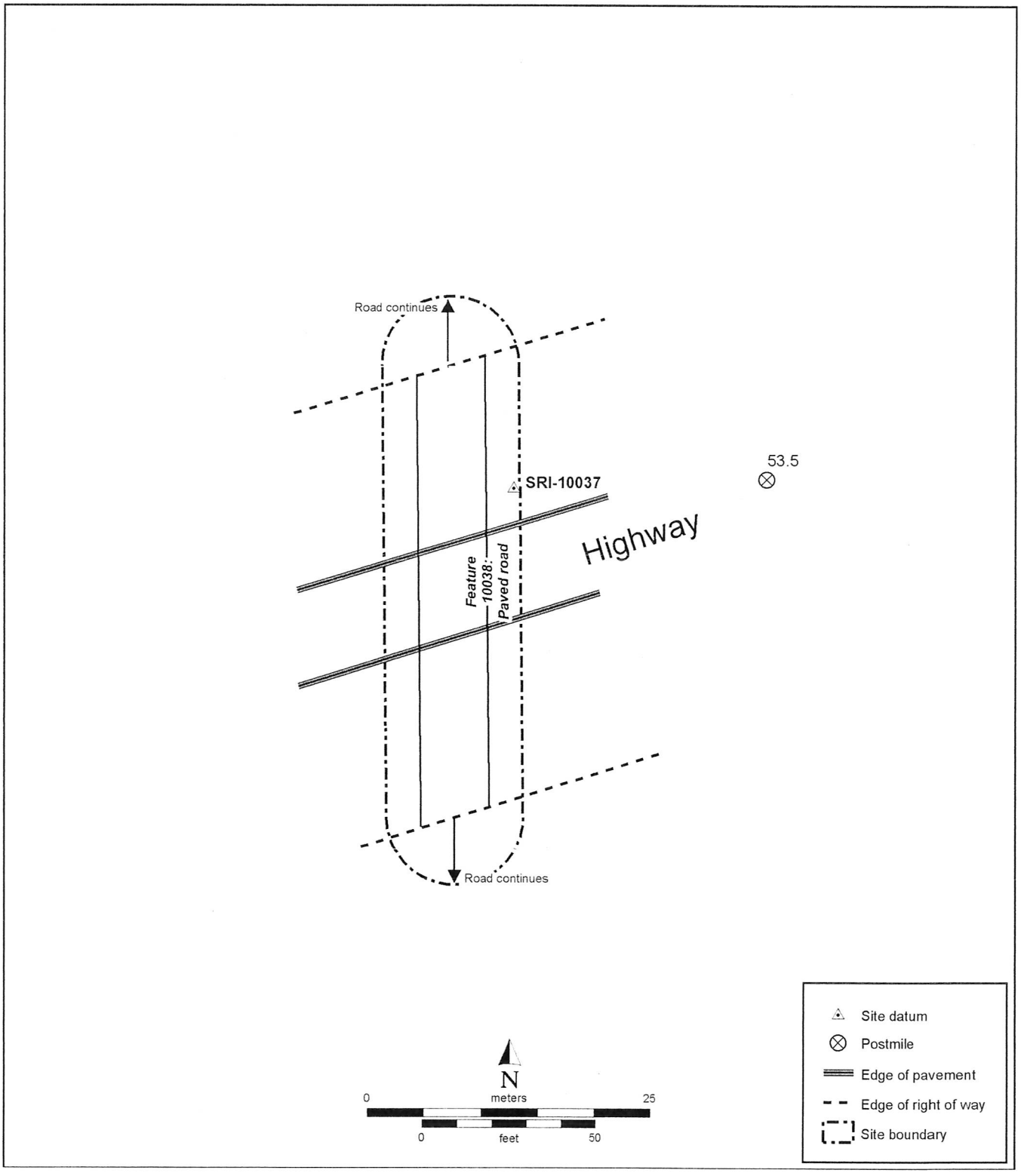
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10037

*Drawn By: J. Lev-Tov

*Date: 06/09/2011



*Required Information

P2d. UTM
Zone 11; 513609 mE/ 3790843 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

SCHICK, GREGORY G
BOX 650
BIG BEAR LAKE, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The site also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

L3. Description
Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

L6. Setting
plants.

7/12

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # 36-024562
HRI #
Trinomial CA-SBR-15603 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

 *Resource Name or #: SRI-10061

P1. Other Identifier: SRI-10061
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SE¼ of NE¼ of Sec. 15; SBBM
c. Address:
d. UTM: Zone 11; 513032 mE/ 3790845 mN NAD27 GPS
e. Other Locational Data:
This road intersects both sides of Highway 18 at postmile 53.0 in Big Bear City.

*P3a. Description:
The site consists of three features: an asphalt-paved road called Pine View Drive, a bronze survey benchmark, and a concrete culvert into which the benchmark is set. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this site.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing N; 6/10/2011; Pine View Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
BERTOLINO, FRANK R, 3630
SORKSBILL DR
HEMET CA 92545

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

ARCHAEOLOGICAL SITE RECORD

*A1. Dimensions: a. Length 49 m (N/S) x b. Width 23 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The road is visible on the 1947 Lucerne Valley USGS 15-minute ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: Because the site is relatively well-maintained, the site boundaries are readily apparent.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: ☐ None ☑ Unknown Method of determination: Subsurface testing was not conducted.

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:

The site consists of three features: an asphalt-paved road called Pine View Drive (Feature 10062); a bronze survey benchmark (Feature 10067); and a concrete culvert into which the benchmark is set (Feature 10068).

Pine View Drive is a narrow, two-lane road with no shoulders oriented north to south on both sides of Highway 18. This road grades slightly up at these intersections to meet the level of the highway. No traffic lines are painted on the asphalt, but the word "Stop" and a stop line are painted in white at the intersection with Highway 18. The road is visible on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

The benchmark is bronze, 3 inches in diameter, and bears the inscription U.S. Coastal and Geodetic Survey / 1956/ Pentaly for Removal. The benchmark is set into a concrete culvert. The concrete for the culvert was poured in place into a form, as the marks of form boards are present on its south side. It has a box form and directs water directly in and through it, rather than being the support for a corrugated pipe as is often the case. The culvert is 15 1/2 feet long (east to west).

The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

*A5. Cultural Constituents:

No cultural material is associated with this site.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor

No site disturbances were observed.

*A8. Nearest Water: The nearest water is Big Bear Lake, located approximately 800 meters northwest of this site. ...

*A9. Elevation: 2068 m amsl

A10. Environmental Setting:

Ths site is located in Bear Valley, a deep basin in the San Bernardino Mountains. The valley supports pine and scrub naturally. Within the city, however, residents have planted a wide array of trees and shrubs while non-native grasses have invaded or been planted in many places.

A11. Historical Information:

The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The benchmark has a date of 1956 on it which means that, if original, the concrete culvert must also date to that year.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:

This road serves as a residential road. The culvert brings water from the slopes to the south of the highway underneath it and thence presumably to the lake or a water treatment facility. The survey marker is a remnant of the first half twentieth century surveying program done by the U.S. Coastal and Geodetic Survey, a function later taken over by other agencies of the federal government.

A14. Remarks:

None

A15. References:

None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

***A17. Form Prepared By:** J. Lev-Tov **Date:** 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 ***Resource Name or #:** SRI-10061

L1. Historic and/or Common Name: Pine View Drive
L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10062
L2b. Location of Point or Segment:
Zone 11; 513030 mE/ 3790864 mN NAD27 GPS
Zone 11; 513032 mE/ 3790827 mN NAD27 GPS

L3. Description:
Pine View Drive (Feature 10062) is a narrow, two-lane road with no shoulders oriented north to south on both sides of Highway 18. This road grades slightly up at these intersections to meet the level of the highway. No traffic lines are painted on the asphalt, but the word "Stop" and a stop line are painted in white at the intersection with Highway 18. The road is visible on the 1947 Lucerne Valley USGS 15-minute topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 7.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m
L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
Ths site is located in Bear Valley, a deep basin in the San Bernardino Mountains. The valley supports pine and scrub naturally. Within the city, however, residents have planted a wide array of trees and shrubs while non-native grasses have invaded or been planted in many places.

L7. Integrity Considerations:
No site disturbances were observed.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10061

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/10/2011		3660	Pine View Drive	S	
6/10/2011		3661	benvhmark	Down	
6/10/2011		3662	culvert	SE	
6/10/2011		3659	Pine View Drive	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

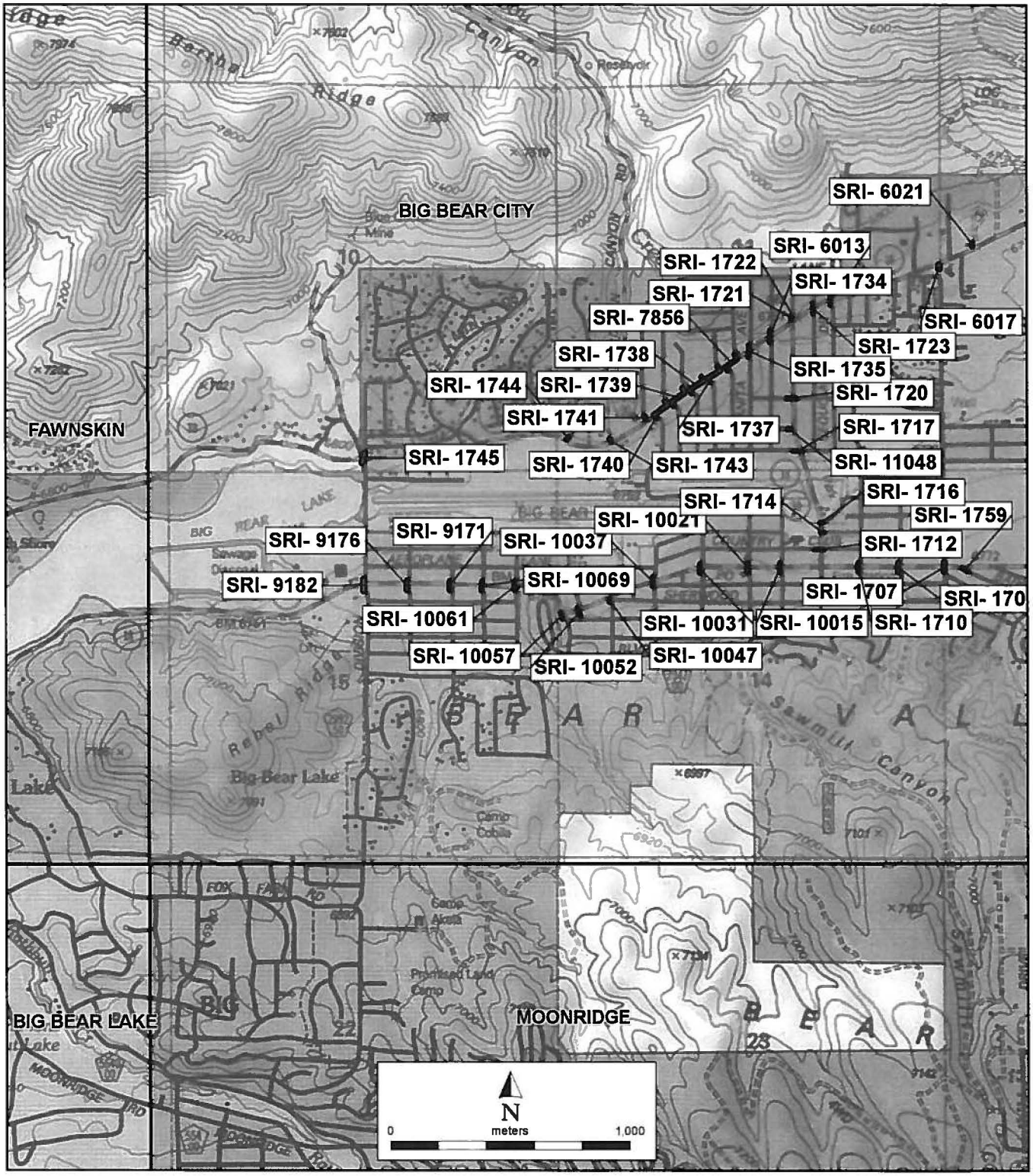
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10061

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



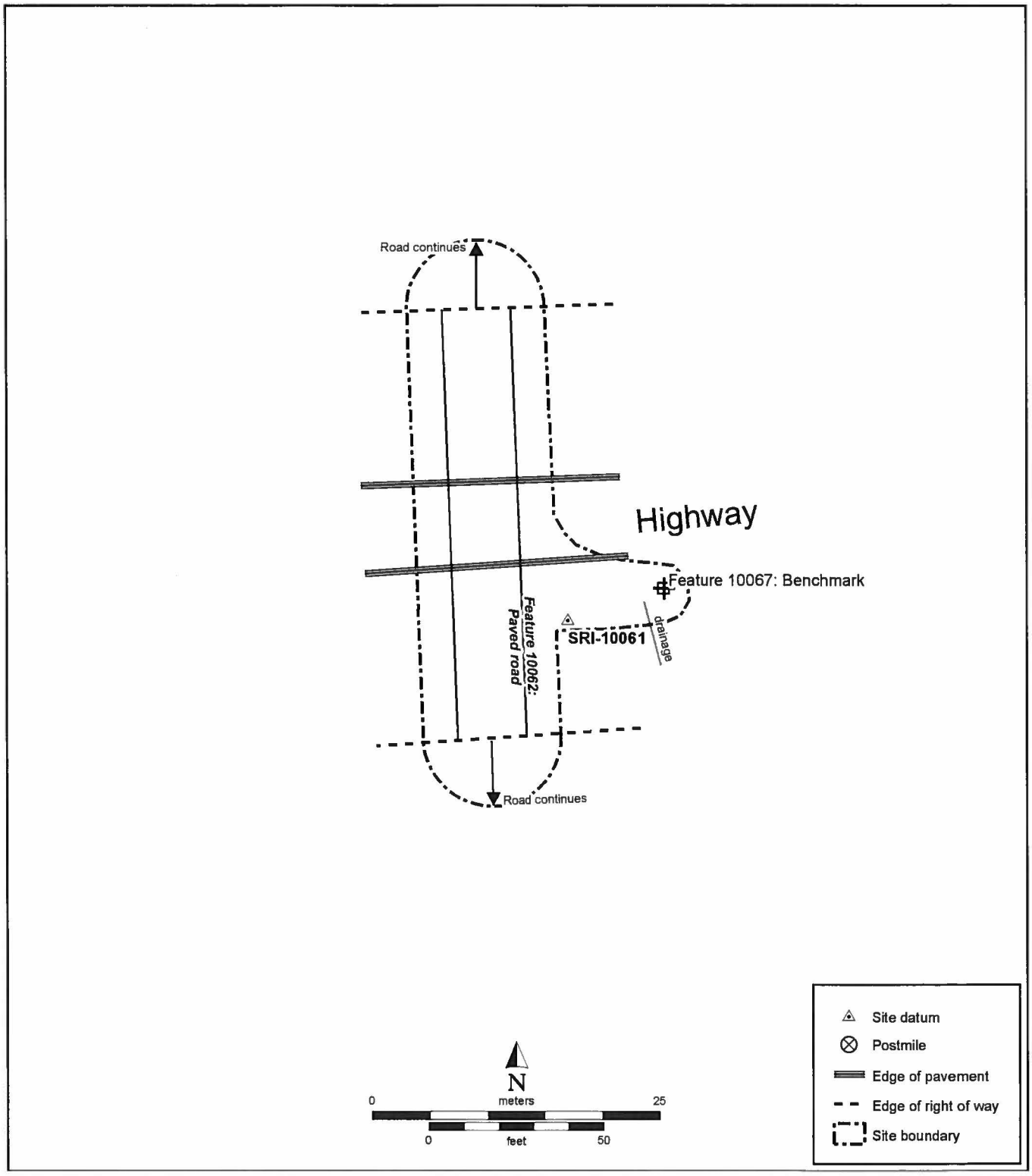
*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

 ***Resource Name or #:** SRI-10061

***Drawn By:** J. Lev-Tov ***Date:** 06/09/2011



P2d. UTM
Zone 11; 513032 mE/ 3790827 mN NAD27 GPS

P7. Owner and Address

RICHARDS, JENNIFER
P O BOX 3215
BIG BEAR LAKE CA

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

TITCHENER, THOMAS E
2883 E ST JAMES AVE
HAYDEN ID 83835

A1. Method of determination
topographic quad map. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded.

A8. Nearest water
There is also the small drainage above which is constructed the culvert bearing the benchmark.

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # 36-024563
HRI #
Trinomial CA-SBR-15604 H
NRHP Status Code
Other Listings
Review Code Reviewer Date

*Resource Name or #: SRI-10069

P1. Other Identifier: SRI-10069
*P2. Location: ☑ Not for Publication ☐ Unrestricted *a. County: San Bernardino
*b. USGS Quad: 7.5' BIG BEAR CITY (2009); T 2N R 1E, SE¼ of NE¼ of Sec. 15; SBBM
c. Address:
d. UTM: Zone 11; 512896 mE/ 3790844 mN NAD27 GPS
e. Other Locational Data:
Holcomb View Drive is located along Highway 18, crossing it at postmile 52.9 in Big Bear City.

*P3a. Description:
The site consists of an asphalt-paved, two-lane road called Holcomb View Drive. The road intersects Highway 18 from the north and south. At these intersections, the word "Stop" and a stop line are painted in white. No other pavement surface markers are visible. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*P3b. Resource Attributes: AH7 Historical-period road, HP37 Historical-period road
*P4. Resources Present: ☐ Building ☐ Structure ☐ Object ☑ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

*P5b. Description of Photo:
Facing N; 6/10/2011; Holcomb View Drive

*P6. Date Constructed/Age & Sources:
☑ Historic ☐ Prehistoric ☐ Both

*P7. Owner and Address:
BAYER, STEVEN M & ROSALVA TR
03/31/1, PO BOX 1423
HIGHLAND CA

*P8. Recorded by:
J. Lev-Tov

*P9. Date Recorded: 6/9/2011
*P10. Survey Type:
Reconnaissance survey of highway right-of-way

*P11. Citation: Report forthcoming

*Attachments: ☐ None ☑ Location Map ☑ Sketch Map ☑ Continuation Sheet ☐ Building, Structure, and Object Record
☑ Archaeological Record ☐ District Record ☑ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record
☐ Artifact Record ☑ Photograph Record ☐ Other:

*Required Information

ARCHAEOLOGICAL SITE RECORD

*A1. Dimensions: a. Length 50 m (N/S) x b. Width 13 m (E/W)
Method of Measurement: ☐ Paced ☐ Taped ☐ Visual estimate ☑ GPS ☐ Other:
Method of Determination: ☐ Artifacts ☑ Features ☐ Soil ☐ Vegetation ☐ Topography ☐ Cut bank ☐ Animal burrow ☐ Excavation ☐ Property boundary ☑ Other: The site boundary is determined in part by the right-of-way established ...
Reliability of determination: ☑ High ☐ Medium ☐ Low
Explain: The edges of the pavement are clearly visible.
Limitations: ☐ Restricted access ☐ Paved/built over ☑ Site limits incompletely defined ☐ Disturbances ☐ Vegetation ☐ Other:

A2. Depth: None ☑ None ☐ Unknown Method of determination: None

*A3. Human Remains: ☐ Present ☑ Absent ☐ Possible ☐ Unknown

*A4. Features:
The site consists of an asphalt-paved, two-lane road called Holcomb View Drive (Feature 10070). The road intersects Highway 18 from the north and south. At these intersections, the word "Stop" and a stop line are painted in white. No other pavement surface markers are visible. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

*A5. Cultural Constituents:
No artifacts were encountered.

*A6. Were Specimens Collected? ☑ No ☐ Yes

*A7. Site Condition ☑ Good ☐ Fair ☐ Poor
The street surface shows slight signs of weathering in the form of cracks in the pavement.

*A8. Nearest Water: The nearest water is a small drainage that crosses Highway 18, one block east of the site. ...

*A9. Elevation: 2066 m amsl

A10. Environmental Setting:
This site is set within Bear Valley, a large basin within the northern side of the San Bernardino Mountains. The north side receives less rain, and consequently exhibits somewhat desert-like conditions. This is despite the lake and the snowy ridges above the valley to the south. The topography of the valley bottom is flat, while the site itself slopes gently northward. Vegetation consists of planted Ponderosa pines, hardwoods and intrusive grasses.

A11. Historical Information:
The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

*A12. Age: ☐ Prehistoric ☐ Protohistoric ☐ 1542-1769 ☐ 1769-1848 ☐ 1848-1880 ☐ 1880-1914 ☐ 1914-1945 ☑ Post-1945 ☐ Undetermined

A13. Interpretations:
Holcomb View Drive is a residential street near the edge of Big Bear City.

A14. Remarks:
None

A15. References:
None

A16. Photographs: See photograph record
Original Media/Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

*A17. Form Prepared By: J. Lev-Tov Date: 6/9/2011
Affiliation and Address: Statistical Research, Inc., 21 W. Stuart Ave, Redlands, CA 92373

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

 *Resource Name or #: SRI-10069

L1. Historic and/or Common Name: Holcomb View Drive
L2a. Portion Described: ☐ Entire Resource ☑ Segment ☐ Point Observation **Designation:** Feature 10070
L2b. Location of Point or Segment:
Zone 11; 512895 mE/ 3790826 mN NAD27 GPS
Zone 11; 512897 mE/ 3790863 mN NAD27 GPS

L3. Description:
The site consists of an asphalt-paved, two-lane road called Holcomb View Drive (Feature 10070). The road intersects Highway 18 from the north and south. At these intersections, the word "Stop" and a stop line are painted in white. No other pavement surface markers are visible. The current project only examines the first 15 meters from the edge of pavement corresponding to the Caltrans right-of-way. The site continues beyond the right-of-way, but these portions were not recorded. The road appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map. No cultural material is associated with this feature.

L4. Dimensions:
a. Top Width: 9.00 m
b. Bottom Width: N/A
c. Height or Depth: None
d. Length of Segment: 39.00 m
L5. Associated Resources:
None

L4e. Sketch of Cross-Section: **Facing:**

L6. Setting:
This site is set within Bear Valley, a large basin within the northern side of the San Bernardino Mountains. The north side receives less rain, and consequently exhibits somewhat desert-like conditions. This is despite the lake and the snowy ridges above the valley to the south. The topography of the valley bottom is flat, while the site itself ...

L7. Integrity Considerations:
The street surface shows slight signs of weathering in the form of cracks in the pavement.

L8b. Description of Photo, Map, or Drawing
See sketch map

L9. Remarks:
None

L10. Form Prepared By:
J. Lev-Tov

L11. Date: 6/9/2011

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PHOTOGRAPH RECORD

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10069

Camera Format:
Lens Size:
Film Type and Speed: Digital
Negatives Kept At: 21 W. Stuart Ave, Redlands, CA 92373

Date	Time	Exp/ Frame	Subject/Description	View Toward	Accession #
6/10/2011		3664	Holcomb View Drive	S	
6/10/2011		3663	Holcomb View Drive	N	

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

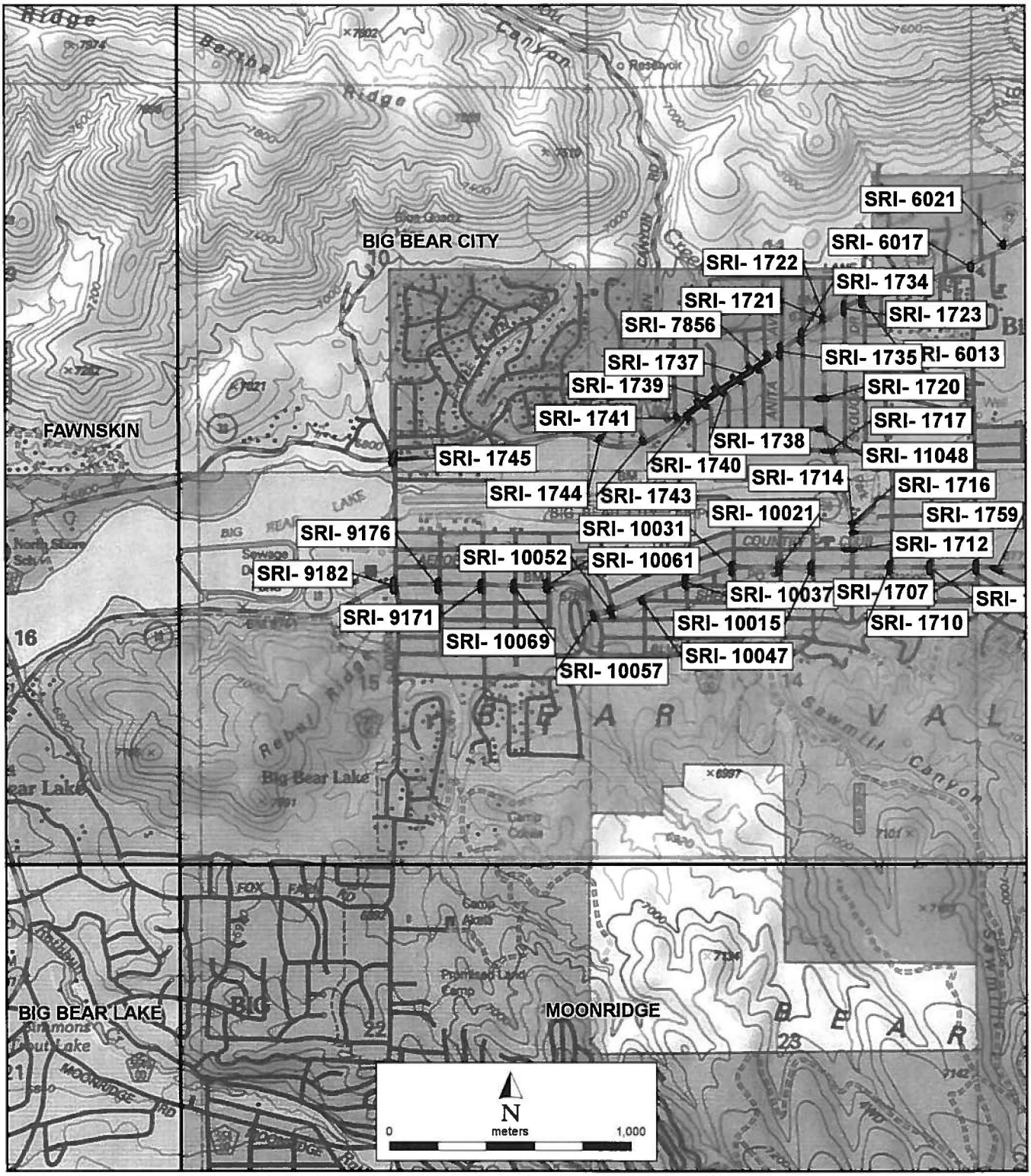
LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10069

*Map Name: 7.5' BIG BEAR CITY USGS Topographic Quad Scale: 1:24,000

*Year: 2009



*Required Information

State of California - The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

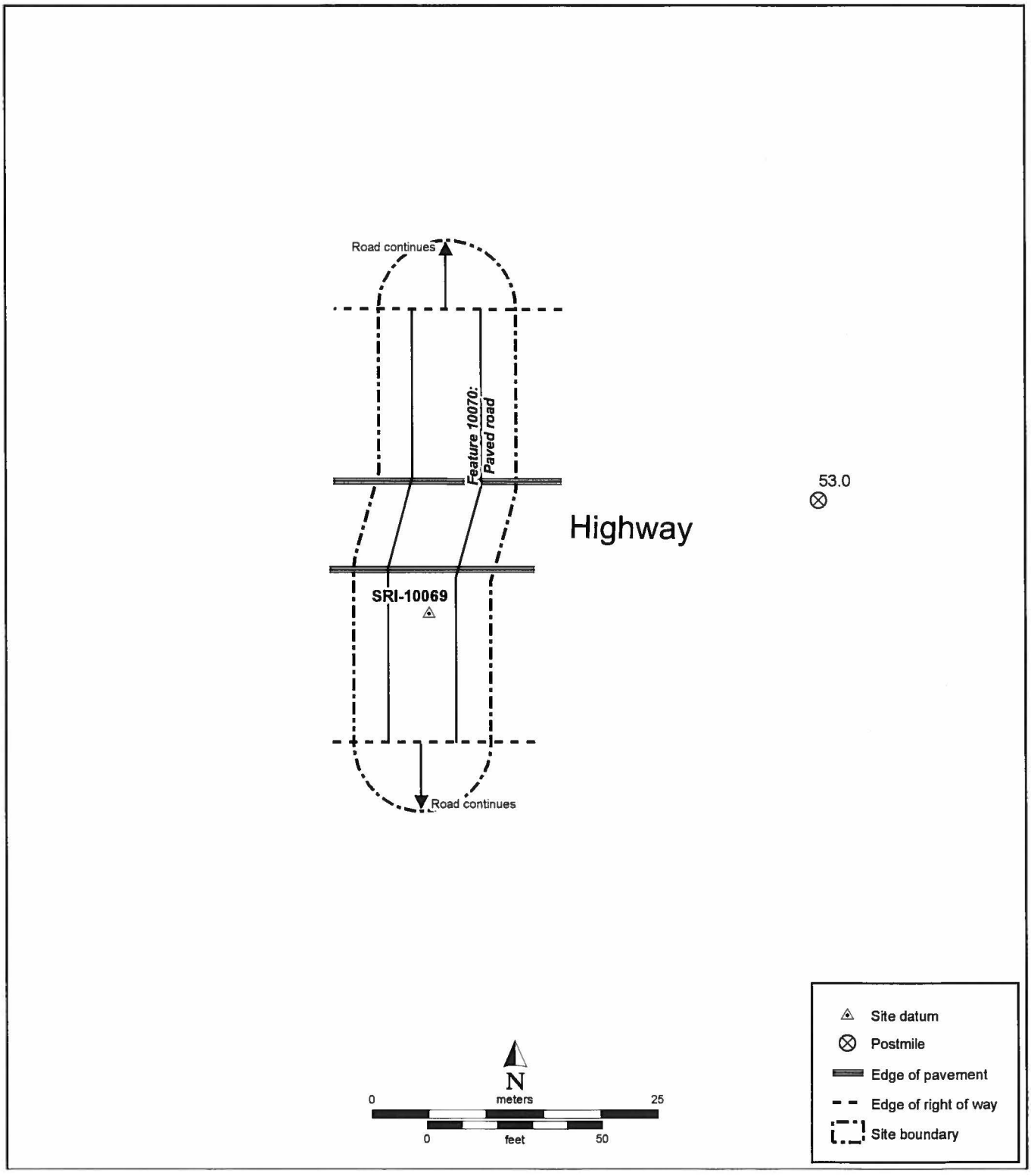
SKETCH MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or #: SRI-10069

*Drawn By: J. Lev-Tov

*Date: 06/09/2011



*Required Information

P2d. UTM
Zone 11; 512897 mE/ 3790863 mN NAD27 GPS

P4. Resources Present
[X] Other (linear)

P7. Owner and Address

MILTON, GARY E
29043 S LAKESHORE DR
AGOURA CA 91301

SAN BERNARDINO NATIONAL FOREST
602 S. TIPPECANOE AVE.
SAN BERNARDINO, CA

A1. Method of determination
by Caltrans. The right-of-way extends 15 m from the edge of the pavement. The site continues beyond the right-of-way, but these portions were not recorded. The road also appears on the 1947 Lucerne Valley USGS 15-minute topographic quad map.

A8. Nearest water
Additionally, Big Bear Lake is located approximately 700 meters northwest of the site.

L6. Setting
slopes gently northward. Vegetation consists of planted Ponderosa pines, hardwoods and intrusive grasses.

State of California--The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

PRIMARY RECORD

Primary # _____
HRI # _____
Trinomial _____
NRHP Status Code 6Z
Other Listings _____
Review Code _____ Reviewer _____ Date _____

*Resource Name or # (Assigned by recorder) CRM TECH 3969-1H

P1. Other Identifier: Big Bear Area Regional Wastewater Agency (BBARWA) treatment plant

***P2. Location:** √ **Not for Publication** ___ **Unrestricted** ***a. County** San Bernardino

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** Big Bear City, Calif. **Date** 1996

T2N; **R**1E/2E; SW **1/4 of Sec** 7 **and** SE **1/4 of Sec** 12 ; S.B. **B.M.**

c. Address 122 Palomino Drive **City** Big Bear City **Zip** 92314

d. UTM: (Give more than one for large and/or linear resources) **Zone** 11 ; 481,785 **mE/** 3,827,891 **mN**

UTM Derivation: ☐ USGS Quad ☒ GPS (NAD 83)

e. Other Locational Data: (e.g., parcel #, directions to resource, etc., as appropriate) APNs 0463-231-11 and -16; at the north end of Palomino Drive, 0.25 miles north of Shay Road

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries): This site consists of the structures, reservoirs, ponds, tanks, chambers, and berms from multiple developmental phases of the BBARWA wastewater treatment plant. The remaining elements from the initial construction phase (1966-1967) are represented by two balance chambers, two "horseshoe ponds," and the oval-shaped berm circling the treatment facility. Those from the second phase (1974) include two clarifiers (Nos. 1 and 2), rotors, and a clarifier splitter. The earthen berm extends north and west from the elevated terrace (*Continued on p. 5*)

***P3b. Resource Attributes:** (List attributes and codes) HP9: Public utility facility

***P4. Resources Present:** ☐ Building ☐ Structure ☐ Object ☒ Site ☐ District ☐ Element of District ☐ Other (isolates, etc.)

P5a. Photograph or Drawing (Photograph required for buildings, structures, and objects.)

P5b. Description of Photo (view, date, accession number): April 28, 2023; South Balance Chamber, view to the north (see also pp. 4-9)

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both 1966-1969 (see Item A11)

***P7. Owner and Address:** Big Bear Area Regional Wastewater Agency, 121 Palomino Drive, Big Bear City, CA 92314

***P8. Recorded by** (Name, affiliation, & address): Hunter O'Donnell, CRM TECH, 1016 East Cooley Drive, Suite A/B, Colton, CA 92324

***P9. Date Recorded:** April 28, 2023

***P10. Survey Type** (describe): Intensive-level survey for Section 106 and CEQA compliance

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") Bai "Tom" Tang, Terri Jacquemain, Deirdre Encarnación, Hunter O'Donnell, and Nina Gallardo (2023): Identification and Evaluation of Historic Properties: Replenish Big Bear Program DEIR, Big Bear Valley Area, San Bernardino County, California

***Attachments:** ☐None ☒Location Map ☒Sketch Map ☒Continuation Sheet ☒Building, Structure, and Object Record ☐Archaeological Record ☐District Record ☐Linear Resource Record ☐Milling Station Record ☐Rock Art Record ☐Artifact Record ☐Photograph Record ☐Other (List): _____

BUILDING, STRUCTURE, AND OBJECT RECORD

*NRHP Status Code 6Z

*Resource Name or # (Assigned by recorder) CRM TECH 4969-1H

B1. Historic Name: Big Bear Area Regional Wastewater Agency (BBARWA) treatment plant

B2. Common Name: Same

B3. Original Use: Wastewater treatment B4. Present Use: Same

***B5. Architectural Style:** N/A

***B6. Construction History:** (Construction date, alterations, and date of alterations) Construction of this wastewater treatment plant began in 1966 with the two balance chambers, a horseshoe pond, and a berm around the facility. In April 1974 Clarifiers #1 and #2, rotors, and possibly the Clarifier Splitter were added. By 1980 Oxidation Ditches #1 and #2 were present, and the Operations and Control Building and sand beds were under construction to be completed by 1981. By 1995 the clarifiers were covered by the metallic domes currently in place. By 2002 the horseshoe pond was shortened and divided by a causeway, creating the two-pond configuration today. As a result, the balance chambers and the perimeter berm are the only relatively unaltered elements of the original 1966 construction.

***B7. Moved?** √ No ___ Yes ___ Unknown **Date:** ___ **Original Location:**

***B8. Related Features:** See Item P3a

B9a. Architect: Unknown b. Builder: Unknown

***B10. Significance: Theme** Post-WWII infrastructure development

Area Big Bear Valley **Period of Significance** 1945-1970

Property Type Civic infrastructure **Applicable Criteria** N/A

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.) The BBARWA treatment plant does not appear to meet any of the criteria for listing in the National Register of Historic Places or the California Register of Historical Resources. Under Criterion A/1, the original construction of the plant dates to a period of rapid population growth in the (*Continued on p. 5*)

B11. Additional Resource Attributes: (List attributes and codes)

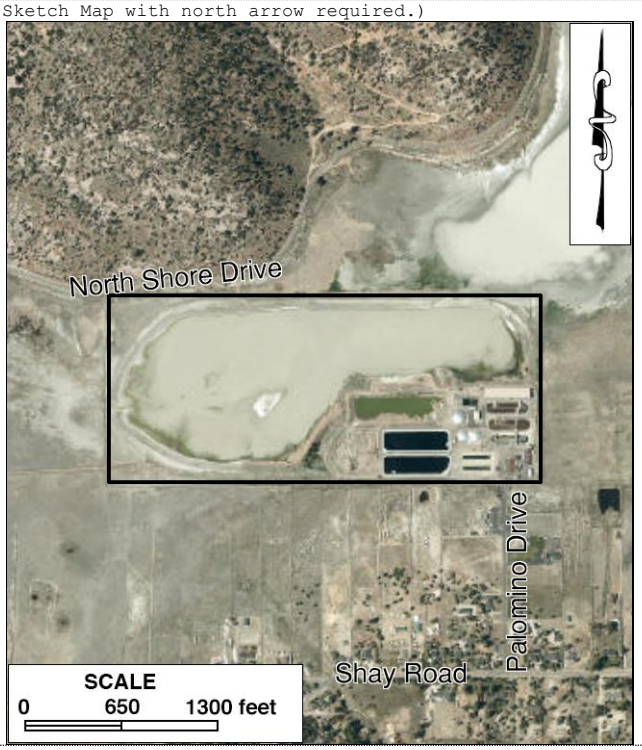
B12. References: *San Bernardino Sun:* various news articles, 1965-1970; historic aerial images from 1938-2020 available at http://www.historicaerials.com; Bridgette Burton, Senior Analyst at BBARWA, personal communications

B13. Remarks:

***B14. Evaluator:** Hunter O'Donnell

***Date of Evaluation:** May 3, 2023

(Sketch Map with north arrow required.)



(This space reserved for official comments.)

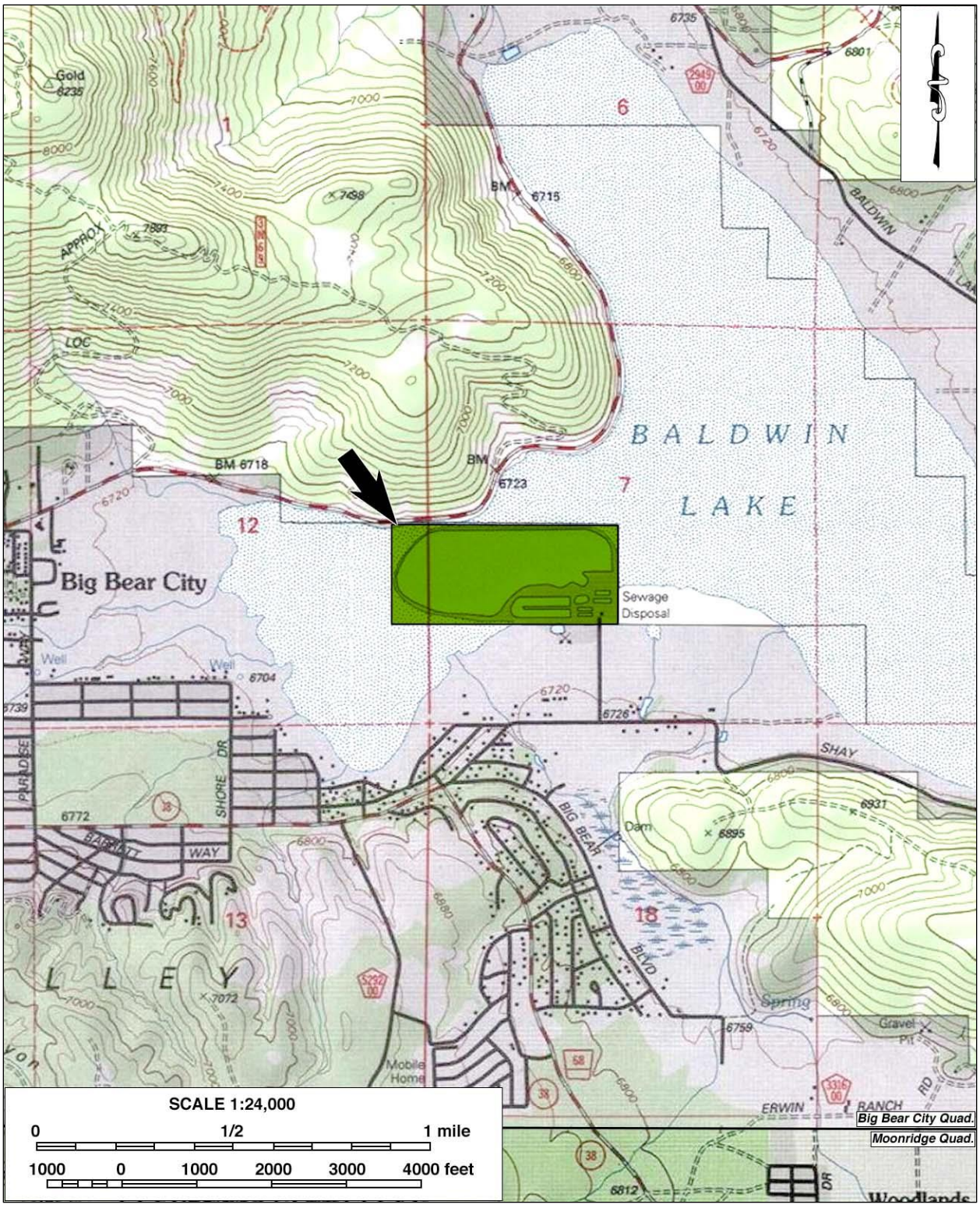
State of California--The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

LOCATION MAP

Primary # _____
HRI # _____
Trinomial _____

*Resource Name or # (Assigned by recorder) CRM TECH 3969-1H

*Map Name: Big Bear City and Moon ridge, Calif.
*Scale: 1:24,000 *Date of Map: 1996



*Required information

State of California--The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

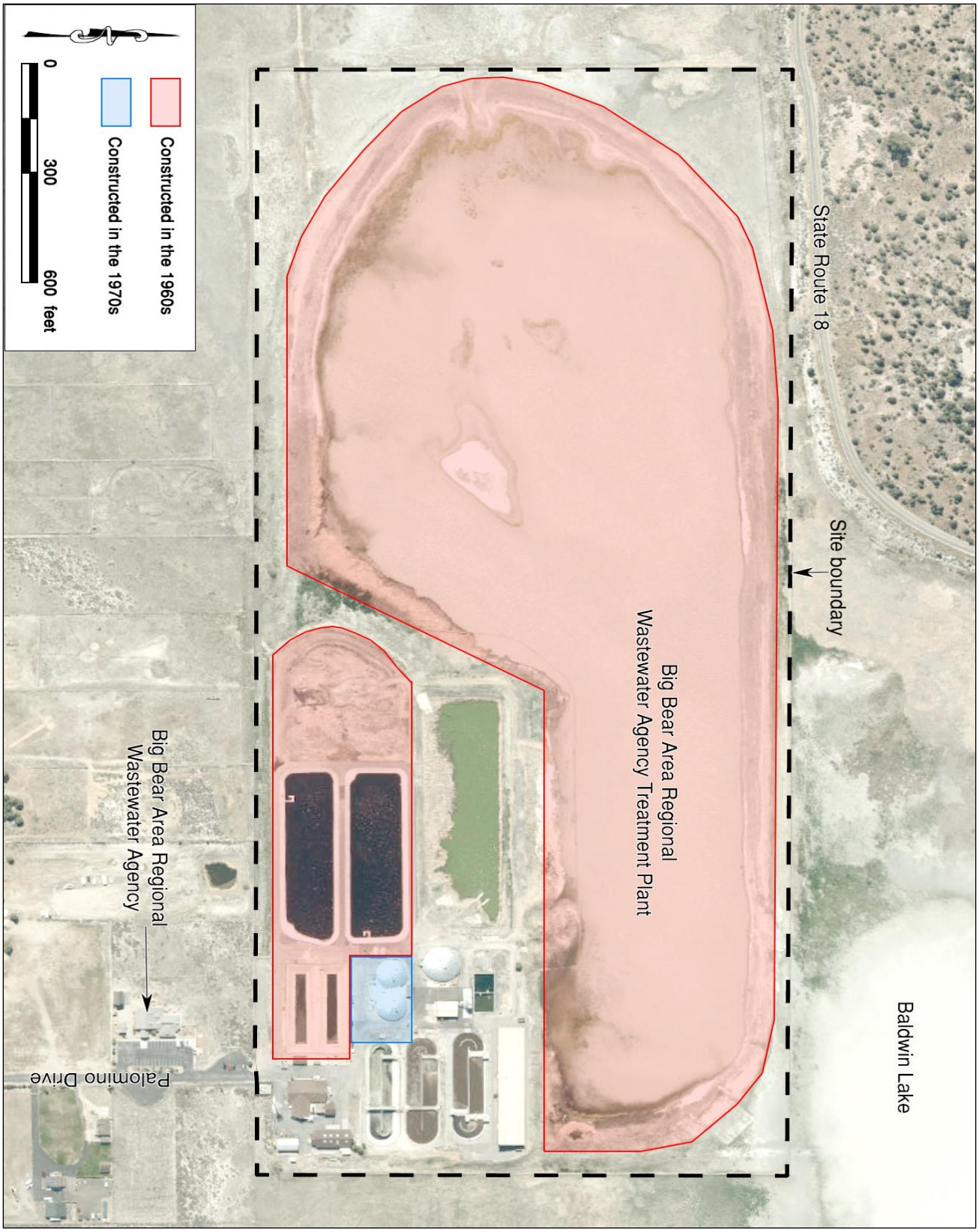
SKETCH MAP

Primary #
HRI #
Trinomial

*Resource Name or # (Assigned by recorder) CRM TECH 3969-1H

*Drawn by: Daniel Ballester

*Date: May 3, 2023



*Required information

Recorded by: Hunter O'Donnell
***Date:** April 28, 2023 √ Continuation Update

***P3a. Description (continued):** containing the wastewater treatment elements, forming a 3/4 oval measuring approximately 0.56 miles along (east-west) and 0.22 miles wide (north-south). The maximum height of the berm is approximately 5', but the height is inconsistent, likely due to erosion as several segments of the berm are currently underwater. The 1966 earthen horseshoe pond was approximately 830' long (east-west) and 320' wide (north-south) with a 625'-long causeway partially bisecting the pond from east to west. In the modern period the pond was shortened by 385', thereby dividing it into two ponds measuring 425' x 125', which were then lined with concrete. The balance chambers are two concrete-lined pits measuring approximately 190' long (east-west) and 20' wide (north-south) with a depth of several feet. The clarifiers, measuring 75' across, were covered with geodesic metallic domes in the modern era and thus obscured from exterior view.

***B10. Significance: (continued):** Big Bear Valley area during the post-WWII suburban boom, which is arguably a pattern of events that substantially influenced the course of local, regional, as well as national history. However, as one of the numerous public utility projects completed at the time, the plant does not demonstrate a unique or particularly close association with this pattern of events or with any other historic theme. Furthermore, the plant is not known to be closely associated with any specific events of recognized significance in history.

Under Criterion B/2, the historical background research has not identified any important historic figures in association with the BBARWA treatment plant. Under Criterion C/3, this utilitarian facility of standard design and construction does not exhibit any significant, special, or remarkable merits in architecture, engineering, technology, or aesthetics, nor does it represent an important example of any property type, period, region, and method of construction or embody the work of a prominent architect, engineer, or builder. Under Criterion D/4, the plant holds little promise for important historical or archaeological data for the study of public utility works in the post-WWII era, a subject that is well documented in existing literature and contemporary publications.

In addition, as a result of alterations and additions made in the modern period, the plant's historical components are now mixed with modern additions and replacements on prominent display. Consequently, it no longer retains sufficient historic integrity in the aspects of design, materials, workmanship, and feeling to relate to its early history.

Recorded by: Hunter O'Donnell
***Date:** April 28, 2023 √ Continuation Update

Additional Photographs:

Aeration ponds

Settling ponds

Recorded by: Hunter O'Donnell
***Date:** April 28, 2023 √ Continuation ___ Update

Methane capture domes

Tanks

Recorded by: Hunter O'Donnell
***Date:** April 28, 2023 √ Continuation Update

Solid separation Building

Electrical station

Recorded by: Hunter O'Donnell
***Date:** April 28, 2023 √ Continuation Update

Onsite office

Maintenance building

Outbuilding and garage

Replenish Big Bear Program

ENERGY ANALYSIS

BIG BEAR AREA REGIONAL WASTEWATER AGENCY

PREPARED BY:

Haseeb Qureshi
hqureshi@urbanxroads.com

Ali Dadabhoy
adadabhoy@urbanxroads.com

SEPTEMBER 7, 2023

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LIST OF ABBREVIATED TERMS

%	Percent
(1)	Reference
AQIA	*Replenish Big Bear Program Air Quality Impact Analysis*
BACM	Best Available Control Measures
BTU	British Thermal Units
CalEEMod	California Emissions Estimator Model
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCR	California Code of Regulations
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPEP	Clean Power and Electrification Pathway
CPUC	California Public Utilities Commission
DMV	Department of Motor Vehicles
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EMFAC	EMissions FACtor
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
GWh	Gigawatt Hour
HHDT	Heavy-Heavy Duty Trucks
hp-hr-gal	Horsepower Hours Per Gallon
IEPR	Integrated Energy Policy Report
ISO	Independent Service Operator
ISTEA	Intermodal Surface Transportation Efficiency Act
ITE	Institute of Transportation Engineers
kBTU	Thousand-British Thermal Units
kWh	Kilowatt Hour
LDA	Light Duty Auto
LDT1/LDT2	Light-Duty Trucks
LHDT1/LHDT2	Light-Heavy Duty Trucks
MARB/IPA	March Air Reserve Base/Inland Port Airport
MDV	Medium Duty Trucks
MHDT	Medium-Heavy Duty Trucks
MMcfd	Million Cubic Feet Per Day

mpg	Miles Per Gallon
MPO	Metropolitan Planning Organization
PG&E	Pacific Gas and Electric
Project	Replenish Big Bear Program
PV	Photovoltaic
SCAB	South Coast Air Basin
BVES	Bear Valley Electric Service
SDAB	San Diego Air Basin
sf	Square Feet
SoCalGas	Southern California Gas
TEA-21	Transportation Equity Act for the 21st Century
U.S.	United States
VMT	Vehicle Miles Traveled

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EXECUTIVE SUMMARY

ES.1 SUMMARY OF FINDINGS

The results of this *Replenish Big Bear Program Energy Analysis* is summarized below based on the significance criteria in Section 5 of this report consistent with Appendix G of the California Environmental Quality Act (CEQA) Statute and Guidelines (*CEQA Guidelines*) (1). Table ES-1 shows the findings of significance for potential energy impacts under CEQA.

TABLE ES-1: SUMMARY OF CEQA SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
Energy Impact #1: Would the Project result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	5.0	*Less Than Significant*	*n/a*
Energy Impact #2: Would the Project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	5.0	*Less Than Significant*	*n/a*

ES.2 PROJECT REQUIREMENTS

The Project would be required to comply with regulations imposed by the federal and state agencies that regulate energy use and consumption through various means and programs. Those that are directly and indirectly applicable to the Project and that would assist in the reduction of energy usage include:

- Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)
- The Transportation Equity Act for the 21st Century (TEA-21)
- Integrated Energy Policy Report (IEPR)
- State of California Energy Plan
- California Code Title 24, Part 6, Energy Efficiency Standards
- California Code Title 24, Part 11, California Green Building Standards Code (CALGreen)
- AB 1493 Pavley Regulations and Fuel Efficiency Standards
- California's Renewable Portfolio Standard (RPS)
- Clean Energy and Pollution Reduction Act of 2015 (SB 350)

Consistency with the above regulations is discussed in detail in section 5 of this report.

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1 INTRODUCTION

This report presents the results of the energy analysis prepared by Urban Crossroads, Inc., for the proposed Replenish Big Bear Program Project (Project). The purpose of this report is to ensure that energy implication is considered by the Big Bear Area Regional Wastewater Agency (Lead Agency), as the lead agency, and to quantify anticipated energy usage associated with construction and operation of the proposed Project, determine if the usage amounts are efficient, typical, or wasteful for the land use type, and to emphasize avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy.

1.1 SITE LOCATION

The Project site is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are located in the middle of this Basin. The overall project area consists of the Valley in the County of San Bernardino, as shown on Exhibit 1-A.

1.2 PROJECT DESCRIPTION

The proposed Project includes upgrades and additions to Big Bear Area Regional Wastewater Agency's (BBARWA) wastewater treatment plant (WWTP) to produce purified water through full advanced treatment to protect the receiving waters and their beneficial uses. The Replenish Big Bear Program would upgrade BBARWA's WWTP to produce full advanced treated water that would be retained within the Big Bear Valley watershed to be used to increase the sustainability of local water supplies, consequently, wastewater currently delivered to Lucerne Valley will be modified. The proposed Project consists of construction and operation of the various facilities which are separated into five project categories: 1) Replenish Big Bear Component 1: Lake Discharge Pipeline Alignment; 2) Replenish Big Bear Component 2: Shay Pond; 3) Replenish Big Bear Component 3: Evaporation Pond; 4) Replenish Big Bear Component 4: BBARWA WWTP Upgrades; and 5) Replenish Big Bear Component 5: Sand Canyon.

This Replenish Big Bear Component includes upgrades to the BBARWA WWTP, to include 2.2 MGD of full advanced treatment, producing up to 2,210 AFY of purified water. The upgrades include the construction of a 40,000 SF building which would provide the following upgrades and new construction in order of process flow:

- Upgrades to the Oxidation Ditches
- New Denitrification Filter
- New UF and RO filtration membranes
- New UV Disinfection
- New AOP
- New Pellet Reactor: 0.22 MGD

The BBARWA WWTP Treatment Upgrades also includes the installation of about 1,350 LF of brine pipeline anticipated to be sized between 8" to 10" from the pellet reactor to the solar evaporation ponds. Additionally, the BBARWA WWTP Treatment Upgrades also includes

installation of a 50 gpm brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

REPLENISH BIG BEAR COMPONENT 2: LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12" in diameter.

REPLENISH BIG BEAR COMPONENT 3: SHAY POND CONVEYANCE PIPELINE

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells.

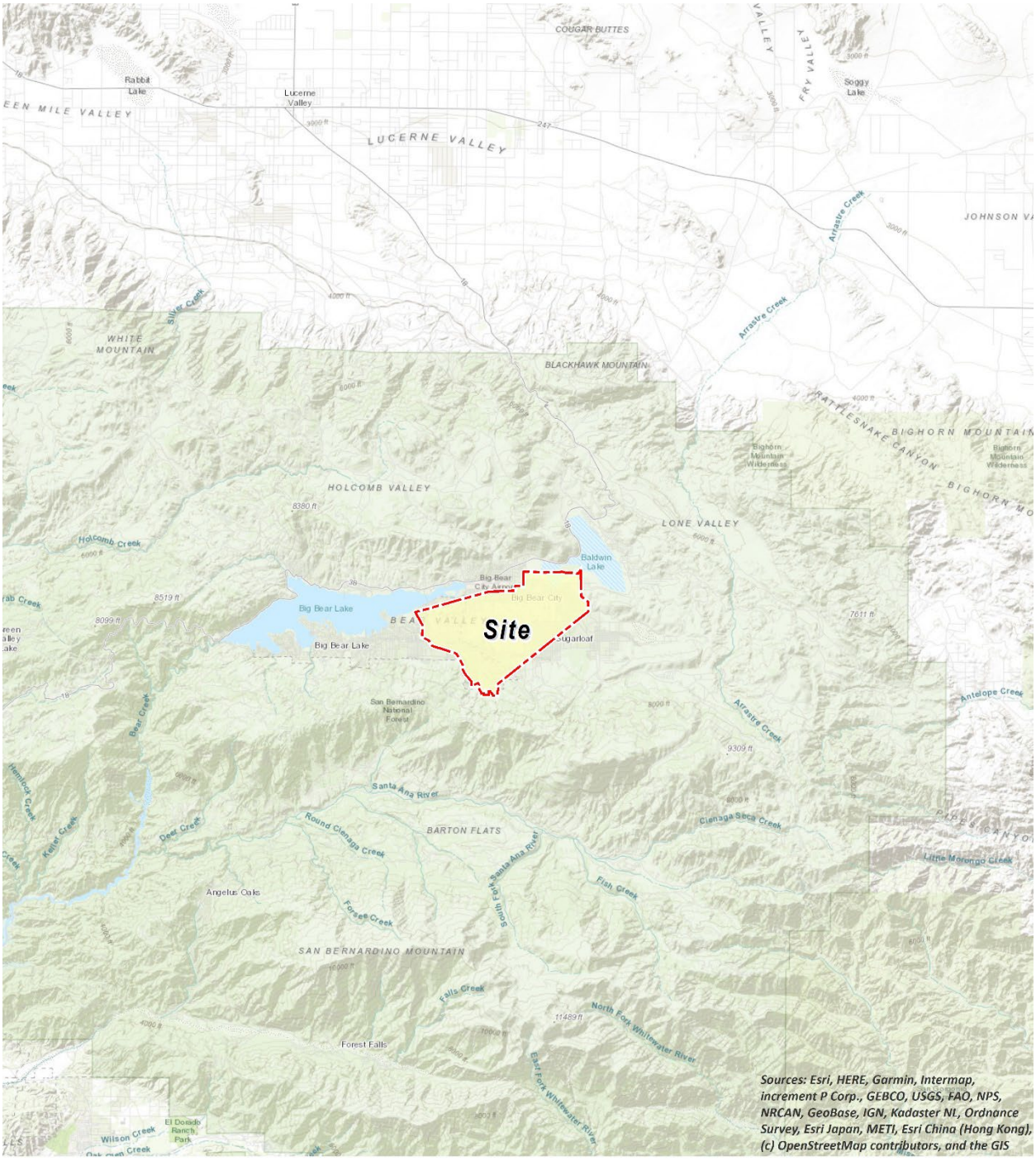
REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

The Sand Canyon groundwater recharge project involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline.

As part of the Replenish Big Bear Program, the following will be constructed:

- A new 471 gpm pump station near the snowmaking pond, at the BBLDWP Sand Canyon Well site, to convey water to Sand Canyon.
- A new 8-inch pipeline that will discharge into Sand Canyon and will be approximately 7,200 feet in length.
- Two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.
- Installation of erosion control using rip rap or similar erosion control methods, at Sand Canyon.

EXHIBIT 1-A: PROJECT LOCATION MAP



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2 EXISTING CONDITIONS

This section provides an overview of the existing energy conditions in the Project region.

2.1 OVERVIEW

The most recent data for California's estimated total energy consumption and natural gas consumption is from 2020, released by the United States (U.S.) Energy Information Administration's (EIA) California State Profile and Energy Estimates in 2021 and included (2):

- As of 2020, approximately 6,923 trillion British Thermal Unit (BTU) of energy was consumed
- As of 2021, approximately 605 million barrels of petroleum
- As of 2021, approximately 2,101 billion cubic feet of natural gas
- As of 2021, approximately 1 million short tons of coal

According to the EIA, in 2021 the U.S. petroleum consumption comprised about 77% of all transportation energy use, excluding fuel consumed for aviation and most marine vessels (3). In 2022, about 251,923 million gallons (or about 5.99 million barrels) of finished petroleum products were consumed in the U.S., an average of about 690 million gallons per day (or about 16.4 million barrels per day) (4). In 2021, California consumed approximately 12,157 million gallons in motor gasoline (33.31 million per day) and approximately 3,541 million gallons of diesel fuel (9.7 million per day) (5).

The most recent data provided by the EIA for energy use in California is reported from 2021 and provided by demand sectors as follows:

- Approximately 37.8% transportation sector
- Approximately 23.2% industrial sector
- Approximately 20.0% residential sector
- Approximately 19.0% commercial sector (6)

According to the EIA, California used approximately 247,250 gigawatt hours of electricity in 2021 (7). By sector in 2021, residential uses utilized 36.5% of the state's electricity, followed by 43.9% for commercial uses, 19.2% for industrial uses, and 0.3% for transportation. Electricity usage in California for differing land uses varies substantially by the type of uses in a building, type of construction materials used in a building, and the efficiency of all electricity-consuming devices within a building (7).

According to the EIA, California used approximately 200,871 million therms of natural gas in 2021 (8). In 2021 (the most recent year for which data is available), by sector, industrial uses utilized 33% of the state's natural gas, followed by 30% used as fuel in the electric power sector, 21% from residential, 11% from commercial, 1% from transportation uses and the remaining 3% was utilized for the operations, processing and production of natural gas itself (8). While the supply of natural gas in the United States and production in the lower 48 states has increased greatly since 2008, California produces little, and imports 90% of its supply of natural gas (9).

In 2022, total system electric generation for California was 287,220 gigawatt hours (GWh). California's massive electricity in-state generation system generated approximately 203,257 GWh which accounted for approximately 71% of the electricity it uses; the rest was imported from the Pacific Northwest (12%) and the U.S. Southwest (17%) (10). Natural gas is the main source for electricity generation at 47.46% of the total in-state electric generation system power as shown in Table 2-1.

An updated summary of, and context for energy consumption and energy demands within the State is presented in "U.S. Energy Information Administration, California State Profile and Energy Estimates, Quick Facts" excerpted below (11):

- In 2022, California was the seventh-largest producer of crude oil among the 50 states, and, as of January 2022, the state ranked third in crude oil refining capacity.
- California is the largest consumer of jet fuel and second-largest consumer of motor gasoline among the 50 states.
- In 2020, California was the second-largest total energy consumer among the states, but its per capita energy consumption was less than in all but three other states.
- In 2022, renewable resources, including hydroelectric power and small-scale, customer-sited solar power, accounted for 49% of California's in-state electricity generation. Natural gas fueled another 42%. Nuclear power supplied almost all the rest.
- In 2022, California was the fourth-largest electricity producer in the nation. The state was also the nation's third-largest electricity consumer, and additional needed electricity supplies came from out-of-state generators.

As indicated below, California is one of the nation's leading energy-producing states, and California's per capita energy use is among the nation's most efficient. Given the nature of the Project, the remainder of this discussion will focus on the three sources of energy that are most relevant to the Project—namely, electricity, natural gas, and transportation fuel for vehicle trips associated with the uses planned for the Project.

TABLE 2-1: TOTAL ELECRICITY SYSTEM POWER (CALIFORNIA 2022)

Fuel Type	California In-State Generation (GWh)	% of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	Total Imports (GWh)	Total California Energy Mix (GWh)	Total California Power Mix
Coal	273	0.13%	181	5,716	5,897	6,170	2.15%
Natural Gas	96,457	47.46%	44	7,994	8,038	104,495	36.38%
Oil	65	0.03%	-	-	-	65	0.2%
Other (Waste Heat/Petroleum Coke)	315	0.15%	-	-	-	315	0.11%
Unspecified	-	0.0%	12,485	7,943	20,428	20,428	7.11%
Total Thermal and Unspecified	**97,110**	**47.78%**	**12,710**	**21,653**	**34,363**	**121,473**	**45.77%**
Nuclear	17,627	8.67%	397	8,342	8,739	26,366	9.18%
Large Hydro	14,607	7.19%	10,803	1,118	11,921	26,528	9.24%
Biomass	5,366	2.64%	771	25	797	6,162	2.15%
Geothermal	11,110	5.47%	253	2,048	2,301	13,412	4.67%
Small Hydro	3,005	1.48%	211	13	225	3,230	1.12%
Solar	40,494	19.92%	231	8,225	8,456	48,950	17.04%
Wind	13,938	6.86%	8,804	8,357	17,161	31,099	10.83%
Total Non-GHG and Renewables	**106,147**	**52.22%**	**21,471**	**28,129**	**49,599**	**155,747**	**54.23%**
SYSTEM TOTALS	***203,257***	***100.0%***	***34,180***	***49,782***	***83,962***	***287,220***	***100.0%***

Source: CECs 2022 Total System Electric Generation

2.2 ELECTRICITY

The usage associated with electricity use were calculated using the California Emissions Estimator Model (CalEEMod) Version 2022.1.1.12. The Southern California region's electricity reliability has been of concern for the past several years due to the planned retirement of aging facilities that depend upon once-through cooling technologies, as well as the June 2013 retirement of the San Onofre Nuclear Generating Station (San Onofre). While the once-through cooling phase-out has been ongoing since the May 2010 adoption of the State Water Resources Control Board's once-through cooling policy, the retirement of San Onofre complicated the situation. California ISO studies revealed the extent to which the South California Air Basin (SCAB) and the San Diego Air Basin (SDAB) region were vulnerable to low-voltage and post-transient voltage instability concerns. A preliminary plan to address these issues was detailed in the 2013 Integrative Energy Policy Report (IEPR) after a collaborative process with other energy agencies, utilities, and air districts (12). Similarly, the subsequent 2022 IEPR provides information and policy recommendations on advancing a clean, reliable, and affordable energy system.

California's electricity industry is an organization of traditional utilities, private generating companies, and state agencies, each with a variety of roles and responsibilities to ensure that electrical power is provided to consumers. The California ISO is a nonprofit public benefit corporation and is the impartial operator of the State's wholesale power grid and is charged with maintaining grid reliability, and to direct uninterrupted electrical energy supplies to California's homes and communities. While utilities still own transmission assets, the ISO routes electrical power along these assets, maximizing the use of the transmission system and its power generation resources. The ISO matches buyers and sellers of electricity to ensure that enough power is available to meet demand. To these ends, every five minutes the ISO forecasts electrical demands, accounts for operating reserves, and assigns the lowest cost power plant unit to meet demands while ensuring adequate system transmission capacities and capabilities (13).

Part of the ISO's charge is to plan and coordinate grid enhancements to ensure that electrical power is provided to California consumers. To this end, utilities file annual transmission expansion/modification plans to accommodate the State's growing electrical needs. The ISO reviews and either approves or denies the proposed additions. In addition, and perhaps most importantly, the ISO works with other areas in the western United States electrical grid to ensure that adequate power supplies are available to the State. In this manner, continuing reliable and affordable electrical power is assured to existing and new consumers throughout the State.

Electricity is currently provided to the Project site by Bear Valley Electric Service (BVES). BVES provides electric power to more than 23 thousand persons in 2 counties, within a service area encompassing approximately 32 square miles. Based on BVES's 2021 Power Content Label Mix, BVES derives electricity from the following two primary energy resources: fossil fuels and purchases from independent power producers and utilities, including out-of-state suppliers (14).

Tables 2-2 identifies BVES's specific proportional shares of electricity sources in 2021. As indicated in Table 2-2, the 2021 BVES Power Mix has renewable energy at 0.0% of the overall energy resources. (15).

TABLE 2-2: BVES 2021 POWER CONTENT MIX

Energy Resources	2021 BVES Power Mix
Eligible Renewable	**0.0%**
Biomass & Waste	0.0%
Geothermal	0.0%
Eligible Hydroelectric	0.0%
Solar	0.0%
Wind	0.0%
Coal	**0.0%**
Large Hydroelectric	**0.0%**
Natural Gas	**1.4%**
Nuclear	**0.0%**
Other	**0.0%**
Unspecified Sources of power*	98.6%
Total	**100%**

* "Unspecified sources of power" means electricity from transactions that are not traceable to specific generation sources

2.3 NATURAL GAS

The following summary of natural gas customers and volumes, supplies, delivery of supplies, storage, service options, and operations is excerpted from information provided by the California Public Utilities Commission (CPUC).

> *"The CPUC regulates natural gas utility service for approximately 10.8 million customers that receive natural gas from Pacific Gas and Electric (PG&E), Southern California Gas (SoCalGas), San Diego Gas & Electric (SDG&E), Southwest Gas, and several smaller natural gas utilities. The CPUC also regulates independent storage operators: Lodi Gas Storage, Wild Goose Storage, Central Valley Storage and Gill Ranch Storage.*
>
> *California's natural gas utilities provide service to over 11 million gas meters. SoCalGas and PG&E provide service to about 5.9 million and 4.3 million customers, respectively, while SDG&E provides service to over 800, 000 customers. In 2018, California gas utilities forecasted that they would deliver about 4740 million cubic feet per day (MMcfd) of gas to their customers, on average, under normal weather conditions.*
>
> *The overwhelming majority of natural gas utility customers in California are residential and small commercials customers, referred to as "core" customers. Larger volume gas customers, like electric generators and industrial customers, are called "noncore" customers. Although very small in number relative to core customers, noncore customers consume about 65% of the natural gas delivered by the state's natural gas utilities, while core customers consume about 35%.*

A significant amount of gas (about 19%, or 1131 MMcfd, of the total forecasted California consumption in 2018) is also directly delivered to some California large volume consumers, without being transported over the regulated utility pipeline system. Those customers, referred to as "bypass" customers, take service directly from interstate pipelines or directly from California producers.

SDG&E and Southwest Gas' southern division are wholesale customers of SoCalGas, i.e., they receive deliveries of gas from SoCalGas and in turn deliver that gas to their own customers. (Southwest Gas also provides natural gas distribution service in the Lake Tahoe area). Similarly, West Coast Gas, a small gas utility, is a wholesale customer of PG&E. Some other wholesale customers are municipalities like the cities of Palo Alto, Long Beach, and Vernon, which are not regulated by the CPUC.

Natural gas from out-of-state production basins is delivered into California via the interstate natural gas pipeline system. The major interstate pipelines that deliver out-of-state natural gas to California gas utilities are Gas Transmission Northwest Pipeline, Kern River Pipeline, Transwestern Pipeline, El Paso Pipeline, Ruby Pipeline, Mojave Pipeline, and Tuscarora. Another pipeline, the North Baja - Baja Norte Pipeline takes gas off the El Paso Pipeline at the California/Arizona border and delivers that gas through California into Mexico. While the Federal Energy Regulatory Commission (FERC) regulates the transportation of natural gas on the interstate pipelines, and authorizes rates for that service, the California Public Utilities Commission may participate in FERC regulatory proceedings to represent the interests of California natural gas consumers.

The gas transported to California gas utilities via the interstate pipelines, as well as some of the California-produced gas, is delivered into the PG&E and SoCalGas intrastate natural gas transmission pipelines systems (commonly referred to as California's "backbone" pipeline system). Natural gas on the utilities' backbone pipeline systems is then delivered to the local transmission and distribution pipeline systems, or to natural gas storage fields. Some large volume noncore customers take natural gas delivery directly off the high-pressure backbone and local transmission pipeline systems, while core customers and other noncore customers take delivery off the utilities' distribution pipeline systems. The state's natural gas utilities operate over 100,000 miles of transmission and distribution pipelines, and thousands more miles of service lines.

Bypass customers take most of their deliveries directly off the Kern/Mojave pipeline system, but they also take a significant amount of gas from California production.

PG&E and SoCalGas own and operate several natural gas storage fields that are located within their service territories in northern and southern California, respectively. These storage fields, and four independently owned storage utilities - Lodi Gas Storage, Wild Goose Storage, Central Valley Storage, and Gill Ranch Storage - help meet peak seasonal and daily natural gas demand and allow California natural gas customers to secure natural gas supplies more efficiently. PG&E is a 25% owner of the Gill Ranch Storage field. These storage fields provide a significant amount of infrastructure capacity to help meet

California's natural gas requirements, and without these storage fields, California would need much more pipeline capacity in order to meet peak gas requirements.

Prior to the late 1980s, California regulated utilities provided virtually all natural gas services to all their customers. Since then, the Commission has gradually restructured the California gas industry in order to give customers more options while assuring regulatory protections for those customers that wish to, or are required to, continue receiving utility-provided services.

The option to purchase natural gas from independent suppliers is one of the results of this restructuring process. Although the regulated utilities procure natural gas supplies for most core customers, core customers have the option to purchase natural gas from independent natural gas marketers, called "core transport agents" (CTA). Contact information for core transport agents can be found on the utilities' web sites. Noncore customers, on the other hand, make natural gas supply arrangements directly with producers or with marketers.

Another option resulting from the restructuring process occurred in 1993, when the Commission removed the utilities' storage service responsibility for noncore customers, along with the cost of this service from noncore customers' transportation rates. The Commission also encouraged the development of independent storage fields, and in subsequent years, all the independent storage fields in California were established. Noncore customers and marketers may now take storage service from the utility or from an independent storage provider (if available), and pay for that service, or may opt to take no storage service at all. For core customers, the Commission assures that the utility has adequate storage capacity set aside to meet core requirements, and core customers pay for that service.

In a 1997 decision, the Commission adopted PG&E's "Gas Accord", which unbundled PG&E's backbone transmission costs from noncore transportation rates. This decision gave customers and marketers the opportunity to obtain pipeline capacity rights on PG&E's backbone transmission pipeline system, if desired, and pay for that service at rates authorized by the Commission. The Gas Accord also required PG&E to set aside a certain amount of backbone transmission capacity in order to deliver gas to its core customers. Subsequent Commission decisions modified and extended the initial terms of the Gas Accord. The "Gas Accord" framework is still in place today for PG&E's backbone and storage rates and services and is now simply referred to as PG&E Gas Transmission and Storage (GT&S).

In a 2006 decision, the Commission adopted a similar gas transmission framework for Southern California, called the "firm access rights" system. SoCalGas and SDG&E implemented the firm access rights (FAR) system in 2008, and it is now referred to as the backbone transmission system (BTS) framework. As under the PG&E backbone transmission system, SoCalGas backbone transmission costs are unbundled from noncore transportation rates. Noncore customers and marketers may obtain, and pay for, firm backbone transmission capacity at various receipt points on the SoCalGas system. A

certain amount of backbone transmission capacity is obtained for core customers to assure meeting their requirements.

Many if not most noncore customers now use a marketer to provide for several of the services formerly provided by the utility. That is, a noncore customer may simply arrange for a marketer to procure its supplies, and obtain any needed storage and backbone transmission capacity, in order to assure that it will receive its needed deliveries of natural gas supplies. Core customers still mainly rely on the utilities for procurement service, but they have the option to take procurement service from a CTA. Backbone transmission and storage capacity is either set aside or obtained for core customers in amounts to assure very high levels of service.

In order properly operate their natural gas transmission pipeline and storage systems, PG&E and SoCalGas must balance the amount of gas received into the pipeline system and delivered to customers or to storage fields. Some of these utilities' storage capacity is dedicated to this service, and under most circumstances, customers do not need to precisely match their deliveries with their consumption. However, when too much or too little gas is expected to be delivered into the utilities' systems, relative to the amount being consumed, the utilities require customers to more precisely match up their deliveries with their consumption. And, if customers do not meet certain delivery requirements, they could face financial penalties. The utilities do not profit from these financial penalties - the amounts are then returned to customers as a whole. If the utilities find that they are unable to deliver all the gas that is expected to be consumed, they may even call for a curtailment of some gas deliveries. These curtailments are typically required for just the largest, noncore customers. It has been many years since there has been a significant curtailment of core customers in California." (16)

As indicated in the preceding discussions, natural gas is available from a variety of in-state and out-of-state sources and is provided throughout the state in response to market supply and demand. Complementing available natural gas resources, biogas may soon be available via existing delivery systems, thereby increasing the availability and reliability of resources in total. The CPUC oversees utility purchases and transmission of natural gas to ensure reliable and affordable natural gas deliveries to existing and new consumers throughout the State.

2.4 TRANSPORTATION ENERGY RESOURCES

The Project would generate additional vehicle trips with resulting consumption of energy resources, predominantly gasoline and diesel fuel. The Department of Motor Vehicles (DMV) identified 36.2 million registered vehicles in California (6), and those vehicles consume an estimated 17.2 billion gallons of fuel each year[1]. Gasoline (and other vehicle fuels) are commercially provided commodities and would be available to the Project patrons and employees via commercial outlets.

[1] Fuel consumptions estimated utilizing information from EMFAC2021.

California's on-road transportation system includes 396,616 lane miles, more than 26.6 million passenger vehicles and light trucks, and almost 9.0 million medium- and heavy-duty vehicles (6). While gasoline consumption has been declining since 2008 it is still by far the dominant fuel. California is the second-largest consumer of petroleum products, after Texas, and accounts for 8% of the nation's total consumption. The State is the largest U.S. consumer of motor gasoline and jet fuel, and 83% of the petroleum consumed in California is used in the transportation sector (17).

California accounts for less than 1% of total U.S. natural gas reserves and production. As with crude oil, California's natural gas production has experienced a gradual decline since 1985. In 2021, about 33% of the natural gas delivered to consumers went to the State's industrial sector, and about 31% was delivered to the electric power sector. Natural gas fueled more than two-fifths of the State's utility-scale electricity generation in 2021. The residential sector, where three-fifths of California households use natural gas for home heating, accounted for 22% of natural gas deliveries. The commercial sector received 12% of the deliveries to end users and the transportation sector consumed the remaining 1% (17).

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3 REGULATORY BACKGROUND

Federal and state agencies regulate energy use and consumption through various means and programs. On the federal level, the United States Department of Transportation, the United States Department of Energy, and the United States Environmental Protection Agency (EPA) are three federal agencies with substantial influence over energy policies and programs. On the state level, the CPUC and the CEC are two agencies with authority over different aspects of energy. Relevant federal and state energy-related laws and plans are summarized below.

3.1 FEDERAL REGULATIONS

3.1.1 INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT OF 1991 (ISTEA)

The ISTEA promoted the development of inter-modal transportation systems to maximize mobility as well as address national and local interests in air quality and energy. ISTEA contained factors that Metropolitan Planning Organizations (MPOs) were to address in developing transportation plans and programs, including some energy-related factors. To meet the new ISTEA requirements, MPOs adopted explicit policies defining the social, economic, energy, and environmental values guiding transportation decisions.

3.1.2 THE TRANSPORTATION EQUITY ACT FOR THE 21ST CENTURY (TEA-21)

The TEA-21 was signed into law in 1998 and builds upon the initiatives established in the ISTEA legislation, discussed above. TEA-21 authorizes highway, highway safety, transit, and other efficient surface transportation programs. TEA-21 continues the program structure established for highways and transit under ISTEA, such as flexibility in the use of funds, emphasis on measures to improve the environment, and focus on a strong planning process as the foundation of good transportation decisions. TEA-21 also provides for investment in research and its application to maximize the performance of the transportation system through, for example, deployment of Intelligent Transportation Systems, to help improve operations and management of transportation systems and vehicle safety.

3.2 CALIFORNIA REGULATIONS

3.2.1 INTEGRATED ENERGY POLICY REPORT (IEPR)

Senate Bill 1389 (Bowen, Chapter 568, Statutes of 2002) requires the CEC to prepare a biennial integrated energy policy report that assesses major energy trends and issues facing the state's electricity, natural gas, and transportation fuel sectors and provides policy recommendations to conserve resources; protect the environment; ensure reliable, secure, and diverse energy supplies; enhance the state's economy; and protect public health and safety (Public Resources Code § 25301[a]). The CEC prepares these assessments and associated policy recommendations every two years, with updates in alternate years, as part of the Integrated Energy Policy Report.

The 2022 IEPR was adopted February 2023, and continues to work towards improving electricity, natural gas, and transportation fuel energy use in California. The 2022 IEPR introduces a new

framework for embedding equity and environmental justice at the CEC and the California Energy Planning Library which allows for easier access to energy data and analytics for a wide range of users. Additionally, energy reliability, western electricity integration, gasoline cost factors and price spikes, the role of hydrogen in California's clean energy future, fossil gas transition and distributed energy resources are topics discussed within the 2022 IEPR (18).

3.2.2 STATE OF CALIFORNIA ENERGY PLAN

The CEC is responsible for preparing the State Energy Plan, which identifies emerging trends related to energy supply, demand, conservation, public health and safety, and the maintenance of a healthy economy. The Plan calls for the state to assist in the transformation of the transportation system to improve air quality, reduce congestion, and increase the efficient use of fuel supplies with the least environmental and energy costs. To further this policy, the plan identifies several strategies, including assistance to public agencies and fleet operators and encouragement of urban designs that reduce vehicle miles traveled (VMT) and accommodate pedestrian and bicycle access.

3.2.3 CALIFORNIA CODE TITLE 24, PART 6, ENERGY EFFICIENCY STANDARDS

California Code of Regulations (CCR) Title 24 Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption.

The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods. Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases greenhouse gas (GHG) emissions. The 2022 version of Title 24 was adopted by the CEC and became effective on January 1, 2023. The 2022 Title 24 standards require solar photovoltaic systems for new homes, establish requirements for newly constructed healthcare facilities, encourage demand responsive technologies for residential buildings, and update indoor and outdoor lighting standards for nonresidential buildings.

The CEC anticipates that the 2022 energy code will provide $1.5 billion in consumer benefits and reduce GHG emissions by 10 million metric tons (19). The Project would be required to comply with the applicable standards in place at the time building permit document submittals are made. These require, among other items (20):

NONRESIDENTIAL MANDATORY MEASURES

- Short-term bicycle parking. If the new project or an additional alteration is anticipated to generate visitor traffic, provide permanently anchored bicycle racks within 200 feet of the visitors' entrance, readily visible to passers-by, for 5% of new visitor motorized vehicle parking spaces being added, with a minimum of one two-bike capacity rack (5.106.4.1.1).
- Long-term bicycle parking. For new buildings with tenant spaces that have 10 or more tenant-occupants, provide secure bicycle parking for 5% of the tenant-occupant vehicular parking spaces with a minimum of one bicycle parking facility (5.106.4.1.2).

- Designated parking for clean air vehicles. In new projects or additions to alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of low-emitting, fuel-efficient and carpool/van pool vehicles as shown in Table 5.106.5.2 (5.106.5.2).
- EV charging stations. New construction shall facilitate the future installation of EV supply equipment. The compliance requires empty raceways for future conduit and documentation that the electrical system has adequate capacity for the future load. The number of spaces to be provided for is contained in Table 5.106. 5.3.3 (5.106.5.3). Additionally, Table 5.106.5.4.1 specifies requirements for the installation of raceway conduit and panel power requirements for medium- and heavy-duty EV supply equipment for warehouses, grocery stores, and retail stores.
- Outdoor light pollution reduction. Outdoor lighting systems shall be designed to meet the backlight, uplight and glare ratings per Table 5.106.8 (5.106.8).
- Construction waste management. Recycle and/or salvage for reuse a minimum of 65% of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1. 5.405.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent (5.408.1).
- Excavated soil and land clearing debris. 100% of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reuse or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed (5.408.3).
- Recycling by Occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage, and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive (5.410.1).
- Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:
    - Water Closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush (5.303.3.1)
    - Urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush (5.303.3.2.1). The effective flush volume of floor- mounted or other urinals shall not exceed 0.5 gallons per flush (5.303.3.2.2).
    - Showerheads. Single showerheads shall have a minimum flow rate of not more than 1.8 gallons per minute and 80 psi (5.303.3.3.1). When a shower is served by more than one showerhead, the combine flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi (5.303.3.3.2).
    - Faucets and fountains. Nonresidential lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi (5.303.3.4.1). Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute of 60 psi (5.303.3.4.2). Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute (5.303.3.4.3). Metering faucets shall not deliver more than 0.20 gallons per cycle (5.303.3.4.4). Metering faucets for wash fountains shall have a maximum flow rate not more than 0.20 gallons per cycle (5.303.3.4.5).

- Outdoor potable water uses in landscaped areas. Nonresidential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent (5.304.1).
- Water meters. Separate submeters or metering devices shall be installed for new buildings or additions in excess of 50,000 sf or for excess consumption where any tenant within a new building or within an addition that is project to consume more than 1,000 gallons per day (GPD) (5.303.1.1 and 5.303.1.2).
- Outdoor water uses in rehabilitated landscape projects equal or greater than 2,500 sf. Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 2,500 sf requiring a building or landscape permit (5.304.3).
- Commissioning. For new buildings 10,000 sf and over, building commissioning shall be included in the design and construction processes of the building project to verify that the building systems and components meet the owner's or owner representative's project requirements (5.410.2).

3.2.4 AB 1493 Pavley Regulations and Fuel Efficiency Standards

California AB 1493, enacted on July 22, 2002, required CARB to develop and adopt regulations that reduce GHGs emitted by passenger vehicles and light duty trucks. Under this legislation, CARB adopted regulations to reduce GHG emissions from non-commercial passenger vehicles (cars and light-duty trucks). Although aimed at reducing GHG emissions, specifically, a co-benefit of the Pavley standards is an improvement in fuel efficiency and consequently a reduction in fuel consumption.

3.2.5 California's Renewable Portfolio Standard (RPS)

First established in 2002 under Senate Bill (SB) 1078, California's Renewable Portfolio Standards (RPS) requires retail sellers of electric services to increase procurement from eligible renewable resources to 33% of total retail sales by 2020 (21).

3.2.6 Clean Energy and Pollution Reduction Act of 2015 (SB 350)

In October 2015, the legislature approved, and the Governor signed SB 350, which reaffirms California's commitment to reducing its GHG emissions and addressing climate change. Key provisions include an increase in the renewables portfolio standard (RPS), higher energy efficiency requirements for buildings, initial strategies towards a regional electricity grid, and improved infrastructure for electric vehicle charging stations. Specifically, SB 350 requires the following to reduce statewide GHG emissions:

- Increase the amount of electricity procured from renewable energy sources from 33% to 50% by 2030, with interim targets of 40% by 2024, and 25% by 2027.
- Double the energy efficiency in existing buildings by 2030. This target will be achieved through the California Public Utility Commission (CPUC), the California Energy Commission (CEC), and local publicly owned utilities.

- Reorganize the Independent System Operator (ISO) to develop more regional electrify transmission markets and to improve accessibility in these markets, which will facilitate the growth of renewable energy markets in the western United States (California Leginfo 2015).

3.2.7 100 PERCENT CLEAN ENERGY ACT OF 2018 (SB 100)

In September 2018, the legislature approved, and the Governor signed SB 100, which builds on the targets established in SB 1078 and SB 350. Most notably, SB 100 sets a goal of powering all retail electricity sold in California with renewable and zero-carbon resources. Additionally, SB 100 updates the interim renewables target from 50% to 60% by 2030.

3.2.8 EXECUTIVE ORDER N-79-20 AND ADVANCED CLEAN CARS II

On August 25, 2022 CARB approved the Advanced Clean Cars II rule, which codifies the goals set out in Executive Order N-79-20 and establishes a year-by-year roadmap such that by 2035, 100% of new cars and light trucks sold in California will be zero-emission vehicles. Under this regulation, automakers are required to accelerate deliveries of zero-emission light-duty vehicles, beginning with model year 2026. CARB estimates that between 2026 and 2040, the regulation would reduce GHG emissions by a cumulative 395 million metric tons, equivalent to reducing petroleum use by 915 million barrels.

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4 PROJECT ENERGY DEMANDS AND ENERGY EFFICIENCY MEASURES

4.1 EVALUATION CRITERIA

Per Appendix F of the *State CEQA Guidelines* (22), states that the means of achieving the goal of energy conservation includes the following:

- Decreasing overall per capita energy consumption;
- Decreasing reliance on fossil fuels such as coal, natural gas, and oil; and
- Increasing reliance on renewable energy sources.

In compliance with Appendix G of the *State CEQA Guidelines* (23), this report analyzes the project's anticipated energy use during construction and operations to determine if the Project would:

- Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation; or
- Conflict with or obstruct a state or local plan for renewable energy or energy efficiency.

4.2 METHODOLOGY

Information from the CalEEMod Version 2022.1.1.12 outputs for the *Replenish Big Bear Program Air Quality Impact Analysis* (24) was utilized in this analysis, detailing Project related construction equipment, transportation energy demands, and facility energy demands.

CONSTRUCTION DURATION

Construction is anticipated to begin in January 2025 and will last through January 2027 (24). The construction schedule utilized in the analysis, shown in Table 4-1, represents a "worst-case" analysis scenario. The duration of construction activity and associated equipment represents a reasonable approximation of the expected construction fleet as required per *CEQA Guidelines* (25).

TABLE 4-1: CONSTRUCTION DURATION

Construction Activity	Start Date	End Date	Days
Replenish Big Bear Component 1: BBARWA WWTP Upgrades	Jan 2025	Jan 2027	515
Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment	May 2025	Oct 2026	370
Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline	May 2025	Oct 2026	370
Replenish Big Bear Component 4: Evaporation Pond	May 2025	Oct 2026	370
Replenish Big Bear Component 5: Sand Canyon	May 2025	Oct 2026	370

CONSTRUCTION EQUIPMENT

Table 4-2 summarizes the equipment fleets and durations modeled for each construction activity.

TABLE 4-2: CONSTRUCTION EQUIPMENT ASSUMPTIONS

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Replenish Big Bear Component 1: BBARWA WWTP Upgrades			
Dozers	Rubber Tired Dozers	1	8
Graders	Graders	1	8
Cranes	Cranes	1	8
Backhoes	Tractors/Loaders/Backhoes	1	8
Drill Rig	Bore/Drill Rig	1	8
Cement Trucks	Off-Highway Trucks	1	8
Forklifts	Forklifts	1	4
Backhoes	Tractors/Loaders/Backhoes	1	4
Front Loaders	Crawler Tractors	1	4
Dump/Delivery Trucks	Off-Highway Trucks	2	8
Replenish Big Bear Component 2: Lake Discharge Pipeline Alignment			
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Paver	Paver	1	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Pavement Cutter	Concrete/Industrial Saws	1	6
Grinder	Concrete/Industrial Saws	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Paving Machine	Pavers	1	2

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Replenish Big Bear Component 3: Shay Pond Conveyance Pipeline			
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Replenish Big Bear Component 4: Evaporation Pond			
Bulldozers	Rubber Tired Dozers	2	8
Front End Loaders	Crawler Tractors	2	8
Water Truck	Off-Highway Trucks	2	8
Scrapers	Scraper	7	8
Excavators	Excavator	2	8
Dump Trucks	Off-Highway Trucks	4	8
Replenish Big Bear Component 5: Sand Canyon			
Drill Rig	Bore/Drill Rig	1	8
Cranes	Cranes	1	4
Forklifts	Forklifts	1	4
Backhoes	Tractors/Loaders/Backhoes	1	4
Front Loaders	Crawler Tractors	1	4
Cement Trucks	Off-Highway Trucks	1	8
Excavator	Excavator	1	8
Backhoe	Tractors/Loaders/Backhoes	1	8

Equipment	CalEEMod Equivalent	Amount	Hours Per Day
Compaction Equipment	Plate Compactor	1	8
Pickup Trucks	Off-Highway Trucks	2	8
Paver	Paver	1	8
Roller	Roller	1	8
Water Truck	Off-Highway Trucks	1	8
Traffic Control Signage and Devices	Signal Boards	1	8
Dump/Delivery Trucks	Off-Highway Trucks	10	8
Backhoe	Tractors/Loaders/Backhoes	1	6
Compactor	Plate Compactor	1	6
Roller/Vibrator	Roller	1	6
Pavement Cutter	Concrete/Industrial Saws	1	6
Grinder	Concrete/Industrial Saws	1	6
Haul Truck	Off-Highway Trucks	1	6
Dump Truck	Off-Highway Trucks	2	6
Water Truck	Off-Highway Trucks	1	4
Excavator	Excavator	1	4
Paving Machine	Pavers	1	2
Compactor	Plate Compactor	1	2

Source: Construction equipment based on information provided by BBARWA and the Project Team. It should be noted that the Haul/Dump/Delivery trucks are modeled into the Trips & VMT section of CalEEMod.

4.2.1 CALEEMOD

In May 2023 the California Air Pollution Control Officers Association (CAPCOA) in conjunction with other California air districts, including the South Coast Air Quality Management District (SCAQMD), released the latest version of CalEEMod version 2022.1.1.12. The purpose of this model is to calculate construction-source and operational-source criteria pollutant (VOCs, NO_X, SO_X, CO, PM_{10}, and $PM_{2.5}$) and GHG emissions from direct and indirect sources; and quantify applicable air quality and GHG reductions achieved from mitigation measures (26). Accordingly, the latest version of CalEEMod has been used for this Project to determine construction and operational air quality emissions. Output from the model runs for both construction and operational activity are provided in Appendix 4.1.

4.2.2 EMISSION FACTORS MODEL

On May 2, 2022, the EPA approved the 2021 version of the EMissions FACtor model (EMFAC) web database for use in State Implementation Plan and transportation conformity analyses. EMFAC2021 is a mathematical model that was developed to calculate emission rates, fuel consumption, VMT from motor vehicles that operate on highways, freeways, and local roads in

California and is commonly used by the CARB to project changes in future emissions from on-road mobile sources (27). This energy study utilizes the different fuel types for each vehicle class from the annual EMFAC2021 emission inventory in order to derive the average vehicle fuel economy which is then used to determine the estimated annual fuel consumption associated with vehicle usage during Project construction and operational activities. For purposes of the analysis, the 2025, 2026, 2027 analysis years were utilized to determine the average vehicle fuel economy used throughout the duration of the Project. Output from the EMFAC2021 model runs are provided in Appendix 4.2.

4.3 CONSTRUCTION ENERGY DEMANDS

The focus within this section is the energy implications of the construction process, specifically the power cost from on-site electricity consumption during construction of the proposed Project.

4.3.1 CONSTRUCTION POWER COST

The total Project construction power costs is the summation of the products of the area (sf) by the construction duration and the typical power cost.

PROJECT CONSTRUCTION POWER COST

The *2023 National Construction Estimator* identifies a typical power cost per 1,000 sf of construction per month of $2.50, which was used to calculate the Project's total construction power cost (28).

As shown on Table 4-3, the total power cost of the on-site electricity usage during the construction of the Project is estimated to be approximately $126,967.83.

TABLE 4-3: CONSTRUCTION POWER COST

Land Use	Power Cost (per 1,000 SF of construction per month)	Size (1,000 SF)	Construction Duration (months)	Project Construction Power Cost
BBARWA WWTP Upgrades	$2.50	173.805	24	$10,428.28
Lake Discharge Pipeline Alignment	$2.50	3,092.766	17	$3,813.68
Shay Pond Conveyance Pipeline	$2.50	28.314	17	$1,203.35
Evaporation Pond	$2.50	141.135	17	$105,524.29
Sand Canyon	$2.50	2,482.924	17	$5,998.22
TOTAL CONSTRUCTION POWER COST				***$126,967.83***

4.3.2 CONSTRUCTION ELECTRICITY USAGE

The total Project construction electricity usage is the summation of the products of the power cost (estimated in Table 4-3) by the utility provider cost per kilowatt hour (kWh) of electricity.

PROJECT CONSTRUCTION ELECTRICITY USAGE

The BVES's general service rate schedule were used to determine the Project's electrical usage. As of March 1, 2023, BVES's general service rate is $0.25 per kilowatt hours (kWh) of electricity for general services (29). As shown on Table 4-4, the total electricity usage from on-site Project construction related activities is estimated to be approximately 505,164 kWh.

TABLE 4-4: CONSTRUCTION ELECTRICITY USAGE

Land Use	Cost per kWh	Project Construction Electricity Usage (kWh)
Proposed Project		
BBARWA WWTP Upgrades	$0.25	41,491
Lake Discharge Pipeline Alignment	$0.25	15,173
Shay Pond Conveyance Pipeline	$0.25	4,788
Evaporation Pond	$0.25	419,847
Sand Canyon	$0.25	23,865
TOTAL CONSTRUCTION ELECTRICITY USAGE		***505,164***

4.3.3 CONSTRUCTION EQUIPMENT FUEL ESTIMATES

Fuel consumed by construction equipment would be the primary energy resource expended over the course of Project construction.

PROJECT CONSTRUCTION EQUIPMENT FUEL CONSUMPTION

Project construction activity timeline estimates, construction equipment schedules, equipment power ratings, load factors, and associated fuel consumption estimates are presented in Table 4-5.

The aggregate fuel consumption rate for all equipment is estimated at 18.5 horsepower hour per gallon (hp-hr-gal.), obtained from CARB 2018 Emissions Factors Tables and cited fuel consumption rate factors presented in Table D-24 of the Moyer guidelines (30). For the purposes of this analysis, the calculations are based on all construction equipment being diesel-powered which is consistent with industry standards. Diesel fuel would be supplied by existing commercial fuel providers serving the Project area and region[2]. As presented on Table 4-5, Project construction activities would consume an estimated 565,550 gallons of diesel fuel. Project construction would represent a "single-event" diesel fuel demand and would not require on-going or permanent commitment of diesel fuel resources for this purpose.

[2] Based on Appendix A of the CalEEMod User's Guide, Construction consists of several types of off-road equipment. Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod assumes all of the equipment operates on diesel fuel.

TABLE 4-5: CONSTRUCTION EQUIPMENT FUEL CONSUMPTION ESTIMATES

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption (gal. diesel fuel)
BBARWA WWTP Upgrades								
Linear, Grading & Excavation	30	Bore/Drill Rigs	83	1	8	0.5	332	538
		Off-Highway Trucks	376	1	8	0.38	1,143	1,854
		Tractors/Loaders/Backhoes	84	1	4	0.37	124	202
Building Construction	465	Rubber Tired Dozers	367	1	8	0.4	1,174	29,519
		Graders	148	1	8	0.41	485	12,202
		Cranes	367	1	8	0.29	851	21,401
		Tractors/Loaders/Backhoes	84	1	8	0.37	249	6,250
		Off-Highway Trucks	376	2	8	0.38	2,286	57,461
		Crawler Tractors	87	1	4	0.43	150	3,761
		Forklifts	82	1	4	0.2	66	1,649
BBARWA WWTP UPGRADES - CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***134,836***
Lake Discharge Pipeline Alignment								
Linear, Grading & Excavation	190	Excavators	36	1	8	0.38	109	1,124
		Tractors/Loaders/Backhoes	84	1	8	0.37	249	2,554
		Plate Compactors	8	1	8	0.43	28	283
		Signal Boards	6	1	8	0.82	39	404
		Off-Highway Trucks	376	1	8	0.38	1,143	11,739
Linear, Drainage, Utilities, & Sub-Grade	190	Tractors/Loaders/Backhoes	84	1	6	0.37	186	1,915
		Plate Compactors	8	1	6	0.43	21	212
		Rollers	36	1	6	0.38	82	843
		Off-Highway Trucks	376	1	4	0.38	572	5,870
		Excavators	36	1	4	0.38	55	562
		Pavers	81	1	2	0.42	68	699
		Plate Compactors	8	1	2	0.43	7	71
Demolition	70	Concrete/Industrial Saws	33	2	6	0.73	289	1,094
LAKE DISCHARGE PIPELINE ALIGNMENT - CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***27,369***

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption (gal. diesel fuel)
Shay Pond Conveyance Pipeline								
Linear, Grading & Excavation	190	Signal Boards	6	1	8	0.82	39	404
		Excavators	36	1	8	0.38	109	1,124
		Tractors/Loaders/Backhoes	84	1	8	0.37	249	2,554
		Plate Compactors	8	1	8	0.43	28	283
		Rollers	36	1	8	0.38	109	1,124
		Off-Highway Trucks	376	1	8	0.38	1,143	11,739
Linear, Drainage, Utilities, & Sub-Grade	190	Tractors/Loaders/Backhoes	84	1	6	0.37	186	1,915
		Plate Compactors	8	1	6	0.43	21	212
		Rollers	36	1	6	0.38	82	843
		Excavators	36	1	4	0.38	55	562
		Off-Highway Trucks	376	1	4	0.38	572	5,870
SHAY POND CONVEYANCE PIPELINE - CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***26,630***
Evaporations Ponds								
Site Preparation	380	Rubber Tired Dozers	367	2	8	0.4	2,349	48,246
		Crushing/Proc. Equipment	12	2	2	0.85	41	838
		Off-Highway Trucks	376	2	8	0.38	2,286	46,957
		Scrapers	423	7	8	0.48	11,370	233,551
		Excavators	36	2	8	0.38	219	4,496
EVAPORATIONS PONDS - CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***334,088***
Sand Canyon								
Linear, Grading & Excavation	190	Tractors/Loaders/Backhoes	84	1	4	0.37	124	1,277
		Crawler Tractors	87	1	4	0.43	150	1,537
		Excavators	36	1	8	0.38	109	1,124
		Plate Compactors	8	1	8	0.43	28	283
		Pavers	81	1	8	0.42	272	2,795
		Rollers	36	1	8	0.38	109	1,124
		Off-Highway Trucks	376	1	8	0.38	1,143	11,739

Construction Activity	Duration (Days)	Equipment	HP Rating	Quantity	Usage Hours	Load Factor	HP-hrs/day	Total Fuel Consumption (gal. diesel fuel)
		Signal Boards	6	1	8	0.82	39	404
Linear, Drainage, Utilities, & Sub-Grade	190	Cranes	367	1	4	0.29	426	4,372
		Forklifts	82	1	4	0.2	66	674
		Tractors/Loaders/Backhoes	84	1	8	0.37	249	2,554
		Plate Compactors	8	1	6	0.43	21	212
		Rollers	36	1	6	0.38	82	843
		Excavators	36	1	4	0.38	55	562
Linear, Drainage, Utilities, & Sub-Grade	190	Off-Highway Trucks	376	1	4	0.38	572	5,870
		Pavers	81	1	2	0.42	68	699
Demolition	20	Concrete/Industrial Saws	33	2	6	0.73	289	313
Building Construction	220	Bore/Drill Rigs	83	1	8	0.5	332	3,948
		Plate Compactors	8	1	2	0.43	7	82
		Tractors/Loaders/Backhoes	84	1	6	0.37	186	2,218
SAND CANYON - CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***42,628***
TOTAL CONSTRUCTION FUEL DEMAND (GALLONS DIESEL FUEL)								***565,550***

4.3.4 CONSTRUCTION TRIPS AND VMT

Construction generates on-road vehicle emissions from vehicle usage for workers, hauling, and vendors commuting to and from the site. The number of workers, hauling, and vendor trips are presented below in Table 4-6. It should be noted that the trip length for workers, hauling, and vendor trips were adjusted to 100 miles based on BBARWA and the Project Team provided data.

TABLE 4-6: CONSTRUCTION TRIPS AND VMT

Construction Activity	One-Way Trips per Day			Trip Length		
	Worker	Vendor	Hauling	Worker	Vendor	Hauling
BBARWA WWTP Upgrades						
Demolition	50	25	46	100	100	100
Building Construction	50	7	2	100	100	100
Linear, Grading & Excavation	50	0	0	100	10.2	100
Lake Discharge Pipeline Alignment						
Demolition	5	0	21	100	10.2	100
Linear, Grading & Excavation	15	0	36	100	10.2	100
Linear, Drainage, Utilities, & Sub-Grade	18	0	0	100	10.2	20
Shay Pond Conveyance Pipeline						
Linear, Grading & Excavation	2	13	5	100	100	20
Linear, Drainage, Utilities, & Sub-Grade	0	0	0	18.5	10.2	20
Evaporation Ponds						
Site Preparation	10	0	11	100	10.2	100
Sand Canyon						
Demolition	5	0	19	100	10.2	100
Linear, Grading & Excavation	20	0	18	100	10.2	100
Building Construction	5	6	0	100	100	20
Linear, Drainage, Utilities, & Sub-Grade	20	0	0	100	10.2	20

4.3.5 CONSTRUCTION WORKER FUEL ESTIMATES

With respect to estimated VMT for the Project, the construction worker trips would generate an estimated 4,532,000 VMT during construction (24). Based on CalEEMod methodology, it is assumed that 50% of all worker trips are from light-duty-auto vehicles (LDA), 25% are from light-duty-trucks (LDT1[3]), and 25% are from light-duty-trucks (LDT2[4]). Data regarding Project related construction worker trips were based on CalEEMod defaults utilized within the AQIA.

[3] Vehicles under the LDT1 category have a gross vehicle weight rating (GVWR) of less than 6,000 lbs. and equivalent test weight (ETW) of less than or equal to 3,750 lbs.

[4] Vehicles under the LDT2 category have a GVWR of less than 6,000 lbs. and ETW between 3,751 lbs. and 5,750 lbs.

Vehicle fuel efficiencies for LDA, LDT1, and LDT2 were estimated using information generated within the 2021 version of the EMFAC developed by CARB. EMFAC2021 is a mathematical model that was developed to calculate emission rates, fuel consumption, and VMT from motor vehicles that operate on highways, freeways, and local roads in California and is commonly used by the CARB to project changes in future emissions from on-road mobile sources (27). EMFAC2021 was run for the LDA, LDT1, and LDT2 vehicle class within the San Bernardino South Coast sub-area for the 2025, 2026, 2027 calendar years. Data from EMFAC2021 is shown in Appendix 4.2.

Tables 4-7 through 4-9 provide estimated annual fuel consumption resulting from Project construction worker trips. Based on Tables 4-7 through 4-9, it is estimated that 157,463 gallons of fuel will be consumed related to construction worker trips during full construction of the Project.

It should be noted that construction worker trips would represent a "single-event" gasoline fuel demand and would not require on-going or permanent commitment of fuel resources for this purpose.

TABLE 4-7: CONSTRUCTION WORKER FUEL CONSUMPTION ESTIMATES – LDA

Category	**Construction Activity**	**Duration** (Days)	**Worker** (Trips/Day)	**Trip Length** (miles)	**Vehicle Miles Traveled**	**Average Vehicle Fuel Economy** (mpg)	**Estimated Fuel Consumption** (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	25	100	52,500	32.57	1,612
	Building Construction	226	25	100	565,000	32.57	17,349
	2026						
	Building Construction	239	25	100	597,500	33.47	17,849
	Linear, Grading & Excavation	23	25	100	57,500	33.47	1,718
	2027						
	Linear, Grading & Excavation	7	25	100	17,500	34.38	509
Lake Discharge Pipeline Alignment	**2025**						
	Demolition	71	3	100	17,750	32.57	545
	Linear, Grading & Excavation	175	8	100	131,250	32.57	4,030
	2026						
	Linear, Grading & Excavation	15	8	100	11,250	33.47	336
	Linear, Drainage, Utilities, & Sub-Grade	190	9	100	166,250	33.47	4,966
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	1	100	17,500	32.57	537
	2026						
	Linear, Grading & Excavation	15	1	100	1,500	33.47	45
	Linear, Drainage, Utilities, & Sub-Grade	190	0	18.5	0	33.47	0

Category	Construction Activity	Duration (Days)	Worker (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
Evaporation Ponds	**2025**						
	Site Preparation	175	5	100	87,500	32.57	2,687
	2026						
	Site Preparation	205	5	100	102,500	33.47	3,062
Sand Canyon	**2025**						
	Demolition	21	2.5	100	5,250	32.57	161
	Linear, Grading & Excavation	174	10	100	174,000	32.57	5,343
	Building Construction	144	2.5	100	36,000	32.57	1,105
	2026						
	Linear, Grading & Excavation	16	10	100	16,000	33.47	478
	Building Construction	77	2.5	100	19,250	33.47	575
	Linear, Drainage, Utilities, & Sub-Grade	190	10	100	190,000	33.47	5,676
TOTAL CONSTRUCTION WORKER FUEL CONSUMPTION – LDA							***68,584***

TABLE 4-8: CONSTRUCTION WORKER FUEL CONSUMPTION ESTIMATES – LDT1

Category	Construction Activity	Duration (Days)	Worker (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	12.5	100	26,250	25.11	1,045
	Building Construction	226	12.5	100	282,500	25.11	11,249
	2026						
	Building Construction	239	12.5	100	298,750	25.64	11,650
	Linear, Grading & Excavation	23	12.5	100	28,750	25.64	1,121
	2027						
	Linear, Grading & Excavation	7	12.5	100	8,750	26.20	334
Lake Discharge Pipeline Alignment	**2025**						
	Demolition	71	1	100	8,875	25.11	353
	Linear, Grading & Excavation	175	4	100	65,625	25.11	2,613
	2026						
	Linear, Grading & Excavation	15	4	100	5,625	25.64	219
	Linear, Drainage, Utilities, & Sub-Grade	190	4	100	83,125	25.64	3,241
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	0.5	100	8,750	25.11	348
	2026						
	Linear, Grading & Excavation	15	0.5	100	750	25.64	29
	Linear, Drainage, Utilities, & Sub-Grade	190	0	18.5	0	25.64	0

Category	Construction Activity	Duration (Days)	Worker (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
Evaporation Ponds	**2025**						
	Site Preparation	175	2.5	100	43,750	25.11	1,742
	2026						
	Site Preparation	205	2.5	100	51,250	25.64	1,998
Sand Canyon	**2025**						
	Demolition	21	1.25	100	2,625	25.11	105
	Linear, Grading & Excavation	174	5	100	87,000	25.11	3,464
	Building Construction	144	1.25	100	18,000	25.11	717
	2026						
	Linear, Grading & Excavation	16	5	100	8,000	25.64	312
	Building Construction	77	1.25	100	9,625	25.64	375
	Linear, Drainage, Utilities, & Sub-Grade	190	5	100	95,000	25.64	3,704
TOTAL CONSTRUCTION WORKER FUEL CONSUMPTION – LDT1							***44,621***

TABLE 4-9: CONSTRUCTION WORKER FUEL CONSUMPTION ESTIMATES – LDT2

Category	Construction Activity	Duration (Days)	Worker (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	12.5	100	26,250	25.24	1,040
	Building Construction	226	12.5	100	282,500	25.24	11,193
	2026						
	Building Construction	239	12.5	100	298,750	25.93	11,520
	Linear, Grading & Excavation	23	12.5	100	28,750	25.93	1,109
	2027						
	Linear, Grading & Excavation	7	12.5	100	8,750	26.60	329
Lake Discharge Pipeline Alignment	**2025**						
	Demolition	71	1	100	8,875	25.24	352
	Linear, Grading & Excavation	175	4	100	65,625	25.24	2,600
	2026						
	Linear, Grading & Excavation	15	4	100	5,625	25.93	217
	Linear, Drainage, Utilities, & Sub-Grade	190	4	100	83,125	25.93	3,205
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	0.5	100	8,750	25.24	347
	2026						
	Linear, Grading & Excavation	15	0.5	100	750	25.93	29
	Linear, Drainage, Utilities, & Sub-Grade	190	0	18.5	0	25.93	0

Category	Construction Activity	Duration (Days)	Worker (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
Evaporation Ponds	**2025**						
	Site Preparation	175	2.5	100	43,750	25.24	1,733
	2026						
	Site Preparation	205	2.5	100	51,250	25.93	1,976
Sand Canyon	**2025**						
	Demolition	21	1.25	100	2,625	25.24	104
	Linear, Grading & Excavation	174	5	100	87,000	25.24	3,447
	Building Construction	144	1.25	100	18,000	25.24	713
	2026						
	Linear, Grading & Excavation	16	5	100	8,000	25.93	308
	Building Construction	77	1.25	100	9,625	25.93	371
	Linear, Drainage, Utilities, & Sub-Grade	190	5	100	95,000	25.93	3,663
TOTAL CONSTRUCTION WORKER FUEL CONSUMPTION – LDT2							***44,258***
TOTAL CONSTRUCTION WORKER FUEL CONSUMPTION – LDA, LDT1 & LDT2							***157,463***

4.3.6 CONSTRUCTION VENDOR/HAULING FUEL ESTIMATES

With respect to estimated VMT, the construction vendor and hauling trips (vehicles that deliver/export materials to and from the site during construction) would generate an estimated 3,706,415 VMT along area roadways for the Project over the duration of construction activity (24). It is assumed that 50% of all vendor trips are from medium-heavy duty trucks (MHDT), 50% of vendor trips are from heavy-heavy duty trucks (HHDT), and 100% of all hauling trips are from HHDTs. These assumptions are consistent with the CalEEMod defaults utilized within the within the AQIA (24). Vehicle fuel efficiencies for MHDTs and HHDTs were estimated using information generated within EMFAC2021. EMFAC2021 was run for the MHDT and HHDT vehicle classes within the San Bernardino South Coast sub-area for the 2025, 2026, 2027 calendar years. Data from EMFAC2021 is shown in Appendix 4.2.

Based on Tables 4-10 through 4-12, it is estimated that 583,562 gallons of fuel will be consumed related to construction vendor and hauling trips during full construction of the Project.

It should be noted that construction vendor and hauling trips would represent a “single-event” gasoline fuel demand and would not require on-going or permanent commitment of fuel resources for this purpose.

TABLE 4-10: CONSTRUCTION VENDOR FUEL CONSUMPTION ESTIMATES – MHDT

Category	Construction Activity	Duration (Days)	Vendor (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	13	100	26,250	8.46	3,104
	Building Construction	226	3	100	73,450	8.46	8,684
	2026						
	Building Construction	239	3	100	77,675	8.59	9,046
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	7	100	113,750	8.46	13,449
	2026						
	Linear, Grading & Excavation	15	7	100	9,750	8.59	1,135
Sand Canyon	**2025**						
	Building Construction	144	3	100	43,200	8.46	5,108
	2026						
	Building Construction	77	3	100	23,100	8.59	2,690
TOTAL CONSTRUCTION VENDOR FUEL CONSUMPTION – MHDT							***43,216***

TABLE 4-11: CONSTRUCTION VENDOR FUEL CONSUMPTION ESTIMATES – HHDT

Category	Construction Activity	Duration (Days)	Vendor (Trips/Day)	Trip Length (miles)	Vehicle Miles Traveled	Average Vehicle Fuel Economy (mpg)	Estimated Fuel Consumption (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	13	100	26,250	6.13	4,282
	Building Construction	226	3	100	73,450	6.13	11,982
	2026						
	Building Construction	239	3	100	77,675	6.24	12,447
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	7	100	113,750	6.13	18,557
	2026						
	Linear, Grading & Excavation	15	7	100	9,750	6.24	1,562
Sand Canyon	**2025**						
	Building Construction	144	3	100	43,200	6.13	7,047
	2026						
	Building Construction	77	3	100	23,100	6.24	3,702
TOTAL CONSTRUCTION VENDOR FUEL CONSUMPTION – HHDT							***59,580***

TABLE 4-12: CONSTRUCTION HAULING FUEL CONSUMPTION ESTIMATES – HHDT

Category	**Construction Activity**	**Duration** (Days)	**Hauling** (Trips/Day)	**Trip Length** (miles)	**Vehicle Miles Traveled**	**Average Vehicle Fuel Economy** (mpg)	**Estimated Fuel Consumption** (gallons)
BBARWA WWTP Upgrades	**2025**						
	Demolition	21	46	100	96,600	6.13	15,759
	Building Construction	226	2	100	48,590	6.13	7,927
	2026						
	Building Construction	239	46	100	1,099,400	6.24	176,179
Lake Discharge Pipeline Alignment	**2025**						
	Demolition	71	21	100	149,100	6.13	24,323
	Linear, Grading & Excavation	175	36	100	630,000	6.13	102,775
	2026						
	Linear, Grading & Excavation	15	36	100	54,000	6.24	8,654
Shay Pond Conveyance Pipeline	**2025**						
	Linear, Grading & Excavation	175	5	100	87,500	6.13	14,274
	2026						
	Linear, Grading & Excavation	15	5	100	7,500	6.24	1,202
Evaporation Ponds	**2025**						
	Linear, Grading & Excavation	175	11	100	192,500	6.13	31,403
	2026						
	Linear, Grading & Excavation	205	11	100	225,500	6.24	36,136

Category	**Construction Activity**	**Duration** (Days)	**Hauling** (Trips/Day)	**Trip Length** (miles)	**Vehicle Miles Traveled**	**Average Vehicle Fuel Economy** (mpg)	**Estimated Fuel Consumption** (gallons)
Sand Canyon	**2025**						
	Demolition	21	19	100	39,375	6.13	6,423
	Linear, Grading & Excavation	174	18	100	313,200	6.13	51,094
	2026						
	Linear, Grading & Excavation	16	18	100	28,800	6.24	4,615
TOTAL CONSTRUCTION HAULING FUEL CONSUMPTION – HHDT							***480,765***
TOTAL CONSTRUCTION VENDOR/HAULING FUEL CONSUMPTION – MHDT & HHDT							***583,562***

4.3.7 CONSTRUCTION ENERGY EFFICIENCY/CONSERVATION MEASURES

The equipment used for Project construction would conform to CARB regulations and California emissions standards. There are no unusual Project characteristics or construction processes that would require the use of equipment that would be more energy intensive than is used for comparable activities; or equipment that would not conform to current emissions standards (and related fuel efficiencies). Equipment employed in construction of the Project would therefore not result in inefficient wasteful, or unnecessary consumption of fuel.

The Project would utilize construction contractors which practice compliance with applicable CARB regulation regarding retrofitting, repowering, or replacement of diesel off-road construction equipment. Additionally, CARB has adopted the Airborne Toxic Control Measure to limit heavy-duty diesel motor vehicle idling in order to reduce public exposure to diesel particulate matter and other Toxic Air Contaminants. Compliance with anti-idling and emissions regulations would result in a more efficient use of construction-related energy and the minimization or elimination of wasteful or unnecessary consumption of energy. Idling restrictions and the use of newer engines and equipment would result in less fuel combustion and energy consumption.

Additionally, certain incidental construction-source energy efficiencies would likely accrue through implementation of California regulations and best available control measures (BACM). More specifically, California Code of Regulations Title 13, Motor Vehicles, section 2449(d)(3) Idling, limits idling times of construction vehicles to no more than five minutes, thereby precluding unnecessary and wasteful consumption of fuel due to unproductive idling of construction equipment. To this end, “grading plans shall reference the requirement that a sign shall be posted on-site stating that construction workers need to shut off engines at or before five minutes of idling.” In this manner, construction equipment operators are informed that engines are to be turned off at or prior to five minutes of idling. Enforcement of idling limitations is realized through periodic site inspections conducted by County building officials, and/or in response to citizen complaints.

Indirectly, construction energy efficiencies and energy conservation would be achieved for the proposed development through energy efficiencies realized from bulk purchase, transport and use of construction materials.

A full analysis related to the energy needed to form construction materials is not included in this analysis due to a lack of detailed Project-specific information on construction materials. At this time, an analysis of the energy needed to create Project-related construction materials would be extremely speculative and thus has not been prepared.

In general, the construction processes promote conservation and efficient use of energy by reducing raw materials demands, with related reduction in energy demands associated with raw materials extraction, transportation, processing and refinement. Use of materials in bulk reduces energy demands associated with preparation and transport of construction materials as well as the transport and disposal of construction waste and solid waste in general, with corollary

reduced demands on area landfill capacities and energy consumed by waste transport and landfill operations.

4.4 OPERATIONAL ENERGY DEMANDS

Energy consumption in support of or related to Project operations would include minimal transportation fuel demands (fuel consumed by maintenance vehicles accessing the Project site), fuel demands from operational equipment, and facilities energy demands (energy consumed by building operations and site maintenance activities).

4.4.1 TRANSPORTATION FUEL DEMANDS

In terms of operational energy demands, the proposed Project involves the construction of monitoring wells, conveyance facilities and ancillary facilities, evaporation ponds, advanced water purification facilities, and associated improvements. The proposed Project does not include any substantive new stationary or mobile sources of emissions, and therefore, by its very nature, will not generate substantive amounts of energy demand from Project operations. The Project does not propose a trip-generating land use and while it is anticipated that the Project would require intermittent maintenance, such maintenance would be minimal requiring a negligible amount of traffic trips on an annual basis.

4.4.2 OPERATIONAL ENERGY DEMANDS

Project building operations activities would result in the consumption of natural gas and electricity, which would be supplied to the Project by Southwest Gas Corp. and BVES. As summarized on Table 4-14 the Project would result in 760,427 kBTU/year of natural gas and a net electricity demand of 147,883 kWh/year of electricity after netting out the 3,652,117 kWh/year of electricity generated by the project's photovoltaic solar design feature.

Land Use	Natural Gas Demand (kBTU/year)	Electricity Demand (kWh/year)
Warehouse	760,427	3,800,000
Parking Lot	0	19,079
TOTAL PROJECT ENERGY DEMAND	**760,427**	**3,819,079**
Solar Generation (kWh/year)	***N/A***	***3,652,117***
NET ENERGY DEMANDS	**760,427**	**147,883**

4.5 SUMMARY

4.5.1 CONSTRUCTION ENERGY DEMANDS

The estimated power cost of on-site electricity usage during the construction of the Project is assumed to be approximately $126,967.83. Additionally, based on the assumed power cost, it is estimated that the total electricity usage during construction, after full Project build-out, is calculated to be approximately 505,164 kWh.

Construction equipment used by the Project would result in single event consumption of approximately 565,550 gallons of diesel fuel. Construction equipment use of fuel would not be atypical for the type of construction proposed because there are no aspects of the Project's proposed construction process that are unusual or energy-intensive, and Project construction equipment would conform to the applicable CARB emissions standards, acting to promote equipment fuel efficiencies.

CCR Title 13, Title 13, Motor Vehicles, section 2449(d)(3) Idling, limits idling times of construction vehicles to no more than 5 minutes, thereby precluding unnecessary and wasteful consumption of fuel due to unproductive idling of construction equipment. BACMs inform construction equipment operators of this requirement. Enforcement of idling limitations is realized through periodic site inspections conducted by City building officials, and/or in response to citizen complaints.

Construction worker trips for full construction of the Project would result in the estimated fuel consumption of 157,463 gallons of fuel. Additionally, fuel consumption from construction hauling and vendor trips (MHDTs and HHDTs) will total approximately 583,562 gallons. Diesel fuel would be supplied by City and regional commercial vendors. Indirectly, construction energy efficiencies and energy conservation would be achieved using bulk purchases, transport and use of construction materials. The 2022 IEPR released by the CEC has shown that fuel efficiencies are getting better within on and off-road vehicle engines due to more stringent government requirements (31). As supported by the preceding discussions, Project construction energy consumption would not be considered inefficient, wasteful, or otherwise unnecessary.

4.5.2 Operational Energy Demands

Facility Energy Demands

Project facility operational energy demands are estimated at: 760,427 kBTU/year of natural gas and 147,883 kWh/year of electricity. Natural gas would be supplied to the Project by Southwest Gas Corp.; electricity would be supplied by BVES. The Project does not propose uses that are inherently energy intensive and the energy demands in total would be comparable to other land uses of similar scale and configuration.

Lastly, the Project will comply with the applicable Title 24 standards. Compliance itself with applicable Title 24 standards will ensure that the Project energy demands would not be inefficient, wasteful, or otherwise unnecessary.

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5 CONCLUSIONS

5.1 ENERGY IMPACT 1

Would the Project result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Impact Analysis

A significant impact would occur if the proposed Project would result in the inefficient, wasteful, or unnecessary use of energy.

Construction

Based on CalEEMod estimations within the modeling output files used to estimate GHG emissions, construction-related vehicle trips would result in approximately 8.2 million VMT and consume an estimated 741,025 gallons of gasoline and diesel combined during future development projects construction phases. Additionally, on-site construction equipment would consume an estimated 565,550 gallons of diesel fuel. Limitations on idling of vehicles and equipment and requirements that equipment be properly maintained would result in fuel savings. California Code of Regulations, Title 13, Sections 2449 and 2485, limit idling from both on-road and off-road diesel- powered equipment and are enforced by the ARB. Additionally, given the cost of fuel, contractors and owners have a strong financial incentive to avoid wasteful, inefficient, and unnecessary consumption of energy during construction.

Due to the temporary nature of construction and the financial incentives for developers and contractors to use energy-consuming resources in an efficient manner, the construction phase of the proposed project would not result in wasteful, inefficient, and unnecessary consumption of energy. Therefore, the construction-related impacts related to electricity and fuel consumption would be less than significant.

Operation

Electricity and Natural Gas

Operation of the proposed project would consume energy as part of building operations and transportation activities. Building operations would involve energy consumption for multiple purposes and based on CalEEMod energy use estimations, operations for the Project would result in approximately 147,883 kWh of electricity and 760,427 kBTU/year of natural gas annually.

The Project would be designed and constructed in accordance with the City's latest adopted energy efficiency standards, which are based on the California Title 24 energy efficiency standards. Title 24 standards include a broad set of energy conservation requirements that apply to the structural, mechanical, electrical, and plumbing systems in a building. For example, the Title 24 Lighting Power Density requirements define the maximum wattage of lighting that can be used in a building based on its square footage. Title 24 standards are widely regarded as the

most advanced energy efficiency standards, would help reduce the amount of energy required for lighting, water heating, and heating and air conditioning in buildings and promote energy conservation.

Fuel

As mentioned previously, the proposed Project does not include any substantive new stationary or mobile sources of emissions, and therefore, by its very nature, will not generate substantive amounts of energy demand from Project operations. The Project does not propose trip-generating land use and while it is anticipated that the Project would require intermittent maintenance, such maintenance would be minimal requiring a negligible amount of traffic trips on an annual basis. For these reasons, operational-related transportation fuel consumption would not result in a significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources. Therefore, the operational impact related to vehicle fuel consumption would be less than significant.

5.2 ENERGY IMPACT 2

Would the Project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

Impact Analysis

A significant impact would occur if the proposed Project would conflict with or obstruct a State or local plan for renewable energy or energy efficiency.

Construction

As discussed in Section 5.1, above, the proposed project would result in energy consumption through the combustion of fossil fuels in construction vehicles, worker commute vehicles, and construction equipment, and the use of electricity for temporary buildings, lighting, and other sources. California Code of Regulations Title 13, Sections 2449 and 2485, limit idling from both on- road and off-road diesel-powered equipment and are enforced by the ARB. The proposed project would comply with these regulations. There are no policies at the local level applicable to energy conservation specific to the construction phase. Thus, it is anticipated that construction of the proposed project would not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing energy use or increasing the use of renewable energy. Therefore, construction- related energy efficiency and renewable energy standards consistency impacts would be less than significant.

Operation

California's Renewable Portfolio Standard (RPS) establishes a goal of renewable energy for local providers to be 44 percent by 2040. Similarly, the State is promoting renewable energy targets to meet the 2022 Scoping Plan greenhouse gas emissions reductions. As discussed in Section 5.1, above, the Project would result in approximately 147,883 kWh of electricity and 760,427 kBTU/year of natural gas annually.

The Project would be designed and constructed in accordance with the City's latest adopted energy efficiency standards, which are based on the California Title 24 energy efficiency standards. Title 24 standards include a broad set of energy conservation requirements that apply to the structural, mechanical, electrical, and plumbing systems in a building. For example, the Title 24 Lighting Power Density requirements define the maximum wattage of lighting that can be used in a building based on its square footage. Title 24 standards are widely regarded as the most advanced energy efficiency standards, would help reduce the amount of energy required for lighting, water heating, and heating and air conditioning in buildings and promote energy conservation.

Compliance with the aforementioned mandatory measures would ensure that future development projects would not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing energy use or increasing the use of renewable energy. Therefore, operational energy efficiency and renewable energy standards consistency impacts would be less than significant.

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7 CERTIFICATIONS

The contents of this energy analysis report represent an accurate depiction of the environmental impacts associated with the proposed Replenish Big Bear Program. The information contained in this energy analysis report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at hqureshi@urbanxroads.com.

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Master of Science in Environmental Studies
California State University, Fullerton • May 2010

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University of California, Irvine • June 2006

PROFESSIONAL AFFILIATIONS

AEP – Association of Environmental Planners
AWMA – Air and Waste Management Association
ASTM – American Society for Testing and Materials

PROFESSIONAL CERTIFICATIONS

Planned Communities and Urban Infill – Urban Land Institute • June 2011
Indoor Air Quality and Industrial Hygiene – EMSL Analytical • April 2008
Principles of Ambient Air Monitoring – California Air Resources Board • August 2007
AB2588 Regulatory Standards – Trinity Consultants • November 2006
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APPENDIX 4.1:

CALEEMOD PROJECT COMPONENT 1 EMISSIONS MODEL OUTPUTS

15309-WWTP Upgrades (Unmitigated) Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-WWTP Upgrades (Unmitigated)
Construction Start Date	1/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Unrefrigerated Warehouse-Rail	40.0	1000sqft	0.92	40,000	0.00	—	—	—
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump Station
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—
User Defined Linear	0.26	Mile	0.14	0.00	0.00	—	—	—
Other Asphalt Surfaces	0.44	Acre	0.44	0.00	0.00	—	—	Remaining SF

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Energy	E-10-B	Establish Onsite Renewable Energy Systems: Solar Power

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	5.21	4.63	30.9	56.2	0.16	1.15	13.1	13.4	1.06	3.06	3.82	—	26,339	26,339	2.04	3.77	1.79	27,515
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.72	2.46	18.6	26.1	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.50	0.45	3.40	4.76	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824

Mit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Mit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Mit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792
Mit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	871	871	0.06	0.01	—	874
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.2. Linear, Grading & Excavation (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.3. Linear, Grading & Excavation (2027) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.4. Linear, Grading & Excavation (2027) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.5. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.6. Demolition (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—

Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.7. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811
Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—

Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.8. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811

Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—
Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.9. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

3.10. Building Construction (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehou	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape Equipme	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	12/1/2026	1/11/2027	5.00	30.0	Pipeline Installation
Demolition	Demolition	1/1/2025	1/29/2025	5.00	20.0	—
Building Construction	Building Construction	2/19/2025	12/1/2026	5.00	465	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43

Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT
Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT

Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Building Construction	0.00	0.00	60,000	20,000	7,684

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	—	0.14	0.00	—

Demolition	—	1,350	0.14	3,000	—
Building Construction	—	8,000	581	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-Rail	0.00	0%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%
User Defined Linear	0.14	100%
Other Asphalt Surfaces	0.44	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005
2027	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	60,000	20,000	7,684

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	3,800,000	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00
Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	0.00	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00

Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	5.00	0.73
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73
Fire Pump	Diesel	1.00	24.0	8,760	15.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.

Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A

Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6

Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582

Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8

Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Based on Client Provided data and construction schedule
Construction: Off-Road Equipment	Client Provided construction equipment list
Construction: Trips and VMT	Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.
Operations: Vehicle Data	No trips data available
Operations: Architectural Coatings	SCAQMD Rule 1113
Construction: Dust From Material Movement	Export expected per Project data

Construction: Architectural Coatings	SCAQMD Rule 1113
Operations: Energy Use	Electricity adjusted based on client provided data
Operations: Water and Waste Water	Taken from 2022 Lake Analysis report

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APPENDIX 4.2:

CALEEMOD PROJECT COMPONENT 2 EMISSIONS MODEL OUTPUTS

15309-Lake Pipeline (Unmitigated) Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Lake Pipeline (Unmitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	3.78	Mile	2.06	0.00	—	—	—	—
Other Non-Asphalt Surfaces	1.00	Acre	1.00	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.26	2.04	0.86	17,776
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
2026	0.79	0.65	4.07	11.1	0.01	0.14	1.24	1.38	0.13	0.29	0.42	—	2,467	2,467	0.09	0.05	4.47	2,489
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.30	0.98	18.8	16.9	0.10	0.33	4.40	4.73	0.32	1.16	1.48	—	15,029	15,029	1.26	2.04	0.80	15,670
2026	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.20	2.01	0.86	17,776
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
2026	0.50	0.37	2.90	5.68	0.01	0.09	0.82	0.91	0.08	0.20	0.28	—	1,845	1,845	0.07	0.11	1.51	1,880
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506
2026	0.09	0.07	0.53	1.04	< 0.005	0.02	0.15	0.17	0.01	0.04	0.05	—	305	305	0.01	0.02	0.25	311

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.36	2.92	0.01	0.08	—	0.08	0.08	—	0.08	—	862	862	0.03	0.01	—	865
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.43	0.53	< 0.005	0.02	—	0.02	0.01	—	0.01	—	143	143	0.01	< 0.005	—	143
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.16	0.12	0.31	5.78	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,131	1,131	0.04	0.03	4.24	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.0	6.69	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,194	12,194	1.15	1.99	26.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.12	0.34	4.11	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,036	1,036	0.04	0.03	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.5	6.70	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,195	12,195	1.15	2.00	0.69	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.07	0.06	0.18	2.10	0.00	0.00	0.51	0.51	0.00	0.12	0.12	—	504	504	0.02	0.02	0.88	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.64	0.09	6.59	3.21	0.04	0.08	1.60	1.67	0.08	0.44	0.51	—	5,846	5,846	0.55	0.96	5.50	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.03	0.38	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	83.4	83.4	< 0.005	< 0.005	0.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.12	0.02	1.20	0.59	0.01	0.01	0.29	0.31	0.01	0.08	0.09	—	968	968	0.09	0.16	0.91	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.80	0.67	4.65	6.11	0.02	0.16	—	0.16	0.15	—	0.15	—	1,800	1,800	0.07	0.01	—	1,806
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.19	0.25	< 0.005	0.01	—	0.01	0.01	—	0.01	—	74.0	74.0	< 0.005	< 0.005	—	74.2
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.03	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	12.2	12.2	< 0.005	< 0.005	—	12.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.11	0.31	3.81	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,015	1,015	< 0.005	0.03	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.25	0.10	13.0	6.54	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	11,972	11,972	1.07	1.92	0.64	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.17	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	42.3	42.3	< 0.005	< 0.005	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.05	< 0.005	0.54	0.27	< 0.005	0.01	0.14	0.14	0.01	0.04	0.04	—	492	492	0.04	0.08	0.44	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.00	7.00	< 0.005	< 0.005	0.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.01	< 0.005	0.10	0.05	< 0.005	< 0.005	0.03	0.03	< 0.005	0.01	0.01	—	81.5	81.5	0.01	0.01	0.07	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.32	0.27	1.95	2.55	0.01	0.07	—	0.07	0.07	—	0.07	—	612	612	0.02	< 0.005	—	614
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.46	< 0.005	0.01	—	0.01	0.01	—	0.01	—	101	101	< 0.005	< 0.005	—	102
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.14	0.32	6.23	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,292	1,292	0.04	0.04	4.47	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.17	0.13	0.36	4.44	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,184	1,184	< 0.005	0.04	0.12	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.07	0.21	2.45	0.00	0.00	0.64	0.64	0.00	0.15	0.15	—	625	625	< 0.005	0.02	1.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.45	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	103	103	< 0.005	< 0.005	0.17	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.81	1.81	—	0.27	0.27	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.44	0.53	< 0.005	0.01	—	0.01	0.01	—	0.01	—	70.3	70.3	< 0.005	< 0.005	—	70.5
Demolition	—	—	—	—	—	—	0.35	0.35	—	0.05	0.05	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.6	11.6	< 0.005	< 0.005	—	11.7
Demolition	—	—	—	—	—	—	0.06	0.06	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.78	0.11	7.55	3.90	0.05	0.09	1.95	2.04	0.09	0.53	0.63	—	7,108	7,108	0.67	1.16	15.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.15	0.02	1.54	0.75	0.01	0.02	0.37	0.39	0.02	0.10	0.12	—	1,363	1,363	0.13	0.22	1.28	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	226	226	0.02	0.04	0.21	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—
Demolition	Demolition	5/1/2025	8/7/2025	5.00	70.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82

Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	15.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	36.0	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	17.5	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT

Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	21.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	19,940	5.00	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	2.06	0.00	—
Demolition	0.00	0.00	0.00	5,875	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction

Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	5.00	100%
Other Non-Asphalt Surfaces	66.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	172,498

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase in addition to default CalEEMod hauling trucks. Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.

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APPENDIX 4.3:

CALEEMOD PROJECT COMPONENT 3 EMISSIONS MODEL OUTPUTS

15309-Shay Ponds (Unmitigated) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Shay Ponds (Unmitigated)
Construction Start Date	5/1/2025
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.30
Precipitation (days)	1.80
Location	34.253674, -116.80784
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
User Defined Linear	1.20	Mile	0.65	0.00	—	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.39	8,710
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2025	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
2026	0.56	0.47	3.30	4.32	0.01	0.12	0.00	0.12	0.11	0.00	0.11	—	1,087	1,087	0.04	0.01	0.00	1,091
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.44	0.92	11.0	10.00	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,451	7,451	0.47	0.85	0.39	7,717
2026	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.36	8,710
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
2026	0.35	0.28	2.15	2.66	0.01	0.07	0.07	0.14	0.07	0.02	0.09	—	868	868	0.04	0.04	0.25	881
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613
2026	0.06	0.05	0.39	0.49	< 0.005	0.01	0.01	0.03	0.01	< 0.005	0.02	—	144	144	0.01	0.01	0.04	146

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.78	3.40	0.01	0.10	—	0.10	0.09	—	0.09	—	930	930	0.04	0.01	—	933
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.51	0.62	< 0.005	0.02	—	0.02	0.02	—	0.02	—	154	154	0.01	< 0.005	—	155
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.77	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	151	151	< 0.005	< 0.005	0.56	—
Vendor	0.27	0.06	3.28	1.53	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,807	3,807	0.24	0.58	11.1	—
Hauling	0.17	0.02	1.66	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	3.39	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.55	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.06	3.42	1.50	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,808	3,808	0.24	0.58	0.29	—
Hauling	0.17	0.02	1.74	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	0.09	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—
Vendor	0.13	0.03	1.67	0.72	0.01	0.03	0.52	0.55	0.03	0.14	0.17	—	1,826	1,826	0.11	0.28	2.30	—
Hauling	0.08	0.01	0.85	0.41	< 0.005	0.01	0.21	0.21	0.01	0.06	0.07	—	750	750	0.07	0.12	0.71	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.02	0.01	0.30	0.13	< 0.005	0.01	0.10	0.10	0.01	0.03	0.03	—	302	302	0.02	0.05	0.38	—
Hauling	0.01	< 0.005	0.15	0.08	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	124	124	0.01	0.02	0.12	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.96	0.80	5.53	7.09	0.02	0.20	—	0.20	0.18	—	0.18	—	1,942	1,942	0.08	0.02	—	1,948
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.23	0.29	< 0.005	0.01	—	0.01	0.01	—	0.01	—	79.8	79.8	< 0.005	< 0.005	—	80.1
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.2	13.2	< 0.005	< 0.005	—	13.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.51	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	135	135	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.03	3.22	1.44	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,743	3,743	0.21	0.58	0.26	—
Hauling	0.16	0.01	1.66	0.84	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,537	1,537	0.14	0.25	0.08	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.64	5.64	< 0.005	< 0.005	0.01	—
Vendor	0.01	< 0.005	0.13	0.06	< 0.005	< 0.005	0.04	0.05	< 0.005	0.01	0.01	—	154	154	0.01	0.02	0.18	—
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	63.1	63.1	0.01	0.01	0.06	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.93	0.93	< 0.005	< 0.005	< 0.005	—
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	25.5	25.5	< 0.005	< 0.005	0.03	—
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	10.5	10.5	< 0.005	< 0.005	0.01	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.29	0.24	1.72	2.25	0.01	0.06	—	0.06	0.06	—	0.06	—	566	566	0.02	< 0.005	—	568
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.31	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	93.7	93.7	< 0.005	< 0.005	—	94.0
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

4. Operations Emissions Details

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38

Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	2.00	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	13.0	100	HHDT,MHDT
Linear, Grading & Excavation	Hauling	4.62	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	0.00	18.5	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,020	0.65	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.65	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.65	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	39.3	annual days of extreme heat
Extreme Precipitation	4.40	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	31.0	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase.

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APPENDIX 4.4:

CALEEMOD PROJECT COMPONENT 4 EMISSIONS MODEL OUTPUTS

15309-Evaporation Ponds Detailed Report

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1.1. Basic Project Information

Data Field	Value
Project Name	15309-Evaporation Ponds
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.270764, -116.820355
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Other Non-Asphalt Surfaces	57.0	Acre	57.0	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
2026	26.8	24.9	71.5	90.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,400	23,400	1.12	0.76	10.1	23,665
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
2026	26.8	24.9	71.7	89.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,338	23,338	1.10	0.76	0.26	23,593
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	13.1	12.1	37.4	43.9	0.10	1.55	3.39	4.94	1.41	1.15	2.56	—	11,232	11,232	0.55	0.38	2.26	11,361
2026	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.38	2.21	6.83	8.01	0.02	0.28	0.62	0.90	0.26	0.21	0.47	—	1,860	1,860	0.09	0.06	0.37	1,881
2026	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10
Area	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066

Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	12.8	12.0	35.3	41.5	0.08	1.53	—	1.53	1.38	—	1.38	—	9,110	9,110	0.37	0.07	—	9,141
Dust From Material Movement	—	—	—	—	—	—	2.56	2.56	—	0.94	0.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.34	2.20	6.44	7.57	0.02	0.28	—	0.28	0.25	—	0.25	—	1,508	1,508	0.06	0.01	—	1,513
Dust From Material Movement	—	—	—	—	—	—	0.47	0.47	—	0.17	0.17	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	3.85	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	754	754	0.02	0.02	2.82	764
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.96	2.04	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	8.08	3,924
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.23	2.74	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	690	690	0.02	0.02	0.07	698
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.05	4.13	2.05	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	0.21	3,917
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.12	1.40	0.00	0.00	0.34	0.34	0.00	0.08	0.08	—	336	336	0.01	0.01	0.58	340
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.20	0.03	2.01	0.98	0.01	0.02	0.49	0.51	0.02	0.13	0.16	—	1,786	1,786	0.17	0.29	1.68	1,879
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.26	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	55.6	55.6	< 0.005	< 0.005	0.10	56.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.37	0.18	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	296	296	0.03	0.05	0.28	311

3.3. Site Preparation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	14.8	13.9	37.9	47.6	0.10	1.66	—	1.66	1.50	—	1.50	—	10,673	10,673	0.43	0.09	—	10,710
Dust From Material Movement	—	—	—	—	—	—	3.00	3.00	—	1.10	1.10	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.70	2.54	6.92	8.68	0.02	0.30	—	0.30	0.27	—	0.27	—	1,767	1,767	0.07	0.01	—	1,773
Dust From Material Movement	—	—	—	—	—	—	0.55	0.55	—	0.20	0.20	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.18	3.56	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	738	738	0.02	0.02	2.55	748
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.81	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	7.59	3,848
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	2.54	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	677	677	< 0.005	0.02	0.07	683
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.96	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	0.20	3,841
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.13	1.51	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	385	385	< 0.005	0.01	0.62	390
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.21	0.02	2.25	1.12	0.01	0.03	0.57	0.60	0.03	0.16	0.18	—	2,054	2,054	0.18	0.33	1.84	2,159
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	63.8	63.8	< 0.005	< 0.005	0.10	64.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.41	0.20	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	340	340	0.03	0.05	0.30	357

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	5/1/2025	10/14/2026	5.00	380	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	2.00	8.00	367	0.40
Site Preparation	Crushing/Proc. Equipment	Gasoline	Average	2.00	2.00	12.0	0.85
Site Preparation	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Site Preparation	Scrapers	Diesel	Average	7.00	8.00	423	0.48
Site Preparation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	10.0	100	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	11.0	100	HHDT
Site Preparation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	175,000	3,040	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Other Non-Asphalt Surfaces	57.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	3.00	0.00	0.00	0.00	300

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	148,975

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A

Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1

Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506

Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—

Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided schedule
Construction: Off-Road Equipment	Client provided equipment list
Construction: Trips and VMT	Client provided total worker trips and hauling trips which equals 8,000 round trips.

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APPENDIX 4.5:

CALEEMOD PROJECT COMPONENT 5 EMISSIONS MODEL OUTPUTS

15309-Sand Canyon Detailed Report

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5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

5.16.2. Process Boilers

5.17. User Defined

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

5.18.2. Sequestration

5.18.2.1. Unmitigated

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

6.2. Initial Climate Risk Scores

6.3. Adjusted Climate Risk Scores

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

7.2. Healthy Places Index Scores

7.3. Overall Health & Equity Scores

7.4. Health & Equity Measures

7.5. Evaluation Scorecard

7.6. Health & Equity Custom Measures

8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Sand Canyon
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.224799, -116.85662
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5157
EDFZ	10
Electric Utility	Southern California Edison
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	1.37	Mile	0.74	0.00	—	—	—	Pipeline
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump/Monitoring Wells
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.86	1.36	0.74	15,893
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
2026	1.48	1.14	9.93	20.8	0.04	0.32	2.27	2.59	0.29	0.55	0.85	—	5,995	5,995	0.25	0.34	11.1	6,114
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.54	1.57	19.2	24.2	0.08	0.55	4.01	4.55	0.51	1.02	1.53	—	12,475	12,475	0.86	1.34	0.66	12,898
2026	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.83	1.36	0.74	15,893
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
2026	0.74	0.57	4.76	8.65	0.02	0.16	1.05	1.21	0.15	0.25	0.40	—	2,633	2,633	0.09	0.13	2.01	2,678
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051
2026	0.13	0.10	0.87	1.58	< 0.005	0.03	0.19	0.22	0.03	0.05	0.07	—	436	436	0.02	0.02	0.33	443

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Stationar	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.51	3.88	4.51	0.01	0.18	—	0.18	0.16	—	0.16	—	1,091	1,091	0.04	0.01	—	1,095
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.71	0.82	< 0.005	0.03	—	0.03	0.03	—	0.03	—	181	181	0.01	< 0.005	—	181

Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.21	0.16	0.41	7.70	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,508	1,508	0.05	0.05	5.65	1,528
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.48	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	13.2	6,422
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.46	5.49	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,381	1,381	0.05	0.05	0.15	1,396
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.76	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	0.34	6,409
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.07	0.24	2.79	0.00	0.00	0.67	0.67	0.00	0.16	0.16	—	669	669	0.02	0.02	1.17	677
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.32	0.04	3.28	1.60	0.02	0.04	0.80	0.83	0.04	0.22	0.26	—	2,911	2,911	0.27	0.48	2.74	3,063
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.19	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.01	0.60	0.29	< 0.005	0.01	0.15	0.15	0.01	0.04	0.05	—	482	482	0.05	0.08	0.45	507

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.23	1.03	7.73	9.43	0.02	0.34	—	0.34	0.31	—	0.31	—	2,286	2,286	0.09	0.02	—	2,294
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.33	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	98.4	98.4	< 0.005	< 0.005	—	98.8
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.3	16.3	< 0.005	< 0.005	—	16.4
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.63	0.05	6.48	3.27	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	5,986	5,986	0.53	0.96	0.32	6,285
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.23	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	59.1	59.1	< 0.005	< 0.005	0.10	59.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.08	< 0.005	0.02	0.02	—	258	258	0.02	0.04	0.23	271
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	9.89
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.05	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.04	44.8

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	3.12	3.84	0.01	0.12	—	0.12	0.11	—	0.11	—	942	942	0.04	0.01	—	945
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.08	0.07	0.57	0.70	< 0.005	0.02	—	0.02	0.02	—	0.02	—	156	156	0.01	< 0.005	—	157
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.37	7.12	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,477	1,477	0.05	0.05	5.11	1,497
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.24	2.80	0.00	0.00	0.73	0.73	0.00	0.17	0.17	—	714	714	< 0.005	0.02	1.15	723
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.13	0.13	0.00	0.03	0.03	—	118	118	< 0.005	< 0.005	0.19	120
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.62	1.62	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.1	20.1	< 0.005	< 0.005	—	20.1
Demolition	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.32	3.32	< 0.005	< 0.005	—	3.34
Demolition	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.69	0.09	6.75	3.49	0.04	0.08	1.74	1.82	0.08	0.48	0.56	—	6,351	6,351	0.60	1.04	13.8	6,689
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.08	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	19.2	19.2	< 0.005	< 0.005	0.03	19.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.01	0.39	0.19	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	348	348	0.03	0.06	0.33	366
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.18	3.18	< 0.005	< 0.005	0.01	3.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	57.6	57.6	0.01	0.01	0.05	60.6

3.9. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.08	0.86	1.53	< 0.005	0.03	—	0.03	0.03	—	0.03	—	241	241	0.01	< 0.005	—	242
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.16	0.28	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	39.9	39.9	< 0.005	< 0.005	—	40.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.13	0.03	1.51	0.71	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	5.11	1,844
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.11	1.37	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	345	345	0.01	0.01	0.04	349
Vendor	0.13	0.03	1.58	0.69	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	0.13	1,839
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.58	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.24	140
Vendor	0.05	0.01	0.63	0.27	0.01	0.01	0.20	0.21	0.01	0.05	0.07	—	695	695	0.04	0.10	0.87	728
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	0.01	0.11	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	22.9	22.9	< 0.005	< 0.005	0.04	23.2
Vendor	0.01	< 0.005	0.12	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	115	115	0.01	0.02	0.14	121
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.11. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.43	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	128
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.2

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.09	1.78	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	369	369	0.01	0.01	1.28	374
Vendor	0.13	0.02	1.43	0.66	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	4.71	1,814
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.27	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	338	338	< 0.005	0.01	0.03	342
Vendor	0.12	0.02	1.49	0.67	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	0.12	1,809
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	71.8	71.8	< 0.005	< 0.005	0.12	72.7
Vendor	0.03	< 0.005	0.32	0.14	< 0.005	0.01	0.11	0.11	0.01	0.03	0.03	—	362	362	0.02	0.06	0.42	379
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.9	11.9	< 0.005	< 0.005	0.02	12.0
Vendor	< 0.005	< 0.005	0.06	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	59.9	59.9	< 0.005	0.01	0.07	62.8
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Total	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/2/2025	1/22/2026	5.00	190	—

Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/22/2026	10/14/2026	5.00	190	—
Demolition	Demolition	5/1/2025	5/29/2025	5.00	20.0	—
Building Construction	Building Construction	6/13/2025	4/17/2026	5.00	220	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Linear, Grading & Excavation	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Drainage, Utilities, & Sub-Grade	Cranes	Diesel	Average	1.00	4.00	367	0.29
Linear, Drainage, Utilities, & Sub-Grade	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37

Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73
Building Construction	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Building Construction	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	18.8	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	18.0	100	HHDT

Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	5.00	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.00	100	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,210	0.74	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.74	0.00	—

Demolition	0.00	0.00	0.00	1,500	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.74	100%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	349	0.03	< 0.005
2026	29.4	346	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	6,534

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	532	0.0330	0.0040	0.00
Parking Lot	19,079	532	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

Parking Lot	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.1	annual days of extreme heat
Extreme Precipitation	8.60	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	32.4	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.

The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	98.7
AQ-PM	4.43
AQ-DPM	1.14

Drinking Water	70.5
Lead Risk Housing	65.1
Pesticides	4.55
Toxic Releases	18.1
Traffic	3.04
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	1.80
Impaired Water Bodies	90.1
Solid Waste	75.7
Sensitive Population	—
Asthma	26.6
Cardio-vascular	44.6
Low Birth Weights	67.2
Socioeconomic Factor Indicators	—
Education	9.73
Housing	12.8
Linguistic	0.26
Poverty	55.9
Unemployment	35.0

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	53.62504812

Employed	15.8475555
Median HI	38.16245348
Education	—
Bachelor's or higher	57.65430515
High school enrollment	0.372128834
Preschool enrollment	1.873476197
Transportation	—
Auto Access	44.50147568
Active commuting	57.28217631
Social	—
2-parent households	49.63428718
Voting	87.82240472
Neighborhood	—
Alcohol availability	85.88476838
Park access	61.54240985
Retail density	2.078788656
Supermarket access	11.39484152
Tree canopy	94.22558707
Housing	—
Homeownership	62.4534839
Housing habitability	66.86770178
Low-inc homeowner severe housing cost burden	47.83780316
Low-inc renter severe housing cost burden	50.78916977
Uncrowded housing	77.4541255
Health Outcomes	—
Insured adults	70.78147055
Arthritis	0.0

Asthma ER Admissions	68.5
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	87.1
Cognitively Disabled	32.0
Physically Disabled	7.5
Heart Attack ER Admissions	26.6
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	97.6
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	72.7
SLR Inundation Area	0.0
Children	75.0
Elderly	8.4
English Speaking	75.9

Foreign-born	3.5
Outdoor Workers	55.8
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.3
Traffic Density	2.9
Traffic Access	23.0
Other Indices	—
Hardship	33.2
Other Decision Support	—
2016 Voting	97.1

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	24.0
Healthy Places Index Score for Project Location (b)	21.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Characteristics: Project Details	Rural Big Bear
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client provided schedule
Construction: Trips and VMT	Client provided pump station trips

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APPENDIX 4.6:

EMFAC2021

Source: EMFAC2021 (v1.0.2) Emissions Inventory
Region Type: Sub-Area
Region: San Bernardino (SC)
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for CVMT and EVMT, trips/day for Trips, kWh/day for Energy Consumption, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Region	Calenc	Vehicle Cat	Model Year	Speed	Fuel	Population	Total VMT	Trips	Fuel_Consumption	Fuel_Consumption	Total Fuel	VMT	Total VMT	Miles per Gallon	Vehicle Class
San Bernardino (SC)	2025	HHDT	Aggregate	Aggregate	Gasoli	3.869766832	177.2217014	77.42629	0.044579975	44.57997511	322298.7048	177.2217014	1975659.248	6.13	HHDT
San Bernardino (SC)	2025	HHDT	Aggregate	Aggregate	Diesel	14693.60242	1799109.244	221962.6	296.221758	296221.758		1799109.244			
San Bernardino (SC)	2025	HHDT	Aggregate	Aggregate	Electr	109.5985203	11409.19414	1368.406	0	0		11409.19414			
San Bernardino (SC)	2025	HHDT	Aggregate	Aggregate	Natur	2560.5176	164963.5875	14771.26	26.0323668	26032.3668		164963.5875			
San Bernardino (SC)	2025	LDA	Aggregate	Aggregate	Gasoli	457374.7047	20012363.19	2124445	659.2303928	659230.3928	671181.1368	20012363.19	21858504.21	32.57	LDA
San Bernardino (SC)	2025	LDA	Aggregate	Aggregate	Diesel	986.5858319	34821.96021	4226.275	0.803361461	803.3614609		34821.96021			
San Bernardino (SC)	2025	LDA	Aggregate	Aggregate	Electr	22921.29943	1119595.112	114790.1	0	0		1119595.112			
San Bernardino (SC)	2025	LDA	Aggregate	Aggregate	Plug-i	13621.71468	691723.9558	56325.79	11.14738256	11147.38256		691723.9558			
San Bernardino (SC)	2025	LDT1	Aggregate	Aggregate	Gasoli	39862.49619	1386010.237	172343.8	55.44488475	55444.88475	55506.30461	1386010.237	1393998.156	25.11	LDT1
San Bernardino (SC)	2025	LDT1	Aggregate	Aggregate	Diesel	9.62153332	138.8700264	27.06662	0.005712258	5.712257886		138.8700264			
San Bernardino (SC)	2025	LDT1	Aggregate	Aggregate	Electr	81.74409231	4029.090974	409.6554	0	0		4029.090974			
San Bernardino (SC)	2025	LDT1	Aggregate	Aggregate	Plug-i	75.22656194	3819.958249	311.0618	0.055707597	55.70759743		3819.958249			
San Bernardino (SC)	2025	LDT2	Aggregate	Aggregate	Gasoli	197589.8024	8156000.659	925465.4	328.0141754	328014.1754	330196.8511	8156000.659	8333682.032	25.24	LDT2
San Bernardino (SC)	2025	LDT2	Aggregate	Aggregate	Diesel	559.2848358	24877.85405	2707.612	0.732985994	732.9859937		24877.85405			
San Bernardino (SC)	2025	LDT2	Aggregate	Aggregate	Electr	1637.444663	58171.59292	8336.729	0	0		58171.59292			
San Bernardino (SC)	2025	LDT2	Aggregate	Aggregate	Plug-i	1934.989022	94631.92591	8001.18	1.449689627	1449.689627		94631.92591			
San Bernardino (SC)	2025	LHDT1	Aggregate	Aggregate	Gasoli	16963.11371	633447.7463	252725.1	45.45107153	45451.07153	66469.9942	633447.7463	1077884.454	16.22	LHDT1
San Bernardino (SC)	2025	LHDT1	Aggregate	Aggregate	Diesel	11403.02981	434286.2222	143435.8	21.01892267	21018.92267		434286.2222			
San Bernardino (SC)	2025	LHDT1	Aggregate	Aggregate	Electr	147.3648902	10150.48537	2061.844	0	0		10150.48537			
San Bernardino (SC)	2025	LHDT2	Aggregate	Aggregate	Gasoli	2823.949841	99825.11713	42072.64	8.149183621	8149.183621	18984.07565	99825.11713	289811.7154	15.27	LHDT2
San Bernardino (SC)	2025	LHDT2	Aggregate	Aggregate	Diesel	4888.887446	187525.0486	61496.05	10.83489203	10834.89203		187525.0486			
San Bernardino (SC)	2025	LHDT2	Aggregate	Aggregate	Electr	37.58571717	2461.549606	498.4225	0	0		2461.549606			
San Bernardino (SC)	2025	MCY	Aggregate	Aggregate	Gasoli	20826.96994	123280.6812	41653.94	2.925130919	2925.130919	2925.130919	123280.6812	123280.6812	42.15	MCY
San Bernardino (SC)	2025	MDV	Aggregate	Aggregate	Gasoli	147056.3511	5833561.643	672637.6	289.7409456	289740.9456	293881.6654	5833561.643	6036663.747	20.54	MDV
San Bernardino (SC)	2025	MDV	Aggregate	Aggregate	Diesel	1906.902909	76374.47974	8796.885	3.151065928	3151.065928		76374.47974			
San Bernardino (SC)	2025	MDV	Aggregate	Aggregate	Electr	1802.834782	63969.43971	9175.356	0	0		63969.43971			
San Bernardino (SC)	2025	MDV	Aggregate	Aggregate	Plug-i	1256.812117	62758.18504	5196.918	0.98965379	989.6537902		62758.18504			
San Bernardino (SC)	2025	MH	Aggregate	Aggregate	Gasoli	3227.585522	28520.15334	322.8877	5.836852659	5836.852659	6997.412696	28520.15334	40386.16204	5.77	MH
San Bernardino (SC)	2025	MH	Aggregate	Aggregate	Diesel	1329.243498	11866.0087	132.9243	1.160560036	1160.560036		11866.0087			
San Bernardino (SC)	2025	MHDT	Aggregate	Aggregate	Gasoli	1427.423114	76828.767	28559.88	14.58515666	14585.15666	88952.25214	76828.767	752323.1368	8.46	MHDT
San Bernardino (SC)	2025	MHDT	Aggregate	Aggregate	Diesel	15347.54129	658670.5437	188328.2	73.22420436	73224.20436		658670.5437			
San Bernardino (SC)	2025	MHDT	Aggregate	Aggregate	Electr	133.1585562	6928.399641	1697.434	0	0		6928.399641			
San Bernardino (SC)	2025	MHDT	Aggregate	Aggregate	Natur	208.419151	9895.426472	1924.329	1.142891124	1142.891124		9895.426472			
San Bernardino (SC)	2025	OBUS	Aggregate	Aggregate	Gasoli	358.2884481	15030.55432	7168.635	2.914537526	2914.537526	5188.582188	15030.55432	32494.86271	6.26	OBUS
San Bernardino (SC)	2025	OBUS	Aggregate	Aggregate	Diesel	215.4704252	15216.87274	2560.668	2.039111404	2039.111404		15216.87274			
San Bernardino (SC)	2025	OBUS	Aggregate	Aggregate	Electr	1.990200949	157.0570869	39.81994	0	0		157.0570869			
San Bernardino (SC)	2025	OBUS	Aggregate	Aggregate	Natur	34.88313202	2090.378559	310.4599	0.234933258	234.9332579		2090.378559			
San Bernardino (SC)	2025	SBUS	Aggregate	Aggregate	Gasoli	300.4577721	14124.28621	1201.831	1.57111818	1571.11818	4959.876607	14124.28621	31963.06277	6.44	SBUS
San Bernardino (SC)	2025	SBUS	Aggregate	Aggregate	Diesel	363.8707141	7488.892183	5268.848	1.014599014	1014.599014		7488.892183			
San Bernardino (SC)	2025	SBUS	Aggregate	Aggregate	Electr	4.690534617	132.2929048	57.7594	0	0		132.2929048			
San Bernardino (SC)	2025	SBUS	Aggregate	Aggregate	Natur	411.4766102	10217.59148	5958.181	2.374159413	2374.159413		10217.59148			
San Bernardino (SC)	2025	UBUS	Aggregate	Aggregate	Gasoli	54.83056931	5264.458034	219.3223	0.406547565	406.5475652	8275.384496	5264.458034	40204.44305	4.86	UBUS
San Bernardino (SC)	2025	UBUS	Aggregate	Aggregate	Diesel	4.529432466	447.4667714	18.11773	0.043317656	43.31765633		447.4667714			
San Bernardino (SC)	2025	UBUS	Aggregate	Aggregate	Electr	7.409987909	1124.502697	29.63995	0	0		1124.502697			
San Bernardino (SC)	2025	UBUS	Aggregate	Aggregate	Natur	243.8212922	33368.01555	975.2852	7.825519274	7825.519274		33368.01555			

Source: EMFAC2021 (v1.0.2) Emissions Inventory
Region Type: Sub-Area
Region: San Bernardino (SC)
Calendar Year: 2026
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for CVMT and EVMT, trips/day for Trips, kWh/day for Energy Consumption, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Region	Calenc	Vehicle Cat	Model Year	Speed	Fuel	Population	Total VMT	Trips	Fuel_Consumption	Fuel_Consumption	Total Fuel	VMT	Total VMT	Miles per Gallon	Vehicle Class
San Bernardino (SC)	2026	HHDT	Aggregate	Aggregate	Gasoli	2.628638455	162.3041519	52.5938	0.038094178	38.09417834	323816.6756	162.3041519	2020691.204	6.24	HHDT
San Bernardino (SC)	2026	HHDT	Aggregate	Aggregate	Diesel	15084.77036	1831295.475	228328.7	297.3157582	297315.7582		1831295.475			
San Bernardino (SC)	2026	HHDT	Aggregate	Aggregate	Electr	191.0683418	19973.63311	2394.287	0	0		19973.63311			
San Bernardino (SC)	2026	HHDT	Aggregate	Aggregate	Natur	2643.959607	169259.7919	15302.22	26.4628232	26462.8232		169259.7919			
San Bernardino (SC)	2026	LDA	Aggregate	Aggregate	Gasoli	456254.7841	19874166.46	2117601	641.5351772	641535.1772	653766.4651	19874166.46	21884485.35	33.47	LDA
San Bernardino (SC)	2026	LDA	Aggregate	Aggregate	Diesel	917.7888375	31994.04388	3923.687	0.730185103	730.185103		31994.04388			
San Bernardino (SC)	2026	LDA	Aggregate	Aggregate	Electr	26082.82543	1250859.603	130014.2	0	0		1250859.603			
San Bernardino (SC)	2026	LDA	Aggregate	Aggregate	Plug-i	14570.87312	727465.2451	60250.56	11.50110282	11501.10282		727465.2451			
San Bernardino (SC)	2026	LDT1	Aggregate	Aggregate	Gasoli	39063.9999	1360017.769	169061.6	53.36846197	53368.46197	53444.7712	1360017.769	1370565.663	25.64	LDT1
San Bernardino (SC)	2026	LDT1	Aggregate	Aggregate	Diesel	7.517030094	107.4585455	20.94662	0.004383307	4.383306977		107.4585455			
San Bernardino (SC)	2026	LDT1	Aggregate	Aggregate	Electr	110.0966514	5426.246616	552.6584	0	0		5426.246616			
San Bernardino (SC)	2026	LDT1	Aggregate	Aggregate	Plug-i	100.2350808	5014.189058	414.4721	0.071925931	71.92593104		5014.189058			
San Bernardino (SC)	2026	LDT2	Aggregate	Aggregate	Gasoli	202612.9731	8343534.623	949148.8	327.3242951	327324.2951	329715.7191	8343534.623	8550437.791	25.93	LDT2
San Bernardino (SC)	2026	LDT2	Aggregate	Aggregate	Diesel	596.9953934	26308.25909	2883.572	0.759292797	759.2927973		26308.25909			
San Bernardino (SC)	2026	LDT2	Aggregate	Aggregate	Electr	2064.91584	72169.29693	10461.88	0	0		72169.29693			
San Bernardino (SC)	2026	LDT2	Aggregate	Aggregate	Plug-i	2256.649793	108425.6117	9331.247	1.63213121	1632.13121		108425.6117			
San Bernardino (SC)	2026	LHDT1	Aggregate	Aggregate	Gasoli	16791.83447	629601.5161	250173.3	44.16498346	44164.98346	64979.5748	629601.5161	1079997.968	16.62	LHDT1
San Bernardino (SC)	2026	LHDT1	Aggregate	Aggregate	Diesel	11393.65177	431830.7159	143317.8	20.81459135	20814.59135		431830.7159			
San Bernardino (SC)	2026	LHDT1	Aggregate	Aggregate	Electr	282.094588	18565.73546	3948.131	0	0		18565.73546			
San Bernardino (SC)	2026	LHDT2	Aggregate	Aggregate	Gasoli	2763.224246	97215.03215	41167.92	7.803597069	7803.597069	18588.78398	97215.03215	289578.9062	15.58	LHDT2
San Bernardino (SC)	2026	LHDT2	Aggregate	Aggregate	Diesel	4937.57725	187863.321	62108.51	10.78518691	10785.18691		187863.321			
San Bernardino (SC)	2026	LHDT2	Aggregate	Aggregate	Electr	71.81390811	4500.553077	952.6366	0	0		4500.553077			
San Bernardino (SC)	2026	MCY	Aggregate	Aggregate	Gasoli	20884.25022	122975.6545	41768.5	2.907527557	2907.527557	2907.527557	122975.6545	122975.6545	42.30	MCY
San Bernardino (SC)	2026	MDV	Aggregate	Aggregate	Gasoli	147189.0217	5833278.241	673332.9	282.9367666	282936.7666	287097.9101	5833278.241	6059751.016	21.11	MDV
San Bernardino (SC)	2026	MDV	Aggregate	Aggregate	Diesel	1900.727125	75215.18536	8735.218	3.046386471	3046.386471		75215.18536			
San Bernardino (SC)	2026	MDV	Aggregate	Aggregate	Electr	2262.574859	78934.40652	11456.87	0	0		78934.40652			
San Bernardino (SC)	2026	MDV	Aggregate	Aggregate	Plug-i	1469.974449	72323.18263	6078.344	1.114757016	1114.757016		72323.18263			
San Bernardino (SC)	2026	MH	Aggregate	Aggregate	Gasoli	3064.468567	27038.8087	306.5694	5.530646832	5530.646832	6673.58648	27038.8087	38715.77147	5.80	MH
San Bernardino (SC)	2026	MH	Aggregate	Aggregate	Diesel	1320.026239	11676.96277	132.0026	1.142939648	1142.939648		11676.96277			
San Bernardino (SC)	2026	MHDT	Aggregate	Aggregate	Gasoli	1396.239062	75343.20605	27935.95	14.13811827	14138.11827	88998.08289	75343.20605	764236.6027	8.59	MHDT
San Bernardino (SC)	2026	MHDT	Aggregate	Aggregate	Diesel	15710.20603	665955.6798	192892.8	73.67630673	73676.30673		665955.6798			
San Bernardino (SC)	2026	MHDT	Aggregate	Aggregate	Electr	245.8765864	12699.29672	3131.477	0	0		12699.29672			
San Bernardino (SC)	2026	MHDT	Aggregate	Aggregate	Natur	220.2089686	10238.42022	2031.192	1.183657888	1183.657888		10238.42022			
San Bernardino (SC)	2026	OBUS	Aggregate	Aggregate	Gasoli	348.5150855	14345.28666	6973.09	2.754710661	2754.710661	5020.348152	14345.28666	32033.51538	6.38	OBUS
San Bernardino (SC)	2026	OBUS	Aggregate	Aggregate	Diesel	220.037016	15248.80528	2628.327	2.024298125	2024.298125		15248.80528			
San Bernardino (SC)	2026	OBUS	Aggregate	Aggregate	Electr	3.340971814	259.0449895	66.84616	0	0		259.0449895			
San Bernardino (SC)	2026	OBUS	Aggregate	Aggregate	Natur	36.78806859	2180.378447	327.4138	0.241339366	241.3393658		2180.378447			
San Bernardino (SC)	2026	SBUS	Aggregate	Aggregate	Gasoli	302.8964194	14222.26132	1211.586	1.577820897	1577.820897	4964.605895	14222.26132	32090.47199	6.46	SBUS
San Bernardino (SC)	2026	SBUS	Aggregate	Aggregate	Diesel	353.6259778	7228.312611	5120.504	0.976501833	976.5018327		7228.312611			
San Bernardino (SC)	2026	SBUS	Aggregate	Aggregate	Electr	8.074559241	228.2385136	100.1786	0	0		228.2385136			
San Bernardino (SC)	2026	SBUS	Aggregate	Aggregate	Natur	423.8773853	10411.65954	6137.745	2.410283165	2410.283165		10411.65954			
San Bernardino (SC)	2026	UBUS	Aggregate	Aggregate	Gasoli	54.94101785	5275.062551	219.7641	0.407858087	407.8580873	7993.083023	5275.062551	40285.42929	5.04	UBUS
San Bernardino (SC)	2026	UBUS	Aggregate	Aggregate	Diesel	4.529432466	447.4667714	18.11773	0.043317653	43.31765334		447.4667714			
San Bernardino (SC)	2026	UBUS	Aggregate	Aggregate	Electr	11.78176765	1911.719241	47.12707	0	0		1911.719241			
San Bernardino (SC)	2026	UBUS	Aggregate	Aggregate	Natur	239.9647068	32651.18073	959.8588	7.541907283	7541.907283		32651.18073			

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Region	Calenc	Vehicle Cat	Model Year	Speed	Fuel	Population	Total VMT	Trips	Fuel_Consumption	Fuel_Consumption	Total Fuel	VMT	Total VMT	Miles per Gallon	Vehicle Class
San Bernardino (SC)	2027	HHDT	Aggregate	Aggregate	Gasoli	2.031197481	158.444704	40.6402	0.03545197	35.45197047	324538.1908	158.444704	2066703.214	6.37	HHDT
San Bernardino (SC)	2027	HHDT	Aggregate	Aggregate	Diesel	15410.14317	1861290.669	233699.1	297.8003661	297800.3661		1861290.669			
San Bernardino (SC)	2027	HHDT	Aggregate	Aggregate	Electr	309.5303952	32362.74223	3862.674	0	0		32362.74223			
San Bernardino (SC)	2027	HHDT	Aggregate	Aggregate	Natur	2715.575882	172891.3587	15772.83	26.70237267	26702.37267		172891.3587			
San Bernardino (SC)	2027	LDA	Aggregate	Aggregate	Gasoli	455364.3713	19787637.94	2112182	626.1101219	626110.1219	638604.9325	19787637.94	21952221.48	34.38	LDA
San Bernardino (SC)	2027	LDA	Aggregate	Aggregate	Diesel	838.6675897	29298.26032	3599.991	0.659294609	659.2946086		29298.26032			
San Bernardino (SC)	2027	LDA	Aggregate	Aggregate	Electr	29132.45727	1375391.516	144543.4	0	0		1375391.516			
San Bernardino (SC)	2027	LDA	Aggregate	Aggregate	Plug-i	15443.22828	759893.7676	63857.75	11.83551602	11835.51602		759893.7676			
San Bernardino (SC)	2027	LDT1	Aggregate	Aggregate	Gasoli	38336.73013	1338397.254	166118.5	51.51343959	51513.43959	51606.62039	1338397.254	1351923.889	26.20	LDT1
San Bernardino (SC)	2027	LDT1	Aggregate	Aggregate	Diesel	4.439852634	65.17772521	12.46356	0.002574711	2.57471119		65.17772521			
San Bernardino (SC)	2027	LDT1	Aggregate	Aggregate	Electr	144.0545689	7086.678198	723.2079	0	0		7086.678198			
San Bernardino (SC)	2027	LDT1	Aggregate	Aggregate	Plug-i	128.8782043	6374.778863	532.9114	0.090606087	90.60608738		6374.778863			
San Bernardino (SC)	2027	LDT2	Aggregate	Aggregate	Gasoli	207676.4312	8538774.779	972676.9	327.3681394	327368.1394	329973.7622	8538774.779	8775845.407	26.60	LDT2
San Bernardino (SC)	2027	LDT2	Aggregate	Aggregate	Diesel	630.9551959	27664.28405	3044.935	0.782780323	782.7803228		27664.28405			
San Bernardino (SC)	2027	LDT2	Aggregate	Aggregate	Electr	2524.548375	86861.55106	12732.42	0	0		86861.55106			
San Bernardino (SC)	2027	LDT2	Aggregate	Aggregate	Plug-i	2587.065461	122544.7931	10697.52	1.822842412	1822.842412		122544.7931			
San Bernardino (SC)	2027	LHDT1	Aggregate	Aggregate	Gasoli	16631.76323	624309.3634	247788.5	42.99085614	42990.85614	63571.75886	624309.3634	1082917.934	17.03	LHDT1
San Bernardino (SC)	2027	LHDT1	Aggregate	Aggregate	Diesel	11353.59669	427724.523	142814	20.58090272	20580.90272		427724.523			
San Bernardino (SC)	2027	LHDT1	Aggregate	Aggregate	Electr	483.3007095	30884.04755	6765.164	0	0		30884.04755			
San Bernardino (SC)	2027	LHDT2	Aggregate	Aggregate	Gasoli	2701.097559	94507.35792	40242.33	7.480744076	7480.744076	18200.52082	94507.35792	289429.504	15.90	LHDT2
San Bernardino (SC)	2027	LHDT2	Aggregate	Aggregate	Diesel	4973.210606	187433.7598	62556.73	10.71977674	10719.77674		187433.7598			
San Bernardino (SC)	2027	LHDT2	Aggregate	Aggregate	Electr	122.9369508	7488.386288	1630.714	0	0		7488.386288			
San Bernardino (SC)	2027	MCY	Aggregate	Aggregate	Gasoli	20938.59567	122694.478	41877.19	2.890537534	2890.537534	2890.537534	122694.478	122694.478	42.45	MCY
San Bernardino (SC)	2027	MDV	Aggregate	Aggregate	Gasoli	147488.8393	5847136.794	674785.1	277.1736638	277173.6638	281362.1261	5847136.794	6096922.964	21.67	MDV
San Bernardino (SC)	2027	MDV	Aggregate	Aggregate	Diesel	1888.455182	74178.21175	8658.513	2.946435768	2946.435768		74178.21175			
San Bernardino (SC)	2027	MDV	Aggregate	Aggregate	Electr	2733.489517	93772.05753	13773.45	0	0		93772.05753			
San Bernardino (SC)	2027	MDV	Aggregate	Aggregate	Plug-i	1684.990864	81835.90048	6967.437	1.242026531	1242.026531		81835.90048			
San Bernardino (SC)	2027	MH	Aggregate	Aggregate	Gasoli	2916.368599	25737.28381	291.7535	5.27019968	5270.19968	6397.211655	25737.28381	37228.95733	5.82	MH
San Bernardino (SC)	2027	MH	Aggregate	Aggregate	Diesel	1309.206187	11491.67351	130.9206	1.127011975	1127.011975		11491.67351			
San Bernardino (SC)	2027	MHDT	Aggregate	Aggregate	Gasoli	1363.931373	73700.39666	27289.54	13.69794739	13697.94739	88901.23052	73700.39666	776532.1125	8.73	MHDT
San Bernardino (SC)	2027	MHDT	Aggregate	Aggregate	Diesel	16024.85269	671004.9398	196835.6	73.98162813	73981.62813		671004.9398			
San Bernardino (SC)	2027	MHDT	Aggregate	Aggregate	Electr	415.444894	21284.00609	5286.808	0	0		21284.00609			
San Bernardino (SC)	2027	MHDT	Aggregate	Aggregate	Natur	231.558042	10542.76998	2138.765	1.221654995	1221.654995		10542.76998			
San Bernardino (SC)	2027	OBUS	Aggregate	Aggregate	Gasoli	338.4979609	13679.12348	6772.667	2.606454389	2606.454389	4867.066738	13679.12348	31634.98876	6.50	OBUS
San Bernardino (SC)	2027	OBUS	Aggregate	Aggregate	Diesel	224.28968	15302.2929	2691.915	2.013017951	2013.017951		15302.2929			
San Bernardino (SC)	2027	OBUS	Aggregate	Aggregate	Electr	5.327608073	407.9589952	106.5948	0	0		407.9589952			
San Bernardino (SC)	2027	OBUS	Aggregate	Aggregate	Natur	38.43104481	2245.613392	342.0363	0.247594398	247.5943984		2245.613392			
San Bernardino (SC)	2027	SBUS	Aggregate	Aggregate	Gasoli	305.3091837	14312.56626	1221.237	1.584072348	1584.072348	4963.461893	14312.56626	32226.7021	6.49	SBUS
San Bernardino (SC)	2027	SBUS	Aggregate	Aggregate	Diesel	342.2196973	6962.145992	4955.341	0.937618085	937.6180855		6962.145992			
San Bernardino (SC)	2027	SBUS	Aggregate	Aggregate	Electr	13.01170465	369.133274	161.3748	0	0		369.133274			
San Bernardino (SC)	2027	SBUS	Aggregate	Aggregate	Natur	435.6655597	10582.85658	6308.437	2.44177146	2441.77146		10582.85658			
San Bernardino (SC)	2027	UBUS	Aggregate	Aggregate	Gasoli	55.04919487	5285.495548	220.1968	0.409776943	409.7769433	7271.552247	5285.495548	40366.41553	5.55	UBUS
San Bernardino (SC)	2027	UBUS	Aggregate	Aggregate	Diesel	4.529432466	447.4667714	18.11773	0.043453785	43.4537853		447.4667714			
San Bernardino (SC)	2027	UBUS	Aggregate	Aggregate	Electr	29.13079723	4558.880161	116.5232	0	0		4558.880161			
San Bernardino (SC)	2027	UBUS	Aggregate	Aggregate	Natur	223.133143	30074.57305	892.5326	6.818321518	6818.321518		30074.57305			

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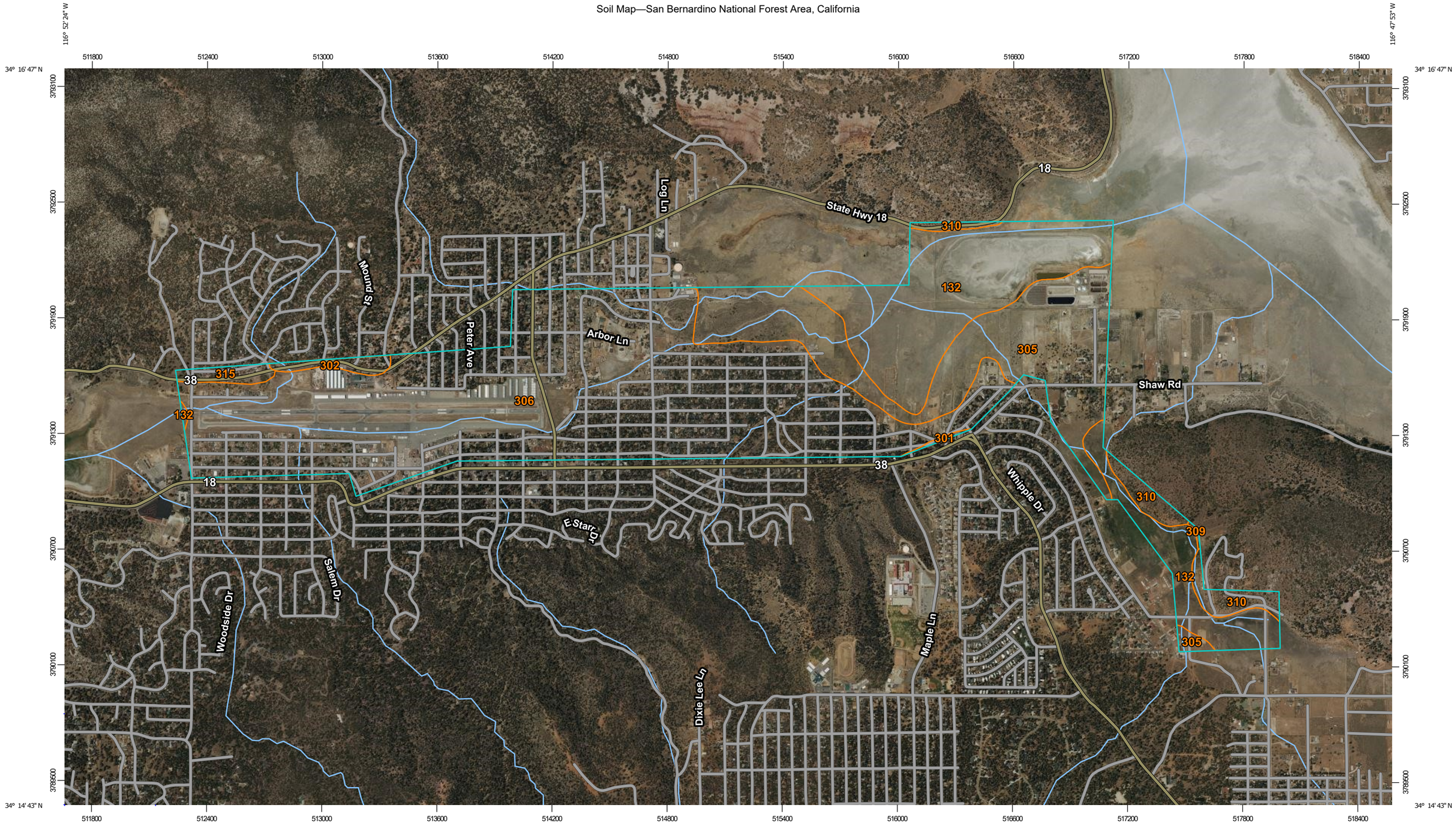

Map Scale: 1:18,600 if printed on B landscape (17" x 11") sheet.

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0 250 500 1000 1500 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino National Forest Area, California
Survey Area Data: Version 14, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

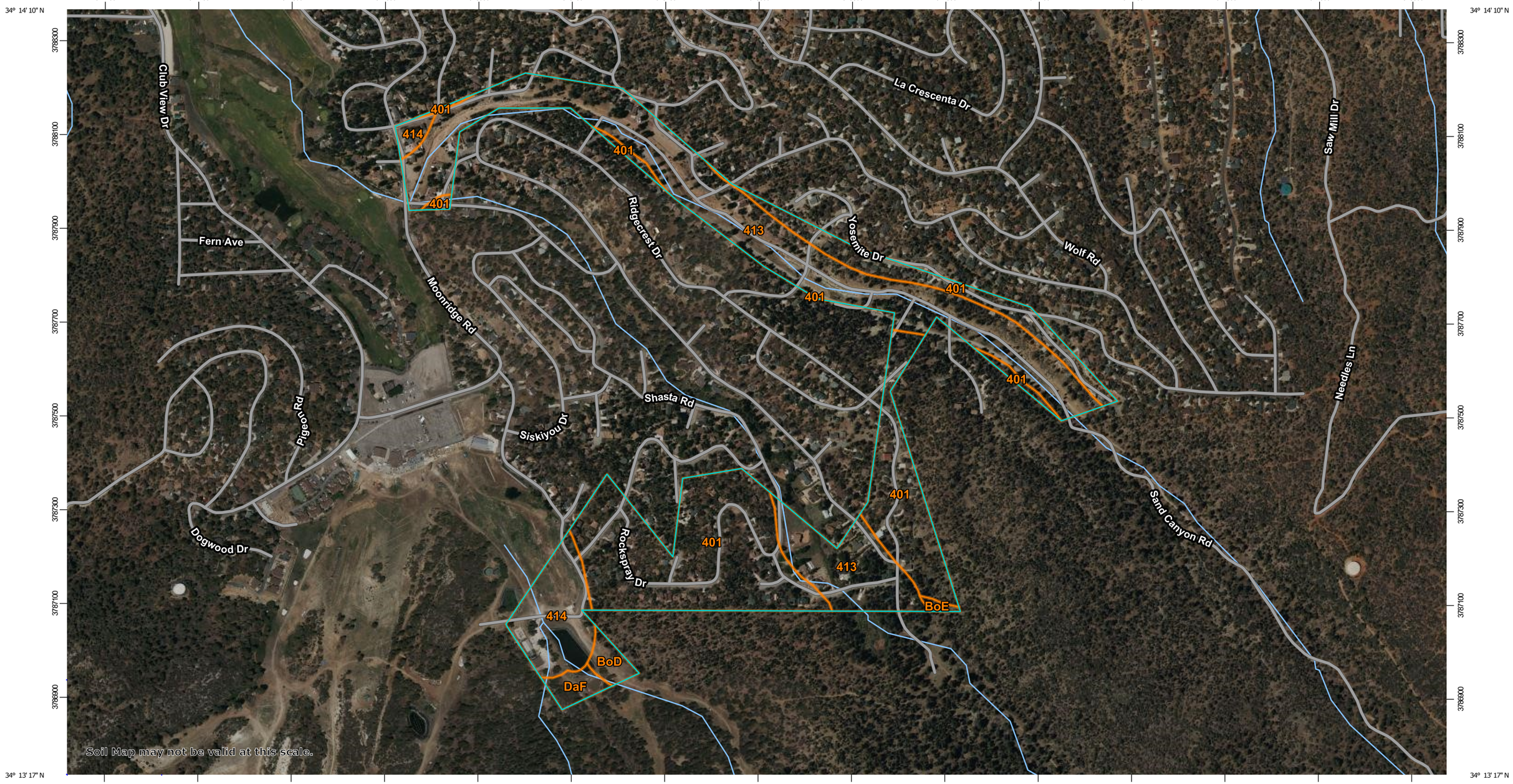
Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
132	Aquents-Grunney complex, 0 to 4 percent slopes	218.4	20.5%
301	Garloaf-Caribou creek complex, 15 to 30 percent slopes	1.2	0.1%
302	Garloaf-Caribou creek-Urban land complex, 9 to 15 percent slopes	9.2	0.9%
305	Moonridge-Shayroad-Caribou creek complex, 0 to 4 percent slopes	197.4	18.5%
306	Moonridge-Caribou creek-Urban land complex, 0 to 4 percent slopes	598.0	56.1%
309	Goldmountain-Deadmansridge-Deadpan complex, 15 to 30 percent slopes	0.6	0.1%
310	Goldmountain-Deadmansridge-Deadpan complex, 30 to 50 percent slopes	30.4	2.9%
315	Minnelusa-Caribou creek complex, 9 to 15 percent slopes	10.1	1.0%
Totals for Area of Interest		**1,065.4**	**100.0%**

Soil Map—San Bernardino National Forest Area, California



Map Scale: 1:7,960 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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Survey Area Data: Version 14, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

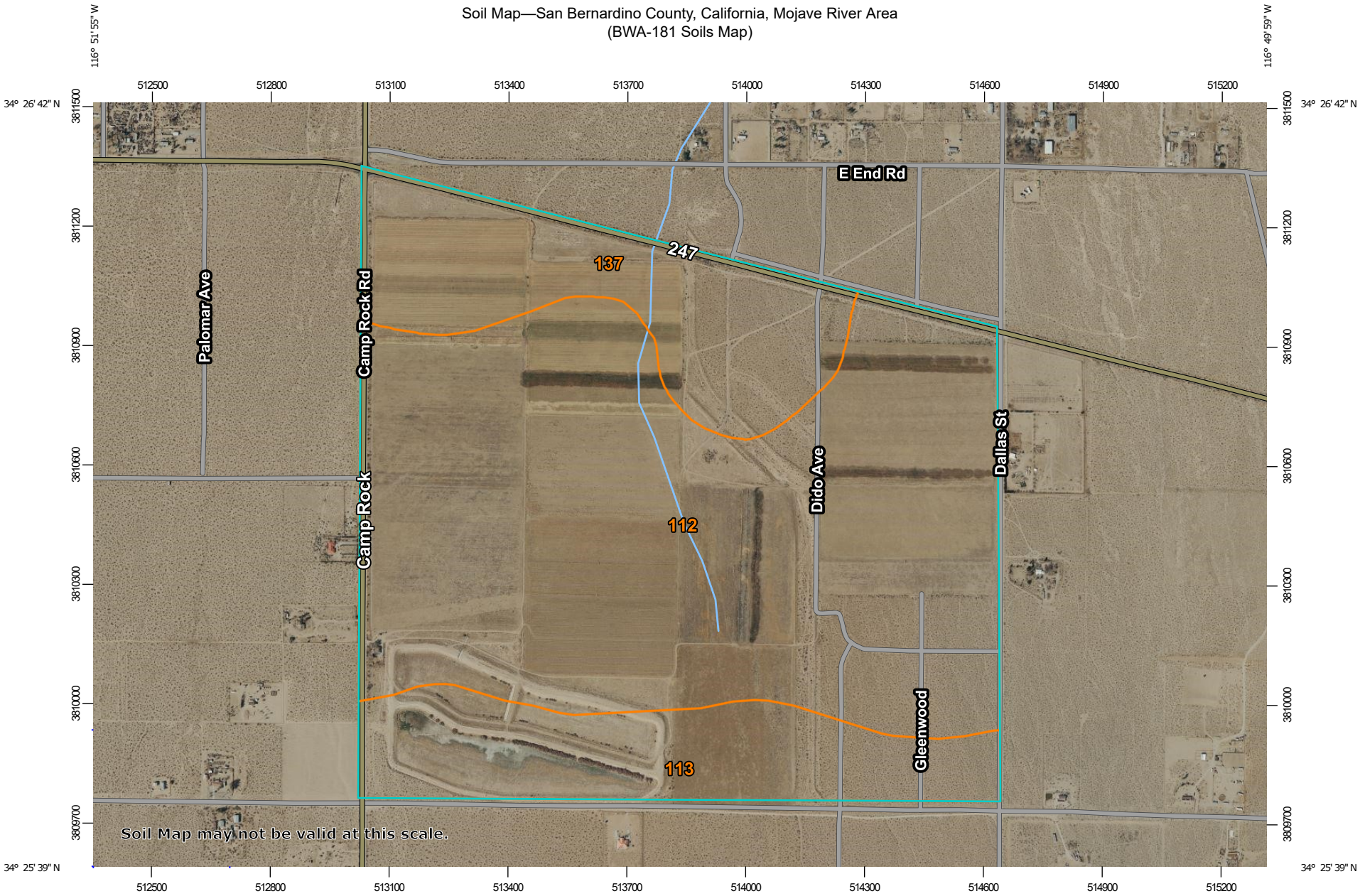
Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
401	Garloaf-Caribou creek-Urban land complex, 15 to 30 percent slopes	48.4	44.4%
413	Aquents-Riverwash complex, 0 to 4 percent slopes	46.9	43.0%
414	Moonridge-Urban land complex, 4 to 9 percent slopes	9.9	9.1%
BoD	Morical, very deep-Hecker families complex, 2 to 15 percent slopes	1.7	1.5%
BoE	Morical, very deep-Hecker families complex, 15 to 30 percent slopes	0.4	0.3%
DaF	Pacifico-Wapi families complex, 30 to 50 percent slopes	1.8	1.6%
Totals for Area of Interest		**109.0**	**100.0%**

Soil Map—San Bernardino County, California, Mojave River Area
(BWA-181 Soils Map)



Map Scale: 1:13,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
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- Soil Map Unit Points

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- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 14, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 27, 2021—May 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	368.5	66.2%
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	89.7	16.1%
137	KIMBERLINA LOAMY FINE SAND, COOL, 0 TO 2 PERCENT SLOPES	98.3	17.7%
Totals for Area of Interest		**556.6**	**100.0%**

Replenish Big Bear Program

GREENHOUSE GAS ANALYSIS

BIG BEAR AREA REGIONAL WASTEWATER AGENCY

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SEPTEMBER 7, 2023

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LIST OF ABBREVIATED TERMS

%	Percent
°C	Degrees Celsius
°F	Degrees Fahrenheit
(1)	Reference
AB	Assembly Bill
AB 32	Global Warming Solutions Act of 2006
AB 1493	Pavley Fuel Efficiency Standards
AB 1181	California Water Conservation Landscaping Act of 2006
ACE	Affordable Clean Energy
Annex I	Industrialized Nations
APA	Administrative Procedure Act
AQIA	Air Quality Impact Analysis
BAU	Business-As-Usual
C_2F_6	Hexafluoroethane
C_2H_6	Ethane
$C_2H_2F_4$	Tetrafluroethane
$C_2H_4F_2$	Ethylidene Fluoride
CAA	Federal Clean Air Act
CalEEMod	California Emissions Estimator Model
CalEPA	California Environmental Protection Agency
CALGAPS	California LBNL GHG Analysis of Policies Spreadsheet
CALGreen	California Green Building Standards Code
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resource Board
CBSC	California Building Standards Commission
CEC	California Energy Commission
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CDFA	California Department of Food and Agriculture
CF_4	Tetrafluoromethane
CFC	Chlorofluorocarbons
CH_4	Methane
CHF_3	Fluoroform
CH_2FCF	1,1,1,2-tetrafluoroethane
CH_3CF_2	1,1-difluoroethane
CNRA	California Natural Resources Agency

CNRA 2009	2009 California Climate Adaptation Strategy
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
Convention	United Nation's Framework Convention on Climate Change
COP	Conference of the Parties
CPUC	California Public Utilities Commission
EPA	Environmental Protection Agency
GCC	Global Climate Change
Gg	Gigagram
GHGA	Greenhouse Gas Analysis
GWP	Global Warming Potential
H_2O	Water
HFC	Hydrofluorocarbons
IPCC	Intergovernmental Panel on Climate Change
ISO	Independent System Operator
ITE	Institute of Transportation Engineers
kWh	Kilowatt Hours
lbs	Pounds
LBNL	Lawrence Berkeley National Laboratory
LCA	Life-Cycle Analysis
LCD	Liquid Crystal Display
LCFS	Low Carbon Fuel Standard or Executive Order S-01-07
LEV III	Low-Emission Vehicle
LULUCF	Land-Use, Land-Use Change and Forestry
MMR	Mandatory Reporting Rule
$MMTCO_2e$	Million Metric Ton of Carbon Dioxide Equivalent
MPG	Miles Per Gallon
MPOs	Metropolitan Planning Organizations
MT/yr	Metric Tons Per Year
$MTCO_2e$	Metric Ton of Carbon Dioxide Equivalent
$MTCO_2e/yr$	Metric Ton of Carbon Dioxide Equivalent Per Year
MW	Megawatts
MWh	Megawatts Per Hour
MWELO	California Department of Water Resources' Model Water Efficient
N_2O	Nitrous Oxide
NDC	Nationally Determined Contributions
NF_3	Nitrogen Trifluoride

NHTSA	National Highway Traffic Safety Administration
NIOSH	National Institute for Occupational Safety and Health
Non-Annex I	Developing Nations
OAL	Office of Administrative Law
OPR	Office of Planning and Research
PFC	Perfluorocarbons
ppb	Parts Per Billion
ppm	Parts Per Million
ppt	Parts Per Trillion
Project	Replenish Big Bear Program
RPS	Renewable Portfolio Standards
RTP/SCS	Regional Transportation Plan/ Sustainable Communities Strategy
SAR	Second Assessment Report
SB	Senate Bill
SB 32	California Global Warming Solutions Act of 2006
SB 375	Regional GHG Emissions Reduction Targets/Sustainable Communities Strategies
SB 1078	Renewable Portfolio Standards
SB 1368	Statewide Retail Provider Emissions Performance Standards
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
Scoping Plan	California Air Resources Board Climate Change Scoping Plan
SF_6	Sulfur Hexaflouride
SLPS	Short-Lived Climate Pollutant Strategy
SP	Service Population
Title 20	Appliance Energy Efficiency Standards
Title 24	California Building Code
U.N.	United Nations
U.S.	United States
UNFCCC	United Nations' Framework Convention on Climate Change
URBEMIS	Urban Emissions
WCI	Western Climate Initiative
WRI	World Resources Institute
ZE/NZE	Zero and Near-Zero Emissions
ZEV	Zero-Emissions Vehicles

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EXECUTIVE SUMMARY

ES.1 SUMMARY OF FINDINGS

The results of this *Replenish Big Bear Program Greenhouse Gas Analysis* (GHGA) is summarized below based on the significance criteria in Section 3 of this report consistent with Appendix G of the California Environmental Quality Act (CEQA) Guidelines (1). Table ES-1 shows the findings of significance for potential greenhouse gas (GHG) impacts under CEQA.

TABLE ES-1: SUMMARY OF CEQA SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
GHG Impact #1: The Project would not generate direct or indirect GHG emission that would result in a significant impact on the environment.	3.8	*Less Than Significant*	*n/a*
GHG Impact #2: The Project would not conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.	3.8	*Less Than Significant*	*n/a*

ES.2 PROJECT REQUIREMENTS

The Project would be required to comply with regulations imposed by the State of California and the South Coast Air Quality Management District (SCAQMD) aimed at the reduction of air pollutant emissions. Those that are directly and indirectly applicable to the Project and that would assist in the reduction of GHG emissions include:

- Global Warming Solutions Act of 2006 (Assembly Bill (AB) 32) (2).
- Regional GHG Emissions Reduction Targets/Sustainable Communities Strategies (Senate Bill (SB) 375) (3).
- Pavley Fuel Efficiency Standards (AB 1493). Establishes fuel efficiency ratings for new vehicles (4).
- California Building Code (Title 24 California Code of Regulations (CCR)). Establishes energy efficiency requirements for new construction (5).
- Appliance Energy Efficiency Standards (Title 20 CCR). Establishes energy efficiency requirements for appliances (6).
- Low Carbon Fuel Standard (LCFS). Requires carbon content of fuel sold in California to be 10 percent (%) less by 2020 (7).
- California Water Conservation in Landscaping Act of 2006 (AB 1881). Requires local agencies to adopt the Department of Water Resources updated Water Efficient Landscape Ordinance or equivalent by January 1, 2010 to ensure efficient landscapes in new development and reduced water waste in existing landscapes (8).

- Statewide Retail Provider Emissions Performance Standards (SB 1368). Requires energy generators to achieve performance standards for GHG emissions (9).
- Renewable Portfolio Standards (SB 1078 – also referred to as RPS). Requires electric corporations to increase the amount of energy obtained from eligible renewable energy resources to 20 % by 2010 and 33% by 2020 (10).
- California Global Warming Solutions Act of 2006 (SB 32). Requires the state to reduce statewide GHG emissions to 40% below 1990 levels by 2030, a reduction target that was first introduced in Executive Order B-30-15 (11).

Promulgated regulations that will affect the Project's emissions are accounted for in the Project's GHG calculations provided in this report. In particular, AB 1493, LCFS, and RPS, and therefore are accounted for in the Project's emission calculations.

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1 INTRODUCTION

This report presents the results of the Greenhouse Gas Analysis (GHGA) prepared by Urban Crossroads, Inc., for the proposed Replenish Big Bear Program (Project). The purpose of this GHGA is to evaluate Project-related construction and operational emissions and determine the level of GHG impacts as a result of constructing and operating the proposed Project.

1.1 SITE LOCATION

The proposed Project site is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are located in the middle of this Basin. The overall project area consists of the Valley in the County of San Bernardino, as shown on Exhibit 1-A.

1.2 PROJECT DESCRIPTION

The proposed Project includes upgrades and additions to Big Bear Area Regional Wastewater Agency's (BBARWA) wastewater treatment plant (WWTP) to produce purified water through full advanced treatment to protect the receiving waters and their beneficial uses. The Replenish Big Bear Program would upgrade BBARWA's WWTP to produce full advanced treated water that would be retained within the Big Bear Valley watershed to be used to increase the sustainability of local water supplies, consequently, wastewater currently delivered to Lucerne Valley will be modified. The proposed Project consists of construction and operation of the various facilities which are separated into five project categories: 1) Replenish Big Bear Component 1: Lake Discharge Pipeline Alignment; 2) Replenish Big Bear Component 2: Shay Pond; 3) Replenish Big Bear Component 3: Evaporation Pond; 4) Replenish Big Bear Component 4: BBARWA WWTP Upgrades; and 5) Replenish Big Bear Component 5: Sand Canyon.

REPLENISH BIG BEAR COMPONENT 1: BBARWA WWTP UPGRADES

This Replenish Big Bear Component includes upgrades to the BBARWA WWTP, to include 2.2 MGD of full advanced treatment, producing up to 2,210 AFY of purified water. The upgrades include the construction of a 40,000 SF building which would provide the following upgrades and new construction in order of process flow:

- Upgrades to the Oxidation Ditches
- New Denitrification Filter
- New UF and RO filtration membranes
- New UV Disinfection
- New AOP
- New Pellet Reactor: 0.22 MGD

The BBARWA WWTP Treatment Upgrades also includes the installation of about 1,350 LF of brine pipeline anticipated to be sized between 8" to 10" from the pellet reactor to the solar evaporation ponds. Additionally, the BBARWA WWTP Treatment Upgrades also includes installation of a 50 gpm brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

REPLENISH BIG BEAR COMPONENT 2: LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12" in diameter.

REPLENISH BIG BEAR COMPONENT 3: SHAY POND CONVEYANCE PIPELINE

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells.

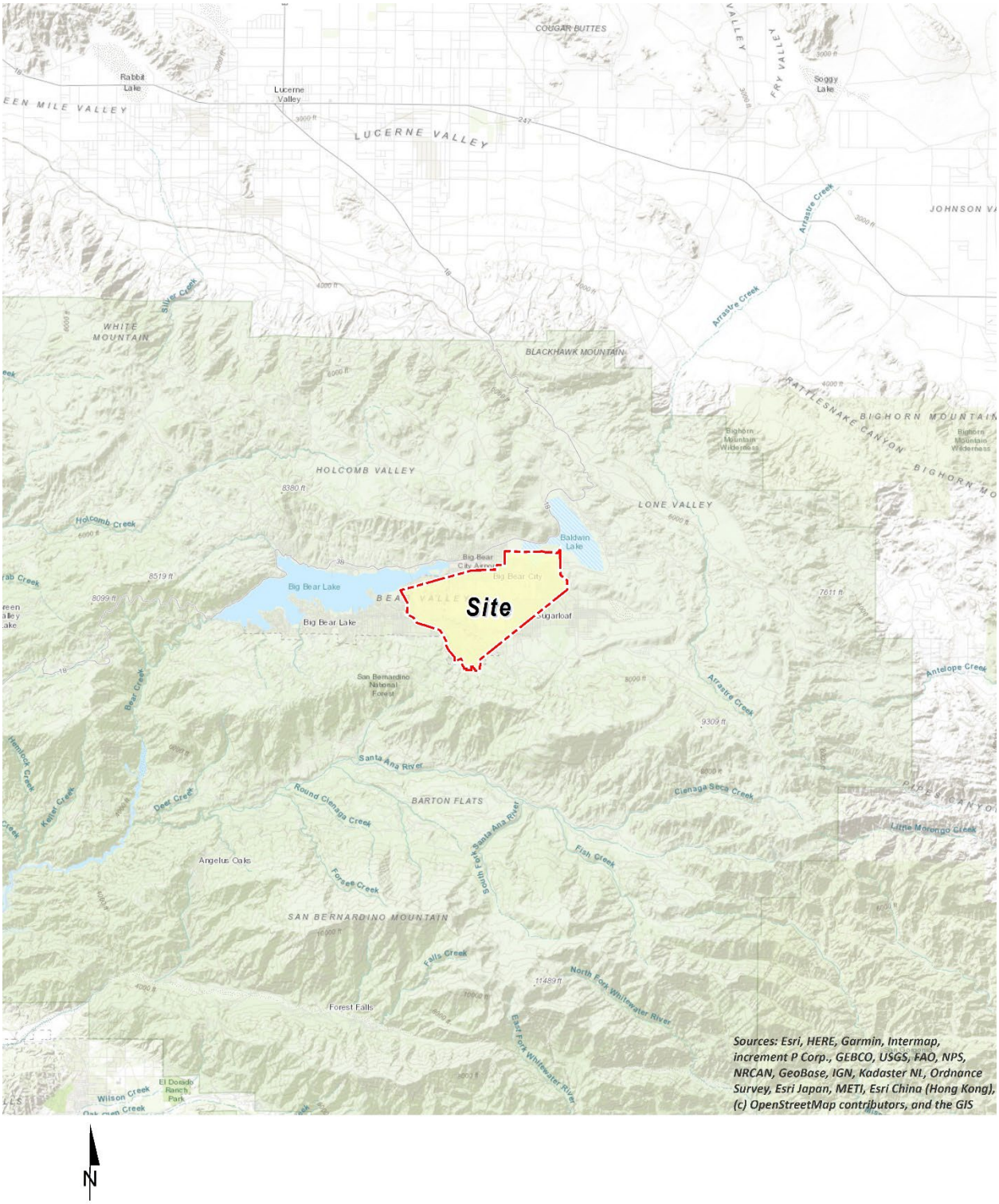
REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

The Sand Canyon groundwater recharge project involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline.

As part of the Replenish Big Bear Program, the following will be constructed:

- A new 471 gpm pump station near the snowmaking pond, at the BBLDWP Sand Canyon Well site, to convey water to Sand Canyon.
- A new 8-inch pipeline that will discharge into Sand Canyon and will be approximately 7,200 feet in length.
- Two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.
- Installation of erosion control using rip rap or similar erosion control methods, at Sand Canyon.

EXHIBIT 1-A: PROJECT LOCATION MAP



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2 CLIMATE CHANGE SETTING

2.1 INTRODUCTION TO GLOBAL CLIMATE CHANGE (GCC)

GCC is defined as the change in average meteorological conditions on the earth with respect to temperature, precipitation, and storms. The majority of scientists believe that the climate shift taking place since the Industrial Revolution is occurring at a quicker rate and magnitude than in the past. Scientific evidence suggests that GCC is the result of increased concentrations of GHGs in the earth's atmosphere, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. The majority of scientists believe that this increased rate of climate change is the result of GHGs resulting from human activity and industrialization over the past 200 years.

An individual project like the proposed Project evaluated in this GHGA cannot generate enough GHG emissions to affect a discernible change in global climate. However, the proposed Project may participate in the potential for GCC by its incremental contribution of GHGs combined with the cumulative increase of all other sources of GHGs, which when taken together constitute potential influences on GCC. Because these changes may have serious environmental consequences, Section 3.0 will evaluate the potential for the proposed Project to have a significant effect upon the environment as a result of its potential contribution to the greenhouse effect.

2.2 GLOBAL CLIMATE CHANGE DEFINED

GCC refers to the change in average meteorological conditions on the earth with respect to temperature, wind patterns, precipitation and storms. Global temperatures are regulated by naturally occurring atmospheric gases such as water vapor, CO_2, N_2O, CH_4, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These particular gases are important due to their residence time (duration they stay) in the atmosphere, which ranges from 10 years to more than 100 years. These gases allow solar radiation into the earth's atmosphere, but prevent radioactive heat from escaping, thus warming the earth's atmosphere. GCC can occur naturally as it has in the past with the previous ice ages.

Gases that trap heat in the atmosphere are often referred to as GHGs. GHGs are released into the atmosphere by both natural and anthropogenic activity. Without the natural GHG effect, the earth's average temperature would be approximately 61 degrees Fahrenheit (°F) cooler than it is currently. The cumulative accumulation of these gases in the earth's atmosphere is considered to be the cause for the observed increase in the earth's temperature.

2.3 GREENHOUSE GASES

2.3.1 GHGS AND HEALTH EFFECTS

GHGs trap heat in the atmosphere, creating a GHG effect that results in global warming and climate change. Many gases demonstrate these properties and as discussed in Table 2-1. For the purposes of this analysis, emissions of CO_2, CH_4, and N_2O were evaluated (see Table 3-1 later in this report) because these gases are the primary contributors to GCC from development projects.

Although there are other substances such as fluorinated gases that also contribute to GCC, these fluorinated gases were not evaluated as their sources are not well-defined and do not contain accepted emissions factors or methodology to accurately calculate these gases.

TABLE 2-1: GREENHOUSE GASES

Greenhouse Gases	Description	Sources	Health Effects
Water	Water is the most abundant, important, and variable GHG in the atmosphere. Water vapor is not considered a pollutant; in the atmosphere it maintains a climate necessary for life. Changes in its concentration are primarily considered to be a result of climate feedbacks related to the warming of the atmosphere rather than a direct result of industrialization. A climate feedback is an indirect, or secondary, change, either positive or negative, that occurs within the climate system in response to a forcing mechanism. The feedback loop in which water is involved is critically important to projecting future climate change. As the temperature of the atmosphere rises, more water is evaporated from ground storage (rivers, oceans, reservoirs, soil). Because the air is warmer, the relative humidity can be higher (in essence, the air is able to 'hold' more water when it is warmer), leading to more water vapor in the atmosphere. As a GHG, the higher concentration of water vapor is then able to absorb more thermal indirect energy radiated from the Earth, thus further warming the atmosphere. The warmer atmosphere can then hold more water vapor and so on and so on. This is referred to as a "positive feedback loop." The extent to which this positive feedback loop will continue is	The main source of water vapor is evaporation from the oceans (approximately 85%). Other sources include evaporation from other water bodies, sublimation (change from solid to gas) from sea ice and snow, and transpiration from plant leaves.	There are no known direct health effects related to water vapor at this time. It should be noted however that when some pollutants react with water vapor, the reaction forms a transport mechanism for some of these pollutants to enter the human body through water vapor.

Greenhouse Gases	Description	Sources	Health Effects
	unknown as there are also dynamics that hold the positive feedback loop in check. As an example, when water vapor increases in the atmosphere, more of it will eventually condense into clouds, which are more able to reflect incoming solar radiation (thus allowing less energy to reach the earth's surface and heat it up) (12).		
CO_2	CO_2 is an odorless and colorless GHG. Since the industrial revolution began in the mid-1700s, the sort of human activity that increases GHG emissions has increased dramatically in scale and distribution. Data from the past 50 years suggests a corollary increase in levels and concentrations. As an example, prior to the industrial revolution, CO_2 concentrations were fairly stable at 280 parts per million (ppm). Today, they are around 370 ppm, an increase of more than 30%. Left unchecked, the concentration of CO_2 in the atmosphere is projected to increase to a minimum of 540 ppm by 2100 as a direct result of anthropogenic sources (13).	CO_2 is emitted from natural and manmade sources. Natural sources include: the decomposition of dead organic matter; respiration of bacteria, plants, animals and fungus; evaporation from oceans; and volcanic outgassing. Anthropogenic sources include: the burning of coal, oil, natural gas, and wood. CO_2 is naturally removed from the air by photosynthesis, dissolution into ocean water, transfer to soils and ice caps, and chemical weathering of carbonate rocks (14).	Outdoor levels of CO_2 are not high enough to result in negative health effects. According to the National Institute for Occupational Safety and Health (NIOSH) high concentrations of CO_2 can result in health effects such as: headaches, dizziness, restlessness, difficulty breathing, sweating, increased heart rate, increased cardiac output, increased blood pressure, coma, asphyxia, and/or convulsions. It should be noted that current concentrations of CO_2 in the earth's atmosphere are estimated to be approximately 370 ppm, the actual reference exposure level (level at which adverse health effects typically occur) is at exposure levels of 5,000 ppm averaged over 10 hours in a 40-hour workweek and short-term reference exposure levels of 30,000 ppm averaged over a 15 minute period (15).

Greenhouse Gases	Description	Sources	Health Effects
CH_4	CH_4 is an extremely effective absorber of radiation, although its atmospheric concentration is less than CO_2 and its lifetime in the atmosphere is brief (10-12 years), compared to other GHGs.	CH_4 has both natural and anthropogenic sources. It is released as part of the biological processes in low oxygen environments, such as in swamplands or in rice production (at the roots of the plants). Over the last 50 years, human activities such as growing rice, raising cattle, using natural gas, and mining coal have added to the atmospheric concentration of CH_4. Other anthropocentric sources include fossil-fuel combustion and biomass burning (16).	CH_4 is extremely reactive with oxidizers, halogens, and other halogen-containing compounds. Exposure to high levels of CH_4 can cause asphyxiation, loss of consciousness, headache and dizziness, nausea and vomiting, weakness, loss of coordination, and an increased breathing rate.
N_2O	N_2O, also known as laughing gas, is a colorless GHG. Concentrations of N_2O also began to rise at the beginning of the industrial revolution. In 1998, the global concentration was 314 parts per billion (ppb).	N_2O is produced by microbial processes in soil and water, including those reactions which occur in fertilizer containing nitrogen. In addition to agricultural sources, some industrial processes (fossil fuel-fired power plants, nylon production, nitric acid production, and vehicle emissions) also contribute to its atmospheric load. It is used as an aerosol spray propellant, i.e., in whipped cream bottles. It is also	N_2O can cause dizziness, euphoria, and sometimes slight hallucinations. In small doses, it is considered harmless. However, in some cases, heavy and extended use can cause Olney's Lesions (brain damage) (17).

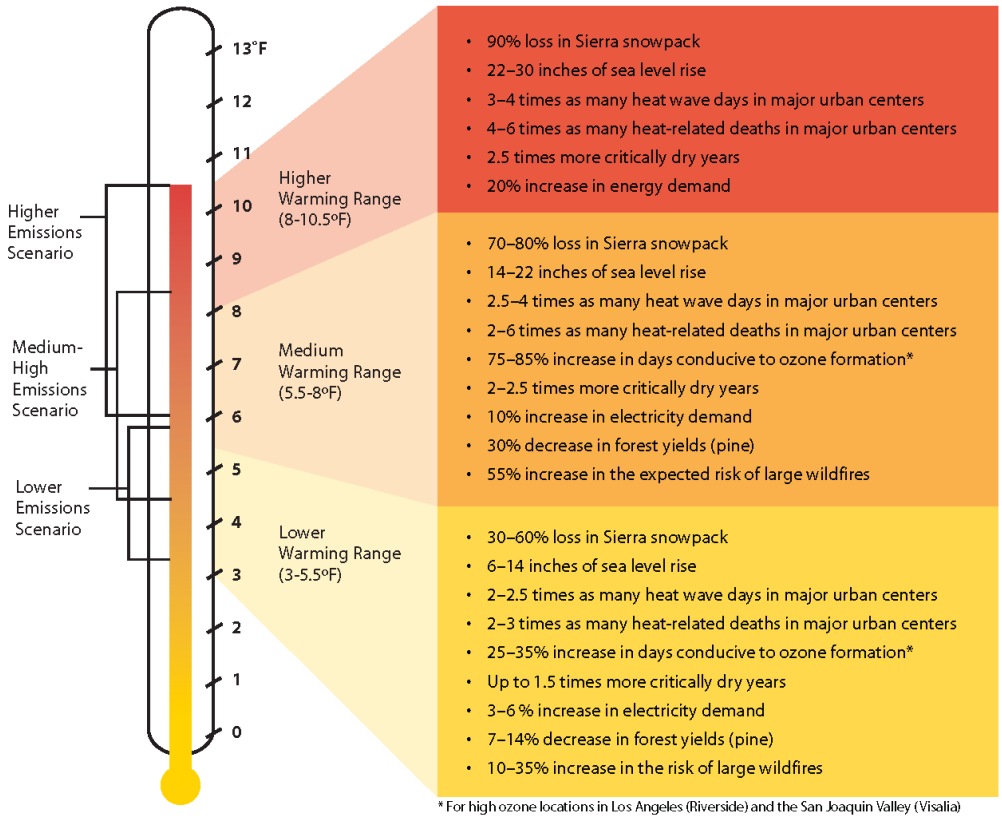
Greenhouse Gases	Description	Sources	Health Effects
		used in potato chip bags to keep chips fresh. It is used in rocket engines and in race cars. N_2O can be transported into the stratosphere, be deposited on the earth's surface, and be converted to other compounds by chemical reaction (17).	
Chlorofluorocarbons (CFCs)	CFCs are gases formed synthetically by replacing all hydrogen atoms in CH_4 or ethane (C_2H_6) with chlorine and/or fluorine atoms. CFCs are nontoxic, nonflammable, insoluble and chemically unreactive in the troposphere (the level of air at the earth's surface).	CFCs have no natural source but were first synthesized in 1928. They were used for refrigerants, aerosol propellants and cleaning solvents. Due to the discovery that they are able to destroy stratospheric ozone, a global effort to halt their production was undertaken and was extremely successful, so much so that levels of the major CFCs are now remaining steady or declining. However, their long atmospheric lifetimes mean that some of the CFCs will remain in the atmosphere for over 100 years (18).	In confined indoor locations, working with CFC-113 or other CFCs is thought to result in death by cardiac arrhythmia (heart frequency too high or too low) or asphyxiation.

Greenhouse Gases	Description	Sources	Health Effects
HFCs	HFCs are synthetic, man-made chemicals that are used as a substitute for CFCs. Out of all the GHGs, they are one of three groups with the highest global warming potential (GWP). The HFCs with the largest measured atmospheric abundances are (in order), fluoroform (CHF_3), 1,1,1,2-tetrafluoroethane (CH_2FCF), and 1,1-difluoroethane (CH_3CF_2). Prior to 1990, the only significant emissions were of CHF_3. CH_2FCF emissions are increasing due to its use as a refrigerant.	HFCs are manmade for applications such as automobile air conditioners and refrigerants.	No health effects are known to result from exposure to HFCs.
PFCs	PFCs have stable molecular structures and do not break down through chemical processes in the lower atmosphere. High-energy ultraviolet rays, which occur about 60 kilometers above earth's surface, are able to destroy the compounds. Because of this, PFCs have very long lifetimes, between 10,000 and 50,000 years. Two common PFCs are tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6). The EPA estimates that concentrations of CF_4 in the atmosphere are over 70 parts per trillion (ppt).	The two main sources of PFCs are primary aluminum production and semiconductor manufacture.	No health effects are known to result from exposure to PFCs.
SF_6	SF_6 is an inorganic, odorless, colorless, nontoxic, nonflammable gas. It also has the highest GWP of any gas evaluated (23,900) (19). The EPA indicates that concentrations in the 1990s were about 4 ppt.	SF_6 is used for insulation in electric power transmission and distribution equipment, in the magnesium industry, in semiconductor manufacturing, and as a tracer gas for leak detection.	In high concentrations in confined areas, the gas presents the hazard of suffocation because it displaces the oxygen needed for breathing.

Greenhouse Gases	Description	Sources	Health Effects
Nitrogen Trifluoride (NF_3)	NF_3 is a colorless gas with a distinctly moldy odor. The World Resources Institute (WRI) indicates that NF_3 has a 100-year GWP of 17,200 (20).	NF_3 is used in industrial processes and is produced in the manufacturing of semiconductors, Liquid Crystal Display (LCD) panels, types of solar panels, and chemical lasers.	Long-term or repeated exposure may affect the liver and kidneys and may cause fluorosis (21).

The potential health effects related directly to the emissions of CO_2, CH_4, and N_2O as they relate to development projects such as the proposed Project are still being debated in the scientific community. Their cumulative effects to GCC have the potential to cause adverse effects to human health. Increases in Earth's ambient temperatures would result in more intense heat waves, causing more heat-related deaths. Scientists also purport that higher ambient temperatures would increase disease survival rates and result in more widespread disease. Climate change will likely cause shifts in weather patterns, potentially resulting in devastating droughts and food shortages in some areas (22). Exhibit 2-A presents the potential impacts of global warming (23).

EXHIBIT 2-A: SUMMARY OF PROJECTED GLOBAL WARMING IMPACT, 2070-2099 (AS COMPARED WITH 1961-1990)



Source: Barbara H. Allen-Diaz. "Climate change affects us all." *University of California, Agriculture and Natural Resources*, 2009.

2.4 GLOBAL WARMING POTENTIAL

GHGs have varying GWP values. GWP of a GHG indicates the amount of warming a gas cause over a given period of time and represents the potential of a gas to trap heat in the atmosphere. CO_2 is utilized as the reference gas for GWP, and thus has a GWP of 1. CO_2 equivalent (CO_2e) is a term used for describing the difference GHGs in a common unit. CO_2e signifies the amount of CO_2 which would have the equivalent GWP.

The atmospheric lifetime and GWP of selected GHGs are summarized at Table 2-2. As shown in the table below, GWP for the 6th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC)'s scientific and socio-economic assessment on climate change, range from 1 for CO_2 to 25,200 for SF_6 (24).

TABLE 2-2: GWP AND ATMOSPHERIC LIFETIME OF SELECT GHGS

Gas	Atmospheric Lifetime (years)	GWP (100-year time horizon)
		6th Assessment Report
CO_2	Multiple	1
CH_4	12 .4	28
N_2O	121	273
HFC-23	222	14,600
HFC-134a	13.4	1,526
HFC-152a	1.5	164
SF_6	3,200	25,200

Source: IPCC Second Assessment Report, 1995 and IPCC Sixth Assessment Report, 2022

2.5 GREENHOUSE GAS EMISSIONS INVENTORIES

2.5.1 GLOBAL

Worldwide anthropogenic GHG emissions are tracked by the IPCC for industrialized nations (referred to as Annex I) and developing nations (referred to as Non-Annex I). Human GHG emissions data for Annex I nations are available through 2020. Based on the latest available data, the sum of these emissions totaled approximately 28,026,643 gigagram (Gg) CO_2e[1] (25) (26) as summarized on Table 2-3.

[1] The global emissions are the sum of Annex I and non-Annex I countries, without counting Land-Use, Land-Use Change and Forestry (LULUCF). For countries without 2020 data, the United Nations' Framework Convention on Climate Change (UNFCCC) data for the most recent year were used U.N. Framework Convention on Climate Change, "Annex I Parties – GHG total without LULUCF," The most recent GHG emissions for China and India are from 2014 and 2016, respectively.

2.5.2 UNITED STATES

As noted in Table 2-3, the United States, as a single country, was the number two producer of GHG emissions in 2020.

TABLE 2-3: TOP GHG PRODUCING COUNTRIES AND THE EUROPEAN UNION [2]

Emitting Countries	GHG Emissions (Gg CO_2e)
China	12,300,200
United States	5,981,354
European Union (27-member countries)	3,706,110
India	2,839,420
Russian Federation	2,051,437
Japan	1,148,122
Total	**28,026,643**

2.5.3 STATE OF CALIFORNIA

California has significantly slowed the rate of growth of GHG emissions due to the implementation of energy efficiency programs as well as adoption of strict emission controls but is still a substantial contributor to the United States (U.S.) emissions inventory total (27). The California Air Resource Board (CARB) compiles GHG inventories for the State of California. Based upon the 2022 GHG inventory data (i.e., the latest year for which data are available) for the 2000-2020 GHG emissions period, California emitted an average 369.2 million metric tons of CO_2e per year ($MMTCO_2e/yr$) or 369,200 Gg CO_2e (6.17% of the total United States GHG emissions) (28).

2.6 EFFECTS OF CLIMATE CHANGE IN CALIFORNIA

2.6.1 PUBLIC HEALTH

Higher temperatures may increase the frequency, duration, and intensity of conditions conducive to air pollution formation. For example, days with weather conducive to ozone formation could increase from 25 to 35% under the lower warming range to 75 to 85% under the medium warming range. In addition, if global background ozone levels increase as predicted in some scenarios, it may become impossible to meet local air quality standards. Air quality could be further compromised by increases in wildfires, which emit fine particulate matter that can travel long distances, depending on wind conditions. Based on *Our Changing Climate Assessing the Risks to California by the California Climate Change Center*, large wildfires could become up to 55% more frequent if GHG emissions are not significantly reduced (29).

In addition, under the higher warming range scenario, there could be up to 100 more days per year with temperatures above 90°F in Los Angeles and 95°F in Sacramento by 2100. This is a large increase over historical patterns and approximately twice the increase projected if temperatures

[2] Used http://unfccc.int data for Annex I countries. Consulted the CAIT Climate Data Explorer in https://www.climatewatchdata.org site to reference Non-Annex I countries of China and India.

rempain within or below the lower warming range. Rising temperatures could increase the risk of death from dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

2.6.2 WATER RESOURCES

A vast network of man-made reservoirs and aqueducts captures and transports water throughout the state from northern California rivers and the Colorado River. The current distribution system relies on Sierra Nevada snowpack to supply water during the dry spring and summer months. Rising temperatures, potentially compounded by decreases in precipitation, could severely reduce spring snowpack, increasing the risk of summer water shortages.

If temperatures continue to increase, more precipitation could fall as rain instead of snow, and the snow that does fall could melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90%. Under the lower warming range scenario, snowpack losses could be only half as large as those possible if temperatures were to rise to the higher warming range. How much snowpack could be lost depends in part on future precipitation patterns, the projections for which remain uncertain. However, even under the wetter climate projections, the loss of snowpack could pose challenges to water managers and hamper hydropower generation. It could also adversely affect winter tourism. Under the lower warming range, the ski season at lower elevations could be reduced by as much as a month. If temperatures reach the higher warming range and precipitation declines, there might be many years with insufficient snow for skiing and snowboarding.

The State's water supplies are also at risk from rising sea levels. An influx of saltwater could degrade California's estuaries, wetlands, and groundwater aquifers. Saltwater intrusion caused by rising sea levels is a major threat to the quality and reliability of water within the southern edge of the Sacramento/San Joaquin River Delta – a major fresh water supply.

2.6.3 AGRICULTURE

Increased temperatures could cause widespread changes to the agriculture industry reducing the quantity and quality of agricultural products statewide. First, California farmers could possibly lose as much as 25% of the water supply needed. Although higher CO_2 levels can stimulate plant production and increase plant water-use efficiency, California's farmers could face greater water demand for crops and a less reliable water supply as temperatures rise. Crop growth and development could change, as could the intensity and frequency of pest and disease outbreaks. Rising temperatures could aggravate ozone pollution, which makes plants more susceptible to disease and pests and interferes with plant growth.

Plant growth tends to be slow at low temperatures, increasing with rising temperatures up to a threshold. However, faster growth can result in less-than-optimal development for many crops, so rising temperatures could worsen the quantity and quality of yield for a number of California's agricultural products. Products likely to be most affected include wine grapes, fruits and nuts.

In addition, continued GCC could shift the ranges of existing invasive plants and weeds and alter competition patterns with native plants. Range expansion could occur in many species while

range contractions may be less likely in rapidly evolving species with significant populations already established. Should range contractions occur, new or different weed species could fill the emerging gaps. Continued GCC could alter the abundance and types of many pests, lengthen pests' breeding season, and increase pathogen growth rates.

2.6.4 FORESTS AND LANDSCAPES

GCC has the potential to intensify the current threat to forests and landscapes by increasing the risk of wildfire and altering the distribution and character of natural vegetation. If temperatures rise into the medium warming range, the risk of large wildfires in California could increase by as much as 55%, which is almost twice the increase expected if temperatures stay in the lower warming range. However, since wildfire risk is determined by a combination of factors, including precipitation, winds, temperature, and landscape and vegetation conditions, future risks will not be uniform throughout the state. In contrast, wildfires in northern California could increase by up to 90% due to decreased precipitation.

Moreover, continued GCC has the potential to alter natural ecosystems and biological diversity within the state. For example, alpine and subalpine ecosystems could decline by as much as 60 to 80% by the end of the century as a result of increasing temperatures. The productivity of the state's forests has the potential to decrease as a result of GCC.

2.6.5 RISING SEA LEVELS

Rising sea levels, more intense coastal storms, and warmer water temperatures could increasingly threaten the state's coastal regions. Under the higher warming range scenario, sea level is anticipated to rise 22 to 35 inches by 2100. Elevations of this magnitude would inundate low-lying coastal areas with saltwater, accelerate coastal erosion, threaten vital levees and inland water systems, and disrupt wetlands and natural habitats. Under the lower warming range scenario, sea level could rise 12-14 inches.

2.7 REGULATORY SETTING

2.7.1 INTERNATIONAL

Climate change is a global issue involving GHG emissions from all around the world; therefore, countries such as the ones discussed below have made an effort to reduce GHGs.

IPCC

In 1988, the United Nations (U.N.) and the World Meteorological Organization established the IPCC to assess the scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation.

UNITED NATION'S FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

On March 21, 1994, the U.S. joined a number of countries around the world in signing the Convention. Under the Convention, governments gather and share information on GHG

emissions, national policies, and best practices; launch national strategies for addressing GHG emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of climate change.

INTERNATIONAL CLIMATE CHANGE TREATIES

The Kyoto Protocol is an international agreement linked to the Convention. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing GHG emissions at an average of 5% against 1990 levels over the five-year period 2008–2012. The Convention (as discussed above) encouraged industrialized countries to stabilize emissions; however, the Protocol commits them to do so. Developed countries have contributed more emissions over the last 150 years; therefore, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

In 2001, President George W. Bush indicated that he would not submit the treaty to the U.S. Senate for ratification, which effectively ended American involvement in the Kyoto Protocol. In December 2009, international leaders met in Copenhagen to address the future of international climate change commitments post-Kyoto. No binding agreement was reached in Copenhagen; however, the Committee identified the long-term goal of limiting the maximum global average temperature increase to no more than 2 degrees Celsius (°C) above pre-industrial levels, subject to a review in 2015. The UN Climate Change Committee held additional meetings in Durban, South Africa in November 2011; Doha, Qatar in November 2012; and Warsaw, Poland in November 2013. The meetings are gradually gaining consensus among participants on individual climate change issues.

On September 23, 2014 more than 100 Heads of State and Government and leaders from the private sector and civil society met at the Climate Summit in New York hosted by the U.N. At the Summit, heads of government, business and civil society announced actions in areas that would have the greatest impact on reducing emissions, including climate finance, energy, transport, industry, agriculture, cities, forests, and building resilience.

Parties to the U.N. Framework Convention on Climate Change (UNFCCC) reached a landmark agreement on December 12, 2015 in Paris, charting a fundamentally new course in the two-decade-old global climate effort. Culminating a four-year negotiating round, the new treaty ends the strict differentiation between developed and developing countries that characterized earlier efforts, replacing it with a common framework that commits all countries to put forward their best efforts and to strengthen them in the years ahead. This includes, for the first time, requirements that all parties report regularly on their emissions and implementation efforts and undergo international review.

The agreement and a companion decision by parties were the key outcomes of the conference, known as the 21st session of the UNFCCC Conference of the Parties (COP) 21. Together, the Paris Agreement and the accompanying COP decision:

- Reaffirm the goal of limiting global temperature increase well below 2°C, while urging efforts to limit the increase to 1.5 degrees;
- Establish binding commitments by all parties to make "nationally determined contributions" (NDCs), and to pursue domestic measures aimed at achieving them;
- Commit all countries to report regularly on their emissions and "progress made in implementing and achieving" their NDCs, and to undergo international review;
- Commit all countries to submit new NDCs every five years, with the clear expectation that they will "represent a progression" beyond previous ones;
- Reaffirm the binding obligations of developed countries under the UNFCCC to support the efforts of developing countries, while for the first time encouraging voluntary contributions by developing countries too;
- Extend the current goal of mobilizing $100 billion a year in support by 2020 through 2025, with a new, higher goal to be set for the period after 2025;
- Extend a mechanism to address "loss and damage" resulting from climate change, which explicitly will not "involve or provide a basis for any liability or compensation;"
- Require parties engaging in international emissions trading to avoid "double counting;" and
- Call for a new mechanism, similar to the Clean Development Mechanism under the Kyoto Protocol, enabling emission reductions in one country to be counted toward another country's NDC (C2ES 2015a) (30).

Following President Biden's day one executive order, the United States officially rejoined the landmark Paris Agreement on February 19, 2021, positioning the country to once again be part of the global climate solution. Meanwhile, city, state, business, and civic leaders across the country and around the world have been ramping up efforts to drive the clean energy advances needed to meet the goals of the agreement and put the brakes on dangerous climate change.

2.7.2 NATIONAL

Prior to the last decade, there have been no concrete federal regulations of GHGs or major planning for climate change adaptation. The following are actions regarding the federal government, GHGs, and fuel efficiency.

GHG ENDANGERMENT

In *Massachusetts v. Environmental Protection Agency* 549 U.S. 497 (2007), decided on April 2, 2007, the United States Supreme Court (U.S. Court) found that four GHGs, including CO_2, are air pollutants subject to regulation under Section 202(a)(1) of the Clean Air Act (CAA). The Court held that the EPA Administrator must determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. On December 7, 2009, the EPA Administrator signed two distinct findings regarding GHGs under section 202(a) of the CAA:

- Endangerment Finding: The Administrator finds that the current and projected concentrations of the six key well-mixed GHGs— CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations.
- Cause or Contribute Finding: The Administrator finds that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution, which threatens public health and welfare.

These findings do not impose requirements on industry or other entities. However, this was a prerequisite for implementing GHG emissions standards for vehicles, as discussed in the section "Clean Vehicles" below. After a lengthy legal challenge, the U.S. Court declined to review an Appeals Court ruling that upheld the EPA Administrator's findings (31).

CLEAN VEHICLES

Congress first passed the Corporate Average Fuel Economy law in 1975 to increase the fuel economy of cars and light duty trucks. The law has become more stringent over time. On May 19, 2009, President Obama put in motion a new national policy to increase fuel economy for all new cars and trucks sold in the U.S. On April 1, 2010, the EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced a joint final rule establishing a national program that would reduce GHG emissions and improve fuel economy for new cars and trucks sold in the U.S.

The first phase of the national program applies to passenger cars, light-duty trucks, and medium-duty (MD) passenger vehicles, covering model years 2012 through 2016. They require these vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile, equivalent to 35.5 miles per gallon (mpg) if the automobile industry were to meet this CO_2 level solely through fuel economy improvements. Together, these standards would cut CO_2 emissions by an estimated 960 million metric tons and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program (model years 2012–2016). The EPA and the NHTSA issued final rules on a second-phase joint rulemaking establishing national standards for light-duty vehicles for model years 2017 through 2025 in August 2012. The new standards for model years 2017 through 2025 apply to passenger cars, light-duty trucks, and MD passenger vehicles. The final standards are projected to result in an average industry fleetwide level of 163 grams/mile of CO_2 in model year 2025, which is equivalent to 54.5 mpg if achieved exclusively through fuel economy improvements.

The EPA and the U.S. Department of Transportation issued final rules for the first national standards to reduce GHG emissions and improve fuel efficiency of heavy-duty trucks (HDT) and buses on September 15, 2011, effective November 14, 2011. For combination tractors, the agencies are proposing engine and vehicle standards that begin in the 2014 model year and achieve up to a 20% reduction in CO_2 emissions and fuel consumption by the 2018 model year. For HDT and vans, the agencies are proposing separate gasoline and diesel truck standards, which phase in starting in the 2014 model year and achieve up to a 10% reduction for gasoline vehicles and a 15% reduction for diesel vehicles by the 2018 model year (12 and 17% respectively if accounting for air conditioning leakage). Lastly, for vocational vehicles, the engine and vehicle

standards would achieve up to a 10% reduction in fuel consumption and CO_2 emissions from the 2014 to 2018 model years.

On April 2, 2018, the EPA signed the Mid-term Evaluation Final Determination, which declared that the MY 2022-2025 GHG standards are not appropriate and should be revised (32). This Final Determination serves to initiate a notice to further consider appropriate standards for MY 2022-2025 light-duty vehicles. On August 2, 2018, the NHTSA in conjunction with the EPA, released a notice of proposed rulemaking, the *Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks* (SAFE Vehicles Rule). The SAFE Vehicles Rule was proposed to amend existing Corporate Average Fuel Economy (CAFE) and tailpipe CO_2 standards for passenger cars and light trucks and to establish new standards covering model years 2021 through 2026. As of March 31, 2020, the NHTSA and EPA finalized the SAFE Vehicle Rule which increased stringency of CAFE and CO_2 emissions standards by 1.5% each year through model year 2026 (33). On December 21, 2021, after reviewing all the public comments submitted on NHTSA's April 2021 Notice of Proposed Rulemaking, NHTSA finalizes the CAFE Preemption rulemaking to withdraw its portions of the so-called SAFE I Rule. The final rule concludes that the SAFE I Rule overstepped the agency's legal authority and established overly broad prohibitions that did not account for a variety of important state and local interests. The final rule ensures that the SAFE I Rule will no longer form an improper barrier to states exploring creative solutions to address their local communities' environmental and public health challenges (34).

On March 31, 2022, NHTSA finalized CAFE standards for MY 2024-2026. The standards for passenger cars and light trucks for MYs 2024-2025 were increased at a rate of 8% per year and then increased at a rate of 10% per year for MY 2026 vehicles. NHTSA currently projects that the revised standards would require an industry fleet-wide average of roughly 49 mpg in MY 2026 and would reduce average fuel outlays over the lifetimes of affected vehicles that provide consumers hundreds of dollars in net savings. These standards are directly responsive to the agency's statutory mandate to improve energy conservation and reduce the nation's energy dependence on foreign sources (35).

MANDATORY REPORTING OF GHGS

The Consolidated Appropriations Act of 2008, passed in December 2007, requires the establishment of mandatory GHG reporting requirements. On September 22, 2009, the EPA issued the Final Mandatory Reporting of GHGs Rule, which became effective January 1, 2010. The rule requires reporting of GHG emissions from large sources and suppliers in the U.S. and is intended to collect accurate and timely emissions data to inform future policy decisions. Under the rule, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons per year (MT/yr) or more of GHG emissions are required to submit annual reports to the EPA.

NEW SOURCE REVIEW

The EPA issued a final rule on May 13, 2010, that establishes thresholds for GHGs that define when permits under the New Source Review Prevention of Significant Deterioration and Title V Operating Permit programs are required for new and existing industrial facilities. This final rule

"tailors" the requirements of these CAA permitting programs to limit which facilities will be required to obtain Prevention of Significant Deterioration and Title V permits. In the preamble to the revisions to the Federal Code of Regulations, the EPA states:

> *"This rulemaking is necessary because without it the Prevention of Significant Deterioration and Title V requirements would apply, as of January 2, 2011, at the 100 or 250 tons per year levels provided under the CAA, greatly increasing the number of required permits, imposing undue costs on small sources, overwhelming the resources of permitting authorities, and severely impairing the functioning of the programs. EPA is relieving these resource burdens by phasing in the applicability of these programs to GHG sources, starting with the largest GHG emitters. This rule establishes two initial steps of the phase-in. The rule also commits the agency to take certain actions on future steps addressing smaller sources but excludes certain smaller sources from Prevention of Significant Deterioration and Title V permitting for GHG emissions until at least April 30, 2016."*

The EPA estimates that facilities responsible for nearly 70% of the national GHG emissions from stationary sources will be subject to permitting requirements under this rule. This includes the nation's largest GHG emitters—power plants, refineries, and cement production facilities.

STANDARDS OF PERFORMANCE FOR GHG EMISSIONS FOR NEW STATIONARY SOURCES: ELECTRIC UTILITY GENERATING UNITS

As required by a settlement agreement, the EPA proposed new performance standards for emissions of CO_2 for new, affected, fossil fuel-fired electric utility generating units on March 27, 2012. New sources greater than 25 megawatts (MW) would be required to meet an output-based standard of 1,000 pounds (lbs) of CO_2 per MW-hour (MWh), based on the performance of widely used natural gas combined cycle technology. It should be noted that on February 9, 2016, the Supreme Court issued a stay of this regulation pending litigation. Additionally, the current EPA Administrator has also signed a measure to repeal the Clean Power Plan, including the CO_2 standards. The Clean Power Plan was officially repealed on June 19, 2019, when the EPA issued the final Affordable Clean Energy rule (ACE). Under ACE, new state-specific emission guidelines were established that provided existing coal-fired electric utility generating units with achievable standards.

On January 19, 2021, the D.C. Circuit Court of Appeals ruled that the EPA's ACE Rule for GHG emissions from power plants rested on an erroneous interpretation of the CAA that barred EPA from considering measures beyond those that apply at and to an individual source. The court therefore vacated and remanded the ACE Rule and adopted a replacement rule which regulates CO_2 emissions from existing power plants, potentially again considering generation shifting and other measures to more aggressively target power sector emissions.

CAP-AND-TRADE

Cap-and-trade refers to a policy tool where emissions are limited to a certain amount and can be traded or provides flexibility on how the emitter can comply. Successful examples in the U.S.

include the Acid Rain Program and the N_2O Budget Trading Program and Clean Air Interstate Rule in the northeast. There is no federal GHG cap-and-trade program currently; however, some states have joined to create initiatives to provide a mechanism for cap-and-trade.

The Regional GHG Initiative is an effort to reduce GHGs among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. Each state caps CO_2 emissions from power plants, auctions CO_2 emission allowances, and invests the proceeds in strategic energy programs that further reduce emissions, save consumers money, create jobs, and build a clean energy economy. The Initiative began in 2008 and in 2020 has retained all participating states.

The Western Climate Initiative (WCI) partner jurisdictions have developed a comprehensive initiative to reduce regional GHG emissions to 15% below 2005 levels by 2020. The partners were originally California, British Columbia, Manitoba, Ontario, and Quebec. However, Manitoba and Ontario are not currently participating. California linked with Quebec's cap-and-trade system January 1, 2014, and joint offset auctions took place in 2015. While the WCI has yet to publish whether it has successfully reached the 2020 emissions goal initiative set in 2007, SB 32, requires that California, a major partner in the WCI, adopt the goal of reducing statewide GHG emissions to 40% below the 1990 level by 2030.

SMARTWAY PROGRAM

The SmartWay Program is a public-private initiative between the EPA, large and small trucking companies, rail carriers, logistics companies, commercial manufacturers, retailers, and other federal and state agencies. Its purpose is to improve fuel efficiency and the environmental performance (reduction of both GHG emissions and air pollution) of the goods movement supply chains. SmartWay is comprised of four components (36):

1. SmartWay Transport Partnership: A partnership in which freight carriers and shippers commit to benchmark operations, track fuel consumption, and improve performance annually.
2. SmartWay Technology Program: A testing, verification, and designation program to help freight companies identify equipment, technologies, and strategies that save fuel and lower emissions.
3. SmartWay Vehicles: A program that ranks light-duty cars and small trucks and identifies superior environmental performers with the SmartWay logo.
4. SmartWay International Interests: Guidance and resources for countries seeking to develop freight sustainability programs modeled after SmartWay.

SmartWay effectively refers to requirements geared towards reducing fuel consumption. Most large trucking fleets driving newer vehicles are compliant with SmartWay design requirements. Moreover, over time, all HDTs will have to comply with the CARB GHG Regulation that is designed with the SmartWay Program in mind, to reduce GHG emissions by making them more fuel-efficient. For instance, in 2015, 53 foot or longer dry vans or refrigerated trailers equipped with a combination of SmartWay-verified low-rolling resistance tires and SmartWay-verified aerodynamic devices would obtain a total of 10% or more fuel savings over traditional trailers.

Through the SmartWay Technology Program, the EPA has evaluated the fuel saving benefits of various devices through grants, cooperative agreements, emissions and fuel economy testing, demonstration projects and technical literature review. As a result, the EPA has determined the following types of technologies provide fuel saving and/or emission reducing benefits when used properly in their designed applications, and has verified certain products:

- Idle reduction technologies – less idling of the engine when it is not needed would reduce fuel consumption.
- Aerodynamic technologies minimize drag and improve airflow over the entire tractor-trailer vehicle. Aerodynamic technologies include gap fairings that reduce turbulence between the tractor and trailer, side skirts that minimize wind under the trailer, and rear fairings that reduce turbulence and pressure drop at the rear of the trailer.
- Low rolling resistance tires can roll longer without slowing down, thereby reducing the amount of fuel used. Rolling resistance (or rolling friction or rolling drag) is the force resisting the motion when a tire rolls on a surface. The wheel will eventually slow down because of this resistance.
- Retrofit technologies include things such as diesel particulate filters, emissions upgrades (to a higher tier), etc., which would reduce emissions.
- Federal excise tax exemptions.

EXECUTIVE ORDER 13990

On January 20, 2021, Federal agencies were directed to immediately review, and take action to address, Federal regulations promulgated and other actions taken during the last 4 years that conflict with national objectives to improve public health and the environment; ensure access to clean air and water; limit exposure to dangerous chemicals and pesticides; hold polluters accountable, including those who disproportionately harm communities of color and low-income communities; reduce GHG emissions; bolster resilience to the impacts of climate change; restore and expand our national treasures and monuments; and prioritize both environmental justice and employment.

2.7.3 CALIFORNIA

LEGISLATIVE ACTIONS TO REDUCE GHGS

The State of California legislature has enacted a series of bills that constitute the most aggressive program to reduce GHGs of any state in the nation. Some legislation such as the landmark AB 32 was specifically enacted to address GHG emissions. Other legislation such as Title 24 and Title 20 energy standards were originally adopted for other purposes such as energy and water conservation, but also provide GHG reductions. This section describes the major provisions of the legislation.

AB 32

The California State Legislature enacted AB 32, which required that GHGs emitted in California be reduced to 1990 levels by the year 2020 (this goal has been met[3]). GHGs as defined under AB 32 include CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6. Since AB 32 was enacted, a seventh chemical, NF_3, has also been added to the list of GHGs. CARB is the state agency charged with monitoring and regulating sources of GHGs. Pursuant to AB 32, CARB adopted regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. AB 32 states the following:

> *"Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems."*

SB 32

On September 8, 2016, Governor Jerry Brown signed the SB 32 and its companion bill, AB 197. SB 32 requires the state to reduce statewide GHG emissions to 40% below 1990 levels by 2030, a reduction target that was first introduced in Executive Order B-30-15. The new legislation builds upon the AB 32 goal and provides an intermediate goal to achieving S-3-05, which sets a statewide GHG reduction target of 80% below 1990 levels by 2050. AB 197 creates a legislative committee to oversee regulators to ensure that CARB not only responds to the Governor, but also the Legislature (11).

2017 CARB SCOPING PLAN

In November 2017, CARB released the *Final 2017 Scoping Plan Update*, which identifies the State's post-2020 reduction strategy. The *Final 2017 Scoping Plan Update* reflects the 2030 target of a 40% reduction below 1990 levels, set by Executive Order B-30-15 and codified by SB 32. Key programs that the proposed Second Update builds upon include the Cap-and-Trade Regulation, the LCFS, and much cleaner cars, trucks and freight movement, utilizing cleaner, renewable energy, and strategies to reduce CH_4 emissions from agricultural and other wastes.

The *Final 2017 Scoping Plan Update* establishes a new emissions limit of 260 $MMTCO_2e$ for the year 2030, which corresponds to a 40% decrease in 1990 levels by 2030 (37).

California's climate strategy will require contributions from all sectors of the economy, including the land base, and will include enhanced focus on zero- and near-zero-emission (ZE/NZE) vehicle technologies; continued investment in renewables, including solar roofs, wind, and other

[3] Based upon the 2019 GHG inventory data (i.e., the latest year for which data are available) for the 2000-2017 GHG emissions period, California emitted an average 424.1 $MMTCO_2e$ **Invalid source specified.**. This is less than the 2020 emissions target of 431 $MMTCO_2e$.

distributed generation; greater use of low carbon fuels; integrated land conservation and development strategies; coordinated efforts to reduce emissions of short-lived climate pollutants (CH_4, black carbon, and fluorinated gases); and an increased focus on integrated land use planning to support livable, transit-connected communities and conservation of agricultural and other lands. Requirements for direct GHG reductions at refineries will further support air quality co-benefits in neighborhoods, including in disadvantaged communities historically located adjacent to these large stationary sources, as well as efforts with California's local air pollution control and air quality management districts (air districts) to tighten emission limits on a broad spectrum of industrial sources. Major elements of the *Final 2017 Scoping Plan Update* framework include:

- Implementing and/or increasing the standards of the Mobile Source Strategy, which include increasing ZEV buses and trucks.
- LCFS, with an increased stringency (18% by 2030).
- Implementing SB 350, which expands the RPS to 50% RPS and doubles energy efficiency savings by 2030.
- California Sustainable Freight Action Plan, which improves freight system efficiency, utilizes near-zero emissions technology, and deployment of zero-emission vehicles (ZEV) trucks.
- Implementing the proposed Short-Lived Climate Pollutant Strategy (SLPS), which focuses on reducing CH_4 and hydroflurocarbon emissions by 40% and anthropogenic black carbon emissions by 50% by year 2030.
- Continued implementation of SB 375.
- Post-2020 Cap-and-Trade Program that includes declining caps.
- 20% reduction in GHG emissions from refineries by 2030.
- Development of a Natural and Working Lands Action Plan to secure California's land base as a net carbon sink.

Note, however, that the *Final 2017 Scoping Plan Update* acknowledges that:

> *"[a]chieving net zero increases in GHG emissions, resulting in no contribution to GHG impacts, may not be feasible or appropriate for every project, however, and the inability of a project to mitigate its GHG emissions to net zero does not imply the project results in a substantial contribution to the cumulatively significant environmental impact of climate change under CEQA."*

In addition to the statewide strategies listed above, the *Final 2017 Scoping Plan Update* also identifies local governments as essential partners in achieving the State's long-term GHG reduction goals and identifies local actions to reduce GHG emissions. As part of the recommended actions, CARB recommends that local governments achieve a community-wide goal to achieve emissions of no more than 6 metric tons of CO_2e ($MTCO_2e$) or less per capita by 2030 and 2 $MTCO_2e$ or less per capita by 2050. For CEQA projects, CARB states that lead agencies may develop evidenced-based bright-line numeric thresholds—consistent with the Scoping Plan and the State's long-term GHG goals—and projects with emissions over that amount may be required to incorporate on-site design features and mitigation measures that avoid or minimize

project emissions to the degree feasible; or, a performance-based metric using a CAP or other plan to reduce GHG emissions is appropriate.

According to research conducted by the Lawrence Berkeley National Laboratory (LBNL) and supported by CARB, California, under its existing and proposed GHG reduction policies, could achieve the 2030 goals under SB 32. The research utilized a new, validated model known as the California LBNL GHG Analysis of Policies Spreadsheet (CALGAPS), which simulates GHG and criteria pollutant emissions in California from 2010 to 2050 in accordance to existing and future GHG-reducing policies. The CALGAPS model showed that by 2030, emissions could range from 211 to 428 $MTCO_2e$ per year ($MTCO_2e$/yr), indicating that "even if all modeled policies are not implemented, reductions could be sufficient to reduce emissions 40% below the 1990 level [of SB 32]." CALGAPS analyzed emissions through 2050 even though it did not generally account for policies that might be put in place after 2030. Although the research indicated that the emissions would not meet the State's 80% reduction goal by 2050, various combinations of policies could allow California's cumulative emissions to remain very low through 2050 (38) (39).

2022 CARB SCOPING PLAN

On December 15, 2022, CARB adopted the 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan) (40). The 2022 Scoping Plan builds on the 2017 Scoping Plan as well as the requirements set forth by AB 1279, which directs the state to become carbon neutral no later than 2045. To achieve this statutory objective, the 2022 Scoping Plan lays out how California can reduce GHG emissions by 85% below 1990 levels and achieve carbon neutrality by 2045. The Scoping Plan scenario to do this is to "deploy a broad portfolio of existing and emerging fossil fuel alternatives and clean technologies, and align with statutes, Executive Orders, Board direction, and direction from the governor." The 2022 Scoping Plan sets one of the most aggressive approaches to reach carbon neutrality in the world. Unlike the 2017 Scoping Plan, CARB no longer includes a numeric per capita threshold and instead advocates for compliance with a local GHG reduction strategy (CAP) consistent with CEQA Guidelines section 15183.5.

The key elements of the 2022 CARB Scoping Plan focus on transportation - the regulations that will impact this sector are adopted and enforced by CARB on vehicle manufacturers and outside the jurisdiction and control of local governments. As stated in the Plan's executive summary:

> "The major element of this unprecedented transformation is the aggressive reduction of fossil fuels wherever they are currently used in California, building on and accelerating carbon reduction programs that have been in place for a decade and a half. That means rapidly moving to zero-emission transportation; electrifying the cars, buses, trains, and trucks that now constitute California's single largest source of planet-warming pollution."
>
> "[A]pproval of this plan catalyzes a number of efforts, including the development of new regulations as well as amendments to strengthen regulations and programs already in place, not just at CARB but across state agencies."

Under the 2022 Scoping Plan, the State will lead efforts to meet the 2045 carbon neutrality goal through implementation of the following objectives:

- Reimagine roadway projects that increase VMT in a way that meets community needs and reduces the need to drive.
- Double local transit capacity and service frequencies by 2030.
- Complete the High-Speed Rail (HSR) System and other elements of the intercity rail network by 2040.
- Expand and complete planned networks of high-quality active transportation infrastructure.
- Increase availability and affordability of bikes, e-bikes, scooters, and other alternatives to light-duty vehicles, prioritizing needs of underserved communities.
- Shift revenue generation for transportation projects away from the gas tax into more durable sources by 2030.
- Authorize and implement roadway pricing strategies and reallocate revenues to equitably improve transit, bicycling, and other sustainable transportation choices.
- Prioritize addressing key transit bottlenecks and other infrastructure investments to improve transit operational efficiency over investments that increase VMT.
- Develop and implement a statewide transportation demand management (TDM) framework with VMT mitigation requirements for large employers and large developments.
- Prevent uncontrolled growth of autonomous vehicle (AV) VMT, particularly zero-passenger miles.
- Channel new mobility services towards pooled use models, transit complementarity, and lower VMT outcomes.
- Establish an integrated statewide system for trip planning, booking, payment, and user accounts that enables efficient and equitable multimodal systems.
- Provide financial support for low-income and disadvantaged Californians' use of transit and new mobility services.
- Expand universal design features for new mobility services.
- Accelerate infill development in existing transportation-efficient places and deploy strategic resources to create more transportation-efficient locations.
- Encourage alignment in land use, housing, transportation, and conservation planning in adopted regional plans (RTP/SCS and RHNA) and local plans (e.g., general plans, zoning, and local transportation plans).
- Accelerate production of affordable housing in forms and locations that reduce VMT and affirmatively further fair housing policy objectives.
- Reduce or eliminate parking requirements (and/or enact parking maximums, as appropriate) and promote redevelopment of excess parking, especially in infill locations.
- Preserve and protect existing affordable housing stock and protect existing residents and businesses from displacement and climate risk.

Included in the 2022 Scoping Plan is a set of Local Actions (Appendix D to the 2022 Scoping Plan) aimed at providing local jurisdictions with tools to reduce GHGs and assist the state in meeting the ambitious targets set forth in the 2022 Scoping Plan. Appendix D to the 2022 Scoping Plan includes a section on evaluating plan-level and project-level alignment with the State's Climate Goals in CEQA GHG analyses. In this section, CARB identifies several recommendations and strategies that should be considered for new development in order to determine consistency

with the 2022 Scoping Plan. Notably, this section is focused on Residential and Mixed-Use Projects, in fact CARB states in Appendix D (page 4): "…focuses primarily on climate action plans (CAPs) and local authority over new residential development. It does not address other land use types (e.g., industrial) or air permitting."

Additionally on Page 21 in Appendix D, CARB states: "The recommendations outlined in this section apply only to residential and mixed-use development project types. California currently faces both a housing crisis and a climate crisis, which necessitates prioritizing recommendations for residential projects to address the housing crisis in a manner that simultaneously supports the State's GHG and regional air quality goals. CARB plans to continue to explore new approaches for other land use types in the future." As such, it would be inappropriate to apply the requirements contained in Appendix D of the 2022 Scoping Plan to any land use types other than residential or mixed-use residential development.

CAP-AND-TRADE PROGRAM

The Scoping Plan identifies a Cap-and-Trade Program as one of the key strategies for California to reduce GHG emissions. According to CARB, a cap-and-trade program will help put California on the path to meet its goal of achieving a 40% reduction in GHG emissions from 1990 levels by 2030. Under cap-and-trade, an overall limit on GHG emissions from capped sectors is established, and facilities subject to the cap will be able to trade permits to emit GHGs within the overall limit.

CARB adopted a California Cap-and-Trade Program pursuant to its authority under AB 32. The Cap-and-Trade Program is designed to reduce GHG emissions from regulated entities by more than 16% between 2013 and 2020, and by an additional 40% by 2030. The statewide cap for GHG emissions from the capped sectors (e.g., electricity generation, petroleum refining, and cement production) commenced in 2013 and will decline over time, achieving GHG emission reductions throughout the program's duration.

Covered entities that emit more than 25,000 $MTCO_2e$/yr must comply with the Cap-and-Trade Program. Triggering of the 25,000 $MTCO_2e$/yr "inclusion threshold" is measured against a subset of emissions reported and verified under the California Regulation for the Mandatory Reporting of GHG Emissions (Mandatory Reporting Rule or "MRR").

Under the Cap-and-Trade Program, CARB issues allowances equal to the total amount of allowable emissions over a given compliance period and distributes these to regulated entities. Covered entities are allocated free allowances in whole or part (if eligible), and may buy allowances at auction, purchase allowances from others, or purchase offset credits. Each covered entity with a compliance obligation is required to surrender "compliance instruments" for each $MTCO_2e$ of GHG they emit. There also are requirements to surrender compliance instruments covering 30% of the prior year's compliance obligation by November of each year (41).

The Cap-and-Trade Program provides a firm cap, which provides the highest certainty of achieving the 2030 target. An inherent feature of the Cap-and-Trade program is that it does not guarantee GHG emissions reductions in any discrete location or by any particular source. Rather, GHG emissions reductions are only guaranteed on an accumulative basis. As summarized by CARB in the *First Update to the Climate Change Scoping Plan*:

> *"The Cap-and-Trade Regulation gives companies the flexibility to trade allowances with others or take steps to cost-effectively reduce emissions at their own facilities. Companies that emit more have to turn in more allowances or other compliance instruments. Companies that can cut their GHG emissions have to turn in fewer allowances. But as the cap declines, aggregate emissions must be reduced. In other words, a covered entity theoretically could increase its GHG emissions every year and still comply with the Cap-and-Trade Program if there is a reduction in GHG emissions from other covered entities. Such a focus on aggregate GHG emissions is considered appropriate because climate change is a global phenomenon, and the effects of GHG emissions are considered cumulative."* (42)

The Cap-and-Trade Program covered approximately 80% of California's GHG emissions (37). The Cap-and-Trade Program covers the GHG emissions associated with electricity consumed in California, whether generated in-state or imported. Accordingly, GHG emissions associated with CEQA projects' electricity usage are covered by the Cap-and-Trade Program. The Cap-and-Trade Program also covers fuel suppliers (natural gas and propane fuel providers and transportation fuel providers) to address emissions from such fuels and from combustion of other fossil fuels not directly covered at large sources in the Program's first compliance period. The Cap-and-Trade Program covers the GHG emissions associated with the combustion of transportation fuels in California, whether refined in-state or imported.

THE SUSTAINABLE COMMUNITIES AND CLIMATE PROTECTION ACT OF 2008 (SB 375)

According to SB 375, the transportation sector is the largest contributor of GHG emissions, which emits over 40% of the total GHG emissions in California. SB 375 states, "Without improved land use and transportation policy, California will not be able to achieve the goals of AB 32." SB 375 does the following: it (1) requires metropolitan planning organizations to include sustainable community strategies in their regional transportation plans for reducing GHG emissions, (2) aligns planning for transportation and housing, and (3) creates specified incentives for the implementation of the strategies.

Concerning CEQA, SB 375, as codified in Public Resources Code Section 21159.28, states that CEQA findings for certain projects are not required to reference, describe, or discuss (1) growth inducing impacts, or (2) any project-specific or cumulative impacts from cars and light-duty truck trips generated by the project on global warming or the regional transportation network, if the project:

1. Is in an area with an approved sustainable communities strategy or an alternative planning strategy that the CARB accepts as achieving the GHG emission reduction targets.
2. Is consistent with that strategy (in designation, density, building intensity, and applicable policies).
3. Incorporates the mitigation measures required by an applicable prior environmental document.

AB 1493

The second phase of the implementation for the Pavley bill was incorporated into Amendments to the Low-Emission Vehicle Program (LEV III) or the Advanced Clean Cars (ACC) program. The ACC program combines the control of smog-causing pollutants and GHG emissions into a single

coordinated package of requirements for MY 2017 through 2025. The regulation will reduce GHGs from new cars by 34% from 2016 levels by 2025. The new rules will clean up gasoline and diesel-powered cars, and deliver increasing numbers of zero-emission technologies, such as full battery electric cars, newly emerging plug-in hybrid EV and hydrogen fuel cell cars. The package will also ensure adequate fueling infrastructure is available for the increasing numbers of hydrogen fuel cell vehicles planned for deployment in California. On March 9, EPA reinstated California's authority under the Clean Air Act to implement its own GHG emission standards for cars and light trucks, which other states can also adopt and enforce. With this authority restored, EPA will continue partnering with states to advance the next generation of clean vehicle technologies.

CLEAN ENERGY AND POLLUTION REDUCTION ACT OF 2015 (SB 350)

In October 2015, the legislature approved, and the Governor signed SB 350, which reaffirms California's commitment to reducing its GHG emissions and addressing climate change. Key provisions include an increase in the RPS, higher energy efficiency requirements for buildings, initial strategies towards a regional electricity grid, and improved infrastructure for EV charging stations. Provisions for a 50% reduction in the use of petroleum statewide were removed from the Bill because of opposition and concern that it would prevent the Bill's passage. Specifically, SB 350 requires the following to reduce statewide GHG emissions:

- Increase the amount of electricity procured from renewable energy sources from 33% to 50% by 2030, with interim targets of 40% by 2024, and 25% by 2027.
- Double the energy efficiency in existing buildings by 2030. This target will be achieved through the California Public Utility Commission (CPUC), the California Energy Commission (CEC), and local publicly owned utilities.
- Reorganize the Independent System Operator to develop more regional electrify transmission markets and to improve accessibility in these markets, which will facilitate the growth of renewable energy markets in the western United States.

2.7.3.1 EXECUTIVE ORDERS RELATED TO GHG EMISSIONS

California's Executive Branch has taken several actions to reduce GHGs through the use of Executive Orders. Although not regulatory, they set the tone for the state and guide the actions of state agencies.

EXECUTIVE ORDER B-55-18 AND SB 100

SB 100 and Executive Order B-55-18 were signed by Governor Brown on September 10, 2018. Under the existing RPS, 25% of retail sales of electricity are required to be from renewable sources by December 31, 2016, 33% by December 31, 2020, 40% by December 31, 2024, 45% by December 31, 2027, and 50% by December 31, 2030. SB 100 raises California's RPS requirement to 50% renewable resources target by December 31, 2026, and to achieve a 60% target by December 31, 2030. SB 100 also requires that retail sellers and local publicly owned electric utilities procure a minimum quantity of electricity products from eligible renewable energy resources so that the total kilowatt hours (kWh) of those products sold to their retail end-use customers achieve 44% of retail sales by December 31, 2024, 52% by December 31, 2027, and 60% by December 31, 2030. In addition to targets under AB 32 and SB 32, Executive Order B-55-18 establishes a carbon neutrality goal for the state of California by 2045; and sets a goal to maintain net negative emissions thereafter. The Executive Order directs the California Natural Resources Agency (CNRA), California EPA (CalEPA), the California Department of Food and Agriculture (CDFA), and CARB to include sequestration targets in the Natural and Working Lands Climate Change Implementation Plan consistent with the carbon neutrality goal.

EXECUTIVE ORDER S-3-05

Former California Governor Arnold Schwarzenegger announced on June 1, 2005, through Executive Order S-3-05, the following reduction targets for GHG emissions:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80% below 1990 levels.

The 2050 reduction goal represents what some scientists believe is necessary to reach levels that will stabilize the climate. The 2020 goal was established to be a mid-term target. Because this is an executive order, the goals are not legally enforceable for local governments or the private sector.

EXECUTIVE ORDER S-01-07 (LCFS)

Governor Schwarzenegger signed Executive Order S-01-07 on January 18, 2007. The order mandates that a statewide goal shall be established to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020. CARB adopted the LCFS on April 23, 2009.

After a series of legal changes, in order to address the Court ruling, CARB was required to bring a new LCFS regulation to the Board for consideration in February 2015. The proposed LCFS regulation was required to contain revisions to the 2010 LCFS as well as new provisions designed to foster investments in the production of the low-carbon intensity fuels, offer additional

flexibility to regulated parties, update critical technical information, simplify and streamline program operations, and enhance enforcement. On November 16, 2015, the Office of Administrative Law (OAL) approved the Final Rulemaking Package. The new LCFS regulation became effective on January 1, 2016.

In 2018, CARB approved amendments to the regulation, which included strengthening the carbon intensity benchmarks through 2030 in compliance with the SB 32 GHG emissions reduction target for 2030. The amendments included crediting opportunities to promote zero emission vehicle adoption, alternative jet fuel, carbon capture and sequestration, and advanced technologies to achieve deep decarbonization in the transportation sector (43).

EXECUTIVE ORDER S-13-08

Executive Order S-13-08 states that "climate change in California during the next century is expected to shift precipitation patterns, accelerate sea level rise and increase temperatures, thereby posing a serious threat to California's economy, to the health and welfare of its population and to its natural resources." Pursuant to the requirements in the Order, the 2009 California Climate Adaptation Strategy (CNRA 2009) was adopted, which is the "…first statewide, multi-sector, region-specific, and information-based climate change adaptation strategy in the United States." Objectives include analyzing risks of climate change in California, identifying and exploring strategies to adapt to climate change, and specifying a direction for future research.

EXECUTIVE ORDER B-30-15

On April 29, 2015, Governor Brown issued an executive order to establish a California GHG reduction target of 40% below 1990 levels by 2030. The Governor's executive order aligned California's GHG reduction targets with those of leading international governments ahead of the U.N. Climate Change Conference in Paris late 2015. The Order sets a new interim statewide GHG emission reduction target to reduce GHG emissions to 40% below 1990 levels by 2030 in order to ensure California meets its target of reducing GHG emissions to 80% below 1990 levels by 2050 and directs CARB to update the *2017 Scoping Plan* to express the 2030 target in terms of $MMTCO_2e$. The Order also requires the state's climate adaptation plan to be updated every three years, and for the State to continue its climate change research program, among other provisions. As with Executive Order S-3-05, this Order is not legally enforceable as to local governments and the private sector. Legislation that would update AB 32 to make post 2020 targets and requirements a mandate is in process in the State Legislature.

2.7.3.2 CALIFORNIA REGULATIONS AND BUILDING CODES

California has a long history of adopting regulations to improve energy efficiency in new and remodeled buildings. These regulations have kept California's energy consumption relatively flat even with rapid population growth.

TITLE 20 CCR SECTIONS 1601 ET SEQ. – APPLIANCE EFFICIENCY REGULATIONS

CCR, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1608: Appliance Efficiency Regulations regulates the sale of appliances in California. The Appliance Efficiency Regulations include standards for both federally regulated appliances and non-federally regulated appliances.

23 categories of appliances are included in the scope of these regulations. The standards within these regulations apply to appliances that are sold or offered for sale in California, except those sold wholesale in California for final retail sale outside the state and those designed and sold exclusively for use in recreational vehicles or other mobile equipment (CEC 2012).

TITLE 24 CCR PART 6 – CALIFORNIA ENERGY CODE

The California Energy Code was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption.

The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods.

TITLE 24 CCR PART 11 – CALIFORNIA GREEN BUILDING STANDARDS CODE

California Code of Regulations (CCR) Title 24 Part 6: The California Energy Code was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption.

The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods. CCR, Title 24, Part 11: California Green Building Standards Code (CALGreen) is a comprehensive and uniform regulatory code for all residential, commercial, and school buildings that went in effect on August 1, 2009, and is administered by the California Building Standards Commission.

CALGreen is updated on a regular basis, with the most recent approved update consisting of the 2022 California Green Building Code Standards that became effective on January 1, 2023. The CEC anticipates that the 2022 energy code will provide $1.5 billion in consumer benefits and reduce GHG emissions by 10 million metric tons (44). The Project would be required to comply with the applicable standards in place at the time plan check submittals are made. These require, among other items (45):

NONRESIDENTIAL MANDATORY MEASURES

- Short-term bicycle parking. If the new project or an additional alteration is anticipated to generate visitor traffic, provide permanently anchored bicycle racks within 200 feet of the visitors' entrance, readily visible to passers-by, for 5% of new visitor motorized vehicle parking spaces being added, with a minimum of one two-bike capacity rack (5.106.4.1.1).
- Long-term bicycle parking. For new buildings with tenant spaces that have 10 or more tenant-occupants, provide secure bicycle parking for 5% of the tenant-occupant vehicular parking spaces with a minimum of one bicycle parking facility (5.106.4.1.2).
- Designated parking for clean air vehicles. In new projects or additions to alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of low-emitting, fuel-efficient and carpool/van pool vehicles as shown in Table 5.106.5.2 (5.106.5.2).

- EV charging stations. New construction shall facilitate the future installation of EV supply equipment. The compliance requires empty raceways for future conduit and documentation that the electrical system has adequate capacity for the future load. The number of spaces to be provided for is contained in Table 5.106. 5.3.3 (5.106.5.3). Additionally, Table 5.106.5.4.1 specifies requirements for the installation of raceway conduit and panel power requirements for medium- and heavy-duty electric vehicle supply equipment for warehouses, grocery stores, and retail stores.
- Outdoor light pollution reduction. Outdoor lighting systems shall be designed to meet the backlight, uplight and glare ratings per Table 5.106.8 (5.106.8).
- Construction waste management. Recycle and/or salvage for reuse a minimum of 65% of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1. 5.405.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent (5.408.1).
- Excavated soil and land clearing debris. 100% of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reuse or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed (5.408.3).
- Recycling by Occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage, and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive (5.410.1).
- Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:
    - Water Closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush (5.303.3.1)
    - Urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush (5.303.3.2.1). The effective flush volume of floor- mounted or other urinals shall not exceed 0.5 gallons per flush (5.303.3.2.2).
    - Showerheads. Single showerheads shall have a minimum flow rate of not more than 1.8 gallons per minute and 80 psi (5.303.3.3.1). When a shower is served by more than one showerhead, the combine flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi (5.303.3.3.2).
    - Faucets and fountains. Nonresidential lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi (5.303.3.4.1). Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute of 60 psi (5.303.3.4.2). Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute (5.303.3.4.3). Metering faucets shall not deliver more than 0.20 gallons per cycle (5.303.3.4.4). Metering faucets for wash fountains shall have a maximum flow rate not more than 0.20 gallons per cycle (5.303.3.4.5).
- Outdoor potable water uses in landscaped areas. Nonresidential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent (5.304.1).

- Water meters. Separate submeters or metering devices shall be installed for new buildings or additions in excess of 50,000 sf or for excess consumption where any tenant within a new building or within an addition that is project to consume more than 1,000 gallons per day (GPD) (5.303.1.1 and 5.303.1.2).
- Outdoor water uses in rehabilitated landscape projects equal or greater than 2,500 sf. Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 2,500 sf requiring a building or landscape permit (5.304.3).
- Commissioning. For new buildings 10,000 sf and over, building commissioning shall be included in the design and construction processes of the building project to verify that the building systems and components meet the owner's or owner representative's project requirements (5.410.2).

MWELO

The MWELO was required by AB 1881, the Water Conservation Act. The bill required local agencies to adopt a local landscape ordinance at least as effective in conserving water as the Model Ordinance by January 1, 2010. Governor Brown's Drought Executive Order of April 1, 2015 (Executive Order B-29-15) directed Department of Water Resources (DWR) to update the Ordinance through expedited regulation. The California Water Commission approved the revised Ordinance on July 15, 2015 effective December 15, 2015. New development projects that include landscape areas of 500 sf or more are subject to the Ordinance. The update requires:

- More efficient irrigation systems;
- Incentives for graywater usage;
- Improvements in on-site stormwater capture;
- Limiting the portion of landscapes that can be planted with high water use plants; and
- Reporting requirements for local agencies.

CARB REFRIGERANT MANAGEMENT PROGRAM

CARB adopted a regulation in 2009 to reduce refrigerant GHG emissions from stationary sources through refrigerant leak detection and monitoring, leak repair, system retirement and retrofitting, reporting and recordkeeping, and proper refrigerant cylinder use, sale, and disposal. The regulation is set forth in sections 95380 to 95398 of Title 17, CCR. The rules implementing the regulation establish a limit on statewide GHG emissions from stationary facilities with refrigeration systems with more than 50 lbs of a high GWP refrigerant. The refrigerant management program is designed to (1) reduce emissions of high-GWP GHG refrigerants from leaky stationary, non-residential refrigeration equipment; (2) reduce emissions from the installation and servicing of refrigeration and air-conditioning appliances using high-GWP refrigerants; and (3) verify GHG emission reductions.

TRACTOR-TRAILER GHG REGULATION

The tractors and trailers subject to this regulation must either use EPA SmartWay certified tractors and trailers or retrofit their existing fleet with SmartWay verified technologies. The regulation applies primarily to owners of 53-foot or longer box-type trailers, including both dry-van and refrigerated-van trailers, and owners of the HD tractors that pull them on California

highways. These owners are responsible for replacing or retrofitting their affected vehicles with compliant aerodynamic technologies and low rolling resistance tires. Sleeper cab tractors model year 2011 and later must be SmartWay certified. All other tractors must use SmartWay verified low rolling resistance tires. There are also requirements for trailers to have low rolling resistance tires and aerodynamic devices.

PHASE I AND 2 HEAVY-DUTY VEHICLE GHG STANDARDS

In September 2011, CARB has adopted a regulation for GHG emissions from HDTs and engines sold in California. It establishes GHG emission limits on truck and engine manufacturers and harmonizes with the EPA rule for new trucks and engines nationally. Existing HD vehicle regulations in California include engine criteria emission standards, tractor-trailer GHG requirements to implement SmartWay strategies (i.e., the Heavy-Duty Tractor-Trailer GHG Regulation), and in-use fleet retrofit requirements such as the Truck and Bus Regulation. The EPA rule has compliance requirements for new compression and spark ignition engines, as well as trucks from Class 2b through Class 8. Compliance requirements began with MY 2014 with stringency levels increasing through MY 2018. The rule organizes truck compliance into three groupings, which include a) HD pickups and vans; b) vocational vehicles; and c) combination tractors. The EPA rule does not regulate trailers.

CARB staff has worked jointly with the EPA and the NHTSA on the next phase of federal GHG emission standards for medium-duty trucks (MDT) and HDT vehicles, called federal Phase 2. The federal Phase 2 standards were built on the improvements in engine and vehicle efficiency required by the Phase 1 emission standards and represent a significant opportunity to achieve further GHG reductions for 2018 and later MY HDT vehicles, including trailers. The EPA and NHTSA have proposed to roll back GHG and fuel economy standards for cars and light-duty trucks, which suggests a similar rollback of Phase 2 standards for MDT and HDT vehicles may be pursued.

SB 97 AND THE CEQA GUIDELINES UPDATE

Passed in August 2007, SB 97 added Section 21083.05 to the Public Resources Code. The code states "(a) On or before July 1, 2009, the Office of Planning and Research (OPR) shall prepare, develop, and transmit to the Resources Agency guidelines for the mitigation of GHG emissions or the effects of GHG emissions as required by this division, including, but not limited to, effects associated with transportation or energy consumption. (b) On or before January 1, 2010, the Resources Agency shall certify and adopt guidelines prepared and developed by the OPR pursuant to subdivision (a)."

In 2012, Public Resources Code Section 21083.05 was amended to state:

> *"The Office of Planning and Research and the Natural Resources Agency shall periodically update the guidelines for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by this division, including, but not limited to, effects associated with transportation or energy consumption, to incorporate new information or criteria established by the State Air Resources Board pursuant to Division 25.5 (commencing with Section 38500) of the Health and Safety Code."*

On December 28, 2018, the Natural Resources Agency announced the OAL approved the amendments to the *CEQA Guidelines* for implementing CEQA. The CEQA Amendments provide guidance to public agencies regarding the analysis and mitigation of the effects of GHG emissions in CEQA documents. The CEQA Amendments fit within the existing CEQA framework by amending existing *CEQA Guidelines* to reference climate change.

Section 15064.4 was added the *CEQA Guidelines* and states that in determining the significance of a project's GHG emissions, the lead agency should focus its analysis on the reasonably foreseeable incremental contribution of the project's emissions to the effects of climate change. A project's incremental contribution may be cumulatively considerable even if it appears relatively insignificant compared to statewide, national, or global emissions. The agency's analysis should consider a timeframe that is appropriate for the project. The agency's analysis also must reasonably reflect evolving scientific knowledge and state regulatory schemes. Additionally, a lead agency may use a model or methodology to estimate GHG emissions resulting from a project. The lead agency has discretion to select the model or methodology it considers most appropriate to enable decision makers to intelligently take into account the project's incremental contribution to climate change. The lead agency must support its selection of a model or methodology with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use (46).

2.7.4 REGIONAL

The project is within the South Coast Air Basin (SCAB), which is under the jurisdiction of the SCAQMD.

SCAQMD

SCAQMD is the agency responsible for air quality planning and regulation in the SCAB. The SCAQMD addresses the impacts to climate change of projects subject to SCAQMD permit as a lead agency if they are the only agency having discretionary approval for the project and acts as a responsible agency when a land use agency must also approve discretionary permits for the project. The SCAQMD acts as an expert commenting agency for impacts to air quality. This expertise carries over to GHG emissions, so the agency helps local land use agencies through the development of models and emission thresholds that can be used to address GHG emissions.

In 2008, SCAQMD formed a Working Group to identify GHG emissions thresholds for land use projects that could be used by local lead agencies in the SCAB. The Working Group developed several different options that are contained in the SCAQMD Draft Guidance Document – Interim CEQA GHG Significance Threshold, that could be applied by lead agencies. The working group has not provided additional guidance since release of the interim guidance in 2008. The SCAQMD Board has not approved the thresholds; however, the Guidance Document provides substantial evidence supporting the approaches to significance of GHG emissions that can be considered by the lead agency in adopting its own threshold. The current interim thresholds consist of the following tiered approach:

- Tier 1 consists of evaluating whether or not the project qualifies for any applicable exemption under CEQA.

- Tier 2 consists of determining whether the project is consistent with a GHG reduction plan. If a project is consistent with a qualifying local GHG reduction plan, it does not have significant GHG emissions.
- Tier 3 consists of screening values, which the lead agency can choose, but must be consistent with all projects within its jurisdiction. A project's construction emissions are averaged over 30 years and are added to the project's operational emissions. If a project's emissions are below one of the following screening thresholds, then the project is less than significant:
    - Residential and Commercial land use: 3,000 $MTCO_2e$/yr
    - Industrial land use: 10,000 $MTCO_2e$/yr
    - Based on land use type: residential: 3,500 $MTCO_2e$/yr; commercial: 1,400 $MTCO_2e$/yr; or mixed use: 3,000 $MTCO_2e$/yr
- Tier 4 has the following options:
    - Option 1: Reduce Business-as-Usual (BAU) emissions by a certain percentage; this percentage is currently undefined.
    - Option 2: Early implementation of applicable AB 32 Scoping Plan measures
    - Option 3: 2020 target for service populations (SP), which includes residents and employees: 4.8 $MTCO_2e$ per SP per year for projects and 6.6 $MTCO_2e$ per SP per year for plans;
    - Option 3, 2035 target: 3.0 $MTCO_2e$ per SP per year for projects and 4.1 $MTCO_2e$ per SP per year for plans
- Tier 5 involves mitigation offsets to achieve target significance threshold.

The SCAQMD's interim thresholds used the Executive Order S-3-05-year 2050 goal as the basis for the Tier 3 screening level. Achieving the Executive Order's objective would contribute to worldwide efforts to cap CO_2 concentrations at 450 ppm, thus stabilizing global climate.

SCAQMD only has authority over GHG emissions from development projects that include air quality permits. At this time, it is unknown if the project would include stationary sources of emissions subject to SCAQMD permits. Notwithstanding, if the Project requires a stationary permit, it would be subject to the applicable SCAQMD regulations.

SCAQMD Regulation XXVII, adopted in 2009 includes the following rules:

- Rule 2700 defines terms and post global warming potentials.
- Rule 2701, SoCal Climate Solutions Exchange, establishes a voluntary program to encourage, quantify, and certify voluntary, high quality certified GHG emission reductions in the SCAQMD.
- Rule 2702, GHG Reduction Program created a program to produce GHG emission reductions within the SCAQMD. The SCAQMD will fund projects through contracts in response to requests for proposals or purchase reductions from other parties.

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3 PROJECT GREENHOUSE GAS IMPACT

3.1 INTRODUCTION

The Project has been evaluated to determine if it will result in a significant GHG impact. The significance of these potential impacts is described in the following section.

3.2 STANDARDS OF SIGNIFICANCE

The criteria used to determine the significance of potential Project-related GHG impacts are taken from the Initial Study Checklist in Appendix G of the State CEQA Guidelines (14 California Code of Regulations §§15000, et seq.). Based on these thresholds, a project would result in a significant impact related to GHG if it would (1):

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment?
- Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs?

3.3 CALIFORNIA EMISSIONS ESTIMATOR MODEL™ EMPLOYED TO ANALYZE GHG EMISSIONS

In May 2023 California Air Pollution Control Officers Association (CAPCOA) in conjunction with other California air districts, including SCAQMD, released the latest version of the CalEEMod Version 2022.1.1.12. The purpose of this model is to calculate construction-source and operational-source criteria pollutant (VOCs, NO_X, SO_X, CO, PM_{10}, and $PM_{2.5}$) and GHG emissions from direct and indirect sources; and quantify applicable air quality and GHG reductions achieved from mitigation (47). Accordingly, the latest version of CalEEMod has been used for this Project to determine construction and operational air quality emissions. CalEEMod output for both construction and operational scenarios is provided in Appendix 3.1.

3.4 CONSTRUCTION LIFE-CYCLE ANALYSIS NOT REQUIRED

A full life-cycle analysis (LCA) for construction and operational activity is not included in this analysis due to the lack of consensus guidance on LCA methodology at this time (48). Life-cycle analysis (i.e., assessing economy-wide GHG emissions from the processes in manufacturing and transporting all raw materials used in the project development, infrastructure and on-going operations) depends on emission factors or econometric factors that are not well established for all processes. At this time, an LCA would be extremely speculative and thus has not been prepared.

Additionally, the SCAQMD recommends analyzing direct and indirect project GHG emissions generated within California and not life-cycle emissions because the life-cycle effects from a project could occur outside of California, might not be very well understood or documented, and would be challenging to mitigate (49). Additionally, the science to calculate life cycle emissions

is not yet established or well defined; therefore, SCAQMD has not recommended, and is not requiring, life-cycle emissions analysis.

3.5 CONSTRUCTION EMISSIONS

Project construction activities would result in emissions of CO_2 and CH_4. The report *Replenish Big Bear Program Air Quality Impact Analysis Report* (AQIA) (Urban Crossroads, Inc.) contains detailed information regarding construction activity (50).

3.6 OPERATIONAL EMISSIONS

In terms of operational GHG emissions, the proposed Project involves the construction of monitoring wells, conveyance facilities and ancillary facilities, evaporation ponds, advanced water purification facilities, and associated improvements. The proposed Project does not include any substantive new stationary or mobile sources of emissions, and therefore, by its very nature, will not generate quantifiable GHG emissions from Project operations. The Project does not propose a trip-generating land use or facilities that would generate any substantive amount of on-going GHG emissions. While it is anticipated that the Project would require intermittent maintenance to be, such maintenance would be minimal requiring a negligible amount of traffic trips on an annual basis. Additionally, based on information provided by BBARWA and the Project Team, the Project will include the installation of solar, which is expected to generate approximately 3,652,117 kWh per year. Therefore, there is no significant operational impact expected, as shown on Table 3-1.

3.7 EMISSIONS SUMMARY

As shown in Table 3-1, the Project will result in approximately 1,499.63 $MTCO_2e$/yr from construction and operational activities.

TABLE 3-1: PROJECT GHG EMISSIONS

Emission Source	Emissions (MT/yr)				
	CO_2	CH_4	N_2O	Refrigerants	Total CO_2e
Annual construction-related emissions amortized over 30 years	361.89	1.94E-02	2.38E-02	2.10E-01	369.69
Mobile Source	0.10	0.00	0.00	0.00	0.10
Area Source	0.81	0.00	0.00	0.00	0.81
Energy Source	44.95	4.61	0.00	0.00	45.08
Water Usage	834.41	0.06	0.01	0.00	837.91
Waste	3.35	0.34	0.00	0.00	11.74
Stationary Source	233.51	166.79	0.01	0.00	234.28
Total CO_2e (All Sources)	**1,499.63**				

Source: CalEEMod output, See Appendices 3.1 through 3.5 for detailed model outputs.

3.8 GREENHOUSE GAS EMISSIONS FINDINGS AND RECOMMENDATIONS

GHG Impact #1: The Project would generate direct or indirect GHG emission that would result in a significant impact on the environment.

The Big Bear Area Regional Wastewater Agency has not adopted its own numeric threshold of significance for determining impacts with respect to GHG emissions. A screening threshold of 3,000 $MTCO_2e$/yr or 10,000 $MTCO_2e$/yr to determine if additional analysis is required is an acceptable approach. This approach is a widely accepted screening threshold used by numerous cities and counties in the SCAB and is based on the SCAQMD staff's proposed GHG screening threshold for stationary source emissions for non-industrial projects, as described in the SCAQMD's *Interim CEQA GHG Significance Threshold for Stationary Sources, Rules and Plans* (SCAQMD Interim GHG Threshold). The SCAQMD Interim GHG Threshold identifies a screening threshold to determine whether additional analysis is required (51).

The Project will result in approximately 1,499.63 $MTCO_2e$/yr from construction and operational activities. As such, the Project would not exceed the SCAQMD's recommended numeric threshold of 3,000 $MTCO_2e$ or 10,000 $MTCO_2e$/yr if it were applied. Thus, the Project would not result in a cumulatively considerable impact with respect to GHG emissions.

GHG Impact #2: The Project would not conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of GHG.

As discussed above, the Project involves construction activity and does not propose a trip-generating land use or facilities that would generate any substantive amount of on-going GHG emissions. As presented in Table 3-1, the Project's GHG emissions are below the 3,000 $MTCO_2e$/yr and 10,000 $MTCO_2e$/yr thresholds. As concluded in Impact Statement GHG-1 the proposed project would not have the potential to generate a significant amount of GHGs emissions. As such, the proposed Project will not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. Impacts are considered less than significant in this regard.

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5 CERTIFICATIONS

The contents of this GHG study report represent an accurate depiction of the GHG impacts associated with the proposed Replenish Big Bear Program Project. The information contained in this GHG report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at hqureshi@urbanxroads.com

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APPENDIX 3.1:

CALEEMOD REPLENISH BIG BEAR COMPONENT 1 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-WWTP Upgrades (Unmitigated) Detailed Report

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4.2.1. Electricity Emissions By Land Use - Unmitigated

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4.2.3. Natural Gas Emissions By Land Use - Unmitigated

4.2.4. Natural Gas Emissions By Land Use - Mitigated

4.3. Area Emissions by Source

4.3.1. Unmitigated

4.3.2. Mitigated

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

4.4.2. Mitigated

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

4.5.2. Mitigated

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

4.6.2. Mitigated

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

4.7.2. Mitigated

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

4.8.2. Mitigated

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

4.9.2. Mitigated

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

5. Activity Data

5.1. Construction Schedule

5.2. Off-Road Equipment

5.2.1. Unmitigated

5.2.2. Mitigated

5.3. Construction Vehicles

5.3.1. Unmitigated

5.3.2. Mitigated

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

5.5. Architectural Coatings

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

5.6.2. Construction Earthmoving Control Strategies

5.7. Construction Paving

5.8. Construction Electricity Consumption and Emissions Factors

5.9. Operational Mobile Sources

5.9.1. Unmitigated

5.9.2. Mitigated

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

5.10.3. Landscape Equipment

5.10.4. Landscape Equipment - Mitigated

5.11. Operational Energy Consumption

5.11.1. Unmitigated

5.11.2. Mitigated

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

5.12.2. Mitigated

5.13. Operational Waste Generation

5.13.1. Unmitigated

5.13.2. Mitigated

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

5.14.2. Mitigated

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

5.15.2. Mitigated

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

5.16.2. Process Boilers

5.17. User Defined

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

5.18.1.2. Mitigated

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

5.18.1.2. Mitigated

5.18.2. Sequestration

5.18.2.1. Unmitigated

5.18.2.2. Mitigated

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

6.2. Initial Climate Risk Scores

6.3. Adjusted Climate Risk Scores

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

7.2. Healthy Places Index Scores

7.3. Overall Health & Equity Scores

7.4. Health & Equity Measures

7.5. Evaluation Scorecard

7.6. Health & Equity Custom Measures

8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-WWTP Upgrades (Unmitigated)
Construction Start Date	1/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Unrefrigerated Warehouse-Rail	40.0	1000sqft	0.92	40,000	0.00	—	—	—
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump Station
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—
User Defined Linear	0.26	Mile	0.14	0.00	0.00	—	—	—
Other Asphalt Surfaces	0.44	Acre	0.44	0.00	0.00	—	—	Remaining SF

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Energy	E-10-B	Establish Onsite Renewable Energy Systems: Solar Power

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	5.21	4.63	30.9	56.2	0.16	1.15	13.1	13.4	1.06	3.06	3.82	—	26,339	26,339	2.04	3.77	1.79	27,515
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.72	2.46	18.6	26.1	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.50	0.45	3.40	4.76	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.18	3.82	27.5	44.3	0.08	1.10	6.19	7.30	1.02	1.93	2.95	—	12,560	12,560	0.56	0.57	21.3	12,766
2026	4.03	3.67	25.4	42.3	0.08	1.01	6.19	7.20	0.93	1.93	2.87	—	12,440	12,440	0.54	0.57	19.4	12,642
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	4.16	3.80	27.7	38.8	0.16	1.10	13.1	13.4	1.02	3.06	3.38	—	26,339	26,339	2.04	3.77	1.79	27,515
2026	5.21	4.63	30.9	56.2	0.09	1.15	9.73	10.9	1.06	2.76	3.82	—	17,376	17,376	0.51	0.70	0.83	17,598
2027	1.19	0.96	5.01	18.1	0.02	0.13	3.53	3.66	0.12	0.83	0.94	—	5,177	5,177	0.08	0.13	0.30	5,218
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.72	2.39	18.6	25.9	0.06	0.70	4.55	5.24	0.65	1.36	2.01	—	9,047	9,047	0.46	0.56	7.33	9,233
2026	2.70	2.46	17.2	26.1	0.05	0.67	4.27	4.94	0.62	1.32	1.94	—	8,305	8,305	0.29	0.38	5.82	8,432
2027	0.03	0.02	0.11	0.40	< 0.005	< 0.005	0.08	0.08	< 0.005	0.02	0.02	—	112	112	< 0.005	< 0.005	0.11	113
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.50	0.44	3.40	4.73	0.01	0.13	0.83	0.96	0.12	0.25	0.37	—	1,498	1,498	0.08	0.09	1.21	1,529
2026	0.49	0.45	3.14	4.76	0.01	0.12	0.78	0.90	0.11	0.24	0.35	—	1,375	1,375	0.05	0.06	0.96	1,396
2027	< 0.005	< 0.005	0.02	0.07	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	18.6	18.6	< 0.005	< 0.005	0.02	18.8

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824

Mit.	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Mit.	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Mit.	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792
Mit.	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	47%	47%	12%	48%	—	47%

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,709	10,729	2.75	0.09	0.00	10,824
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,701	10,722	2.75	0.09	0.00	10,816
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	5,258	5,258	0.37	0.04	—	5,280
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	10,706	10,727	2.75	0.09	0.00	10,821
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	871	871	0.06	0.01	—	874
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	1,773	1,776	0.46	0.01	0.00	1,792

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.20	2.01	4.33	5.92	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,694	5,714	2.41	0.05	0.00	5,788
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	0.89	1.73	4.31	4.18	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,687	5,707	2.41	0.05	0.00	5,781
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.21	1.12	0.01	1.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.90	4.90	< 0.005	< 0.005	—	4.92
Energy	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Waste	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Stationary	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Total	1.10	1.92	4.32	5.37	0.01	0.48	0.00	0.48	0.48	0.00	0.48	20.3	5,691	5,712	2.41	0.05	0.00	5,786
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Energy	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Waste	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Stationary	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9
Total	0.20	0.35	0.79	0.98	< 0.005	0.09	0.00	0.09	0.09	0.00	0.09	3.35	942	946	0.40	0.01	0.00	958

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.2. Linear, Grading & Excavation (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.26	6.30	0.02	0.14	—	0.14	0.13	—	0.13	—	1,863	1,863	0.08	0.02	—	1,869

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.26	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	113	113	< 0.005	< 0.005	—	113
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.7	18.7	< 0.005	< 0.005	—	18.8
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.82	0.00	0.00	0.21	0.21	0.00	0.05	0.05	—	208	208	< 0.005	0.01	0.33	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.5	34.5	< 0.005	< 0.005	0.06	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.3. Linear, Grading & Excavation (2027) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.4. Linear, Grading & Excavation (2027) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.70	0.59	4.09	6.32	0.02	0.13	—	0.13	0.12	—	0.12	—	1,862	1,862	0.08	0.02	—	1,868
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.09	0.14	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.1	40.1	< 0.005	< 0.005	—	40.2
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.64	6.64	< 0.005	< 0.005	—	6.66

Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.49	0.37	0.92	11.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,315	3,315	0.01	0.11	0.30	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.27	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	72.4	72.4	< 0.005	< 0.005	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	12.0	12.0	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.5. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.6. Demolition (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	3.24	3.24	—	0.49	0.49	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.18	0.18	—	0.03	0.03	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Demolition	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—

Vendor	0.52	0.12	6.59	2.89	0.06	0.11	2.10	2.21	0.11	0.58	0.69	—	7,322	7,322	0.46	1.11	0.55	—
Hauling	1.70	0.23	17.3	8.55	0.10	0.20	4.26	4.46	0.20	1.17	1.37	—	15,565	15,565	1.47	2.55	0.87	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.07	0.80	0.00	0.00	0.19	0.19	0.00	0.05	0.05	—	192	192	0.01	0.01	0.33	—
Vendor	0.03	0.01	0.37	0.16	< 0.005	0.01	0.11	0.12	0.01	0.03	0.04	—	401	401	0.02	0.06	0.51	—
Hauling	0.09	0.01	0.96	0.47	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	853	853	0.08	0.14	0.80	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.15	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	31.8	31.8	< 0.005	< 0.005	0.06	—
Vendor	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	66.4	66.4	< 0.005	0.01	0.08	—
Hauling	0.02	< 0.005	0.18	0.09	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	141	141	0.01	0.02	0.13	—

3.7. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811
Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—

Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.8. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.44	2.89	24.0	23.9	0.06	1.07	—	1.07	0.98	—	0.98	—	6,142	6,142	0.25	0.05	—	6,163
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.13	1.79	14.9	14.8	0.04	0.66	—	0.66	0.61	—	0.61	—	3,798	3,798	0.15	0.03	—	3,811

Dust From Material Movement	—	—	—	—	—	—	1.18	1.18	—	0.56	0.56	—	—	—	—	—	—	—
Architectural Coatings	—	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.71	2.69	0.01	0.12	—	0.12	0.11	—	0.11	—	629	629	0.03	0.01	—	631
Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.10	0.10	—	—	—	—	—	—	—
Architectural Coatings	—	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.41	1.03	19.3	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,769	3,769	0.12	0.11	14.1	—
Vendor	0.14	0.03	1.65	0.77	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	5.58	—
Hauling	0.08	0.01	0.77	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	1.58	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.39	1.14	13.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,452	3,452	0.12	0.11	0.37	—
Vendor	0.14	0.03	1.73	0.76	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,920	1,920	0.12	0.29	0.14	—
Hauling	0.08	0.01	0.81	0.40	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	728	728	0.07	0.12	0.04	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.31	0.24	0.77	9.03	0.00	0.00	2.18	2.18	0.00	0.51	0.51	—	2,165	2,165	0.07	0.07	3.77	—
Vendor	0.08	0.02	1.08	0.47	0.01	0.02	0.34	0.36	0.02	0.09	0.11	—	1,187	1,187	0.07	0.18	1.50	—
Hauling	0.05	0.01	0.51	0.25	< 0.005	0.01	0.12	0.13	0.01	0.03	0.04	—	450	450	0.04	0.07	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.14	1.65	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	358	358	0.01	0.01	0.62	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	197	197	0.01	0.03	0.25	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	74.6	74.6	0.01	0.01	0.07	—

3.9. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

3.10. Building Construction (2026) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.31	2.78	22.2	23.4	0.06	0.97	—	0.97	0.89	—	0.89	—	6,145	6,145	0.25	0.05	—	6,166
Dust From Material Movement	—	—	—	—	—	—	1.91	1.91	—	0.90	0.90	—	—	—	—	—	—	—
Architectural Coatings	—	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.17	1.82	14.5	15.3	0.04	0.64	—	0.64	0.59	—	0.59	—	4,029	4,029	0.16	0.03	—	4,042
Dust From Material Movement	—	—	—	—	—	—	1.25	1.25	—	0.59	0.59	—	—	—	—	—	—	—
Architectural Coatings	—	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.40	0.33	2.65	2.79	0.01	0.12	—	0.12	0.11	—	0.11	—	667	667	0.03	0.01	—	669
Dust From Material Movement	—	—	—	—	—	—	0.23	0.23	—	0.11	0.11	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.51	0.40	0.92	17.8	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,692	3,692	0.12	0.11	12.8	—
Vendor	0.14	0.02	1.56	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	5.15	—
Hauling	0.07	0.01	0.74	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	1.48	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.50	0.38	1.03	12.7	0.00	0.00	3.53	3.53	0.00	0.83	0.83	—	3,383	3,383	0.01	0.11	0.33	—
Vendor	0.14	0.02	1.63	0.73	0.01	0.03	0.55	0.58	0.03	0.15	0.18	—	1,888	1,888	0.10	0.29	0.13	—
Hauling	0.07	0.01	0.77	0.39	< 0.005	0.01	0.20	0.21	0.01	0.05	0.06	—	715	715	0.06	0.11	0.04	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.33	0.25	0.75	8.83	0.00	0.00	2.31	2.31	0.00	0.54	0.54	—	2,249	2,249	0.01	0.08	3.62	—
Vendor	0.09	0.01	1.08	0.48	0.01	0.02	0.36	0.38	0.02	0.10	0.12	—	1,238	1,238	0.07	0.19	1.45	—
Hauling	0.05	< 0.005	0.51	0.26	< 0.005	0.01	0.13	0.14	0.01	0.04	0.04	—	469	469	0.04	0.08	0.42	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.05	0.14	1.61	0.00	0.00	0.42	0.42	0.00	0.10	0.10	—	372	372	< 0.005	0.01	0.60	—
Vendor	0.02	< 0.005	0.20	0.09	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	205	205	0.01	0.03	0.24	—
Hauling	0.01	< 0.005	0.09	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	77.6	77.6	0.01	0.01	0.07	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehou	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	5,015	5,015	0.34	0.04	—	5,036
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	830	830	0.06	0.01	—	834

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrige Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrige rated Warehou se-Rail	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.02	0.01	0.20	0.17	< 0.005	0.02	—	0.02	0.02	—	0.02	—	244	244	0.02	< 0.005	—	244
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	< 0.005	0.04	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	40.3	40.3	< 0.005	< 0.005	—	40.5

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landscape Equipme	0.31	0.29	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Total	0.31	1.21	0.01	1.74	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	7.15	7.15	< 0.005	< 0.005	—	7.18
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.04	0.04	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81
Total	0.04	0.20	< 0.005	0.22	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.81	0.81	< 0.005	< 0.005	—	0.81

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	5,040	5,040	0.35	0.04	—	5,061
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	834	834	0.06	0.01	—	838

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	20.3	0.00	20.3	2.03	0.00	—	70.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-Rail	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	3.35	0.00	3.35	0.34	0.00	—	11.7

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	404
Total	0.87	0.79	4.11	4.01	< 0.005	0.46	0.00	0.46	0.46	0.00	0.46	0.00	403	403	0.02	< 0.005	0.00	404
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	0.00
undefined	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	66.9
Total	0.16	0.14	0.75	0.73	< 0.005	0.08	0.00	0.08	0.08	0.00	0.08	0.00	66.7	66.7	< 0.005	< 0.005	0.00	66.9

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	12/1/2026	1/11/2027	5.00	30.0	Pipeline Installation
Demolition	Demolition	1/1/2025	1/29/2025	5.00	20.0	—
Building Construction	Building Construction	2/19/2025	12/1/2026	5.00	465	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Building Construction	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Graders	Diesel	Average	1.00	8.00	148	0.41
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Building Construction	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43

Building Construction	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT
Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	50.0	100	LDA,LDT1,LDT2
Demolition	Vendor	25.0	100	HHDT,MHDT

Demolition	Hauling	46.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	50.0	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.56	100	HHDT,MHDT
Building Construction	Hauling	2.15	100	HHDT
Building Construction	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	50.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	0.00	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Building Construction	0.00	0.00	60,000	20,000	7,684

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	—	0.14	0.00	—

Demolition	—	1,350	0.14	3,000	—
Building Construction	—	8,000	581	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-Rail	0.00	0%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%
User Defined Linear	0.14	100%
Other Asphalt Surfaces	0.44	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005
2027	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	60,000	20,000	7,684

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	3,800,000	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00
Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-Rail	0.00	482	0.0330	0.0040	760,427
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00
Parking Lot	0.00	482	0.0330	0.0040	0.00

Other Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-Rail	0.00	719,653,531
Other Non-Asphalt Surfaces	0.00	0.00
Parking Lot	0.00	0.00
Other Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-Rail	37.6	—
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—
Other Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	5.00	0.73
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73
Fire Pump	Diesel	1.00	24.0	8,760	15.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.

Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A

Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6

Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582

Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8

Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Based on Client Provided data and construction schedule
Construction: Off-Road Equipment	Client Provided construction equipment list
Construction: Trips and VMT	Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.
Operations: Vehicle Data	No trips data available
Operations: Architectural Coatings	SCAQMD Rule 1113
Construction: Dust From Material Movement	Export expected per Project data

Construction: Architectural Coatings	SCAQMD Rule 1113
Operations: Energy Use	Electricity adjusted based on client provided data
Operations: Water and Waste Water	Taken from 2022 Lake Analysis report

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APPENDIX 3.2:

CALEEMOD REPLENISH BIG BEAR COMPONENT 2 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Lake Pipeline (Unmitigated) Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Lake Pipeline (Unmitigated)
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.269428, -116.815824
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	3.78	Mile	2.06	0.00	—	—	—	—
Other Non-Asphalt Surfaces	1.00	Acre	1.00	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.26	2.04	0.86	17,776
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.47	1.41	28.1	27.2	0.15	0.49	8.51	9.00	0.47	2.05	2.52	—	22,975	22,975	1.96	3.22	47.5	24,031
2026	0.79	0.65	4.07	11.1	0.01	0.14	1.24	1.38	0.13	0.29	0.42	—	2,467	2,467	0.09	0.05	4.47	2,489
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.30	0.98	18.8	16.9	0.10	0.33	4.40	4.73	0.32	1.16	1.48	—	15,029	15,029	1.26	2.04	0.80	15,670
2026	2.98	1.53	22.0	25.8	0.11	0.46	5.63	6.09	0.43	1.45	1.89	—	17,145	17,145	1.20	2.01	0.86	17,776
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.33	0.55	11.1	9.79	0.06	0.19	2.89	3.08	0.18	0.73	0.91	—	8,713	8,713	0.74	1.21	7.77	9,099
2026	0.50	0.37	2.90	5.68	0.01	0.09	0.82	0.91	0.08	0.20	0.28	—	1,845	1,845	0.07	0.11	1.51	1,880
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.24	0.10	2.03	1.79	0.01	0.03	0.53	0.56	0.03	0.13	0.17	—	1,443	1,443	0.12	0.20	1.29	1,506
2026	0.09	0.07	0.53	1.04	< 0.005	0.02	0.15	0.17	0.01	0.04	0.05	—	305	305	0.01	0.02	0.25	311

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805

Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.82	0.68	4.92	6.09	0.02	0.18	—	0.18	0.16	—	0.16	—	1,799	1,799	0.07	0.01	—	1,805
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.33	2.36	2.92	0.01	0.08	—	0.08	0.08	—	0.08	—	862	862	0.03	0.01	—	865
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.43	0.53	< 0.005	0.02	—	0.02	0.01	—	0.01	—	143	143	0.01	< 0.005	—	143
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.16	0.12	0.31	5.78	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,131	1,131	0.04	0.03	4.24	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.0	6.69	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,194	12,194	1.15	1.99	26.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.12	0.34	4.11	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,036	1,036	0.04	0.03	0.11	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.33	0.18	13.5	6.70	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	12,195	12,195	1.15	2.00	0.69	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.07	0.06	0.18	2.10	0.00	0.00	0.51	0.51	0.00	0.12	0.12	—	504	504	0.02	0.02	0.88	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.64	0.09	6.59	3.21	0.04	0.08	1.60	1.67	0.08	0.44	0.51	—	5,846	5,846	0.55	0.96	5.50	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.03	0.38	0.00	0.00	0.09	0.09	0.00	0.02	0.02	—	83.4	83.4	< 0.005	< 0.005	0.15	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.12	0.02	1.20	0.59	0.01	0.01	0.29	0.31	0.01	0.08	0.09	—	968	968	0.09	0.16	0.91	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.80	0.67	4.65	6.11	0.02	0.16	—	0.16	0.15	—	0.15	—	1,800	1,800	0.07	0.01	—	1,806
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.19	0.25	< 0.005	0.01	—	0.01	0.01	—	0.01	—	74.0	74.0	< 0.005	< 0.005	—	74.2
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.03	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	12.2	12.2	< 0.005	< 0.005	—	12.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.11	0.31	3.81	0.00	0.00	1.06	1.06	0.00	0.25	0.25	—	1,015	1,015	< 0.005	0.03	0.10	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	1.25	0.10	13.0	6.54	0.08	0.16	3.34	3.50	0.16	0.91	1.07	—	11,972	11,972	1.07	1.92	0.64	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	0.01	0.17	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	42.3	42.3	< 0.005	< 0.005	0.07	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.05	< 0.005	0.54	0.27	< 0.005	0.01	0.14	0.14	0.01	0.04	0.04	—	492	492	0.04	0.08	0.44	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	7.00	7.00	< 0.005	< 0.005	0.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.01	< 0.005	0.10	0.05	< 0.005	< 0.005	0.03	0.03	< 0.005	0.01	0.01	—	81.5	81.5	0.01	0.01	0.07	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	3.75	4.89	0.01	0.14	—	0.14	0.13	—	0.13	—	1,175	1,175	0.05	0.01	—	1,179
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.32	0.27	1.95	2.55	0.01	0.07	—	0.07	0.07	—	0.07	—	612	612	0.02	< 0.005	—	614
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.36	0.46	< 0.005	0.01	—	0.01	0.01	—	0.01	—	101	101	< 0.005	< 0.005	—	102
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.18	0.14	0.32	6.23	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,292	1,292	0.04	0.04	4.47	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.17	0.13	0.36	4.44	0.00	0.00	1.24	1.24	0.00	0.29	0.29	—	1,184	1,184	< 0.005	0.04	0.12	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.07	0.21	2.45	0.00	0.00	0.64	0.64	0.00	0.15	0.15	—	625	625	< 0.005	0.02	1.01	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.45	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	103	103	< 0.005	< 0.005	0.17	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.81	1.81	—	0.27	0.27	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.06	0.05	0.44	0.53	< 0.005	0.01	—	0.01	0.01	—	0.01	—	70.3	70.3	< 0.005	< 0.005	—	70.5
Demolition	—	—	—	—	—	—	0.35	0.35	—	0.05	0.05	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.6	11.6	< 0.005	< 0.005	—	11.7
Demolition	—	—	—	—	—	—	0.06	0.06	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.78	0.11	7.55	3.90	0.05	0.09	1.95	2.04	0.09	0.53	0.63	—	7,108	7,108	0.67	1.16	15.4	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.15	0.02	1.54	0.75	0.01	0.02	0.37	0.39	0.02	0.10	0.12	—	1,363	1,363	0.13	0.22	1.28	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	226	226	0.02	0.04	0.21	—

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.22	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.04	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—
Demolition	Demolition	5/1/2025	8/7/2025	5.00	70.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82

Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	15.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	36.0	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	17.5	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT

Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	21.0	100	HHDT
Demolition	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	19,940	5.00	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	2.06	0.00	—
Demolition	0.00	0.00	0.00	5,875	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction

Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	5.00	100%
Other Non-Asphalt Surfaces	66.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	172,498

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase in addition to default CalEEMod hauling trucks. Per Project applicant, the hauling trucks would travel a distance of up to 100 miles round trip, as such hauling for both the Linear, Grading & Excavation and Demolition phase was adjusted to 100 miles.

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APPENDIX 3.3:

CALEEMOD REPLENISH BIG BEAR COMPONENT 3 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Shay Ponds (Unmitigated) Detailed Report

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8. User Changes to Default Data

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Shay Ponds (Unmitigated)
Construction Start Date	5/1/2025
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.30
Precipitation (days)	1.80
Location	34.253674, -116.80784
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
User Defined Linear	1.20	Mile	0.65	0.00	—	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.39	8,710
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2025	1.44	0.92	10.8	10.2	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,464	7,464	0.47	0.85	15.0	7,744
2026	0.56	0.47	3.30	4.32	0.01	0.12	0.00	0.12	0.11	0.00	0.11	—	1,087	1,087	0.04	0.01	0.00	1,091
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.44	0.92	11.0	10.00	0.06	0.29	1.66	1.95	0.28	0.45	0.73	—	7,451	7,451	0.47	0.85	0.39	7,717
2026	1.96	1.33	13.8	14.2	0.07	0.39	1.66	2.05	0.37	0.45	0.82	—	8,444	8,444	0.47	0.85	0.36	8,710
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.69	0.44	5.32	4.81	0.03	0.14	0.80	0.94	0.13	0.22	0.35	—	3,573	3,573	0.22	0.41	3.12	3,704
2026	0.35	0.28	2.15	2.66	0.01	0.07	0.07	0.14	0.07	0.02	0.09	—	868	868	0.04	0.04	0.25	881
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.13	0.08	0.97	0.88	< 0.005	0.03	0.15	0.17	0.02	0.04	0.06	—	592	592	0.04	0.07	0.52	613
2026	0.06	0.05	0.39	0.49	< 0.005	0.01	0.01	0.03	0.01	< 0.005	0.02	—	144	144	0.01	0.01	0.04	146

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.98	0.82	5.81	7.09	0.02	0.22	—	0.22	0.20	—	0.20	—	1,940	1,940	0.08	0.02	—	1,947
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.47	0.39	2.78	3.40	0.01	0.10	—	0.10	0.09	—	0.09	—	930	930	0.04	0.01	—	933
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.51	0.62	< 0.005	0.02	—	0.02	0.02	—	0.02	—	154	154	0.01	< 0.005	—	155
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.77	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	151	151	< 0.005	< 0.005	0.56	—
Vendor	0.27	0.06	3.28	1.53	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,807	3,807	0.24	0.58	11.1	—
Hauling	0.17	0.02	1.66	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	3.39	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.55	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.06	3.42	1.50	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,808	3,808	0.24	0.58	0.29	—
Hauling	0.17	0.02	1.74	0.86	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,565	1,565	0.15	0.26	0.09	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	67.1	67.1	< 0.005	< 0.005	0.12	—
Vendor	0.13	0.03	1.67	0.72	0.01	0.03	0.52	0.55	0.03	0.14	0.17	—	1,826	1,826	0.11	0.28	2.30	—
Hauling	0.08	0.01	0.85	0.41	< 0.005	0.01	0.21	0.21	0.01	0.06	0.07	—	750	750	0.07	0.12	0.71	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.1	11.1	< 0.005	< 0.005	0.02	—
Vendor	0.02	0.01	0.30	0.13	< 0.005	0.01	0.10	0.10	0.01	0.03	0.03	—	302	302	0.02	0.05	0.38	—
Hauling	0.01	< 0.005	0.15	0.08	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	124	124	0.01	0.02	0.12	—

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.96	0.80	5.53	7.09	0.02	0.20	—	0.20	0.18	—	0.18	—	1,942	1,942	0.08	0.02	—	1,948
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.23	0.29	< 0.005	0.01	—	0.01	0.01	—	0.01	—	79.8	79.8	< 0.005	< 0.005	—	80.1
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.2	13.2	< 0.005	< 0.005	—	13.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.04	0.51	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	135	135	< 0.005	< 0.005	0.01	—
Vendor	0.27	0.03	3.22	1.44	0.03	0.06	1.09	1.15	0.06	0.30	0.36	—	3,743	3,743	0.21	0.58	0.26	—
Hauling	0.16	0.01	1.66	0.84	0.01	0.02	0.43	0.45	0.02	0.12	0.14	—	1,537	1,537	0.14	0.25	0.08	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	5.64	5.64	< 0.005	< 0.005	0.01	—
Vendor	0.01	< 0.005	0.13	0.06	< 0.005	< 0.005	0.04	0.05	< 0.005	0.01	0.01	—	154	154	0.01	0.02	0.18	—
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	63.1	63.1	0.01	0.01	0.06	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.93	0.93	< 0.005	< 0.005	< 0.005	—
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	25.5	25.5	< 0.005	< 0.005	0.03	—
Hauling	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	10.5	10.5	< 0.005	< 0.005	0.01	—

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	3.30	4.32	0.01	0.12	—	0.12	0.11	—	0.11	—	1,087	1,087	0.04	0.01	—	1,091
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.29	0.24	1.72	2.25	0.01	0.06	—	0.06	0.06	—	0.06	—	566	566	0.02	< 0.005	—	568
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.31	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	93.7	93.7	< 0.005	< 0.005	—	94.0
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	—

4. Operations Emissions Details

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequest	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/1/2025	1/21/2026	5.00	190	—
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/21/2026	10/13/2026	5.00	190	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38

Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	2.00	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	13.0	100	HHDT,MHDT
Linear, Grading & Excavation	Hauling	4.62	100	HHDT
Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	0.00	18.5	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,020	0.65	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.65	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.65	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	565	0.03	< 0.005
2026	29.4	482	0.03	< 0.005

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	39.3	annual days of extreme heat
Extreme Precipitation	4.40	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	31.0	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A

Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00

Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1
Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281

Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506
Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2

Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—

2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client Provided Equipment list
Construction: Trips and VMT	13 haul trucks and 2 worker trucks accounted for in Linear, Grading & Excavation Phase.

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APPENDIX 3.4:

CALEEMOD REPLENISH BIG BEAR COMPONENT 4 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Evaporation Ponds Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Evaporation Ponds
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.270764, -116.820355
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5156
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

Other Non-Asphalt Surfaces	57.0	Acre	57.0	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.3	25.2	77.7	92.4	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,481	23,481	1.15	0.79	10.9	23,755
2026	26.8	24.9	71.5	90.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,400	23,400	1.12	0.76	10.1	23,665
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	27.2	25.2	77.9	91.3	0.20	3.24	7.07	10.3	2.94	2.41	5.34	—	23,418	23,418	1.15	0.79	0.28	23,681
2026	26.8	24.9	71.7	89.3	0.20	3.01	7.07	10.1	2.72	2.41	5.13	—	23,338	23,338	1.10	0.76	0.26	23,593
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	13.1	12.1	37.4	43.9	0.10	1.55	3.39	4.94	1.41	1.15	2.56	—	11,232	11,232	0.55	0.38	2.26	11,361
2026	15.1	14.0	40.3	50.2	0.11	1.69	3.97	5.66	1.53	1.35	2.88	—	13,113	13,113	0.62	0.43	2.46	13,259
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.38	2.21	6.83	8.01	0.02	0.28	0.62	0.90	0.26	0.21	0.47	—	1,860	1,860	0.09	0.06	0.37	1,881
2026	2.75	2.55	7.35	9.16	0.02	0.31	0.72	1.03	0.28	0.25	0.53	—	2,171	2,171	0.10	0.07	0.41	2,195

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Area	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.38	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.62	0.62	< 0.005	< 0.005	< 0.005	0.63
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10
Area	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.10	0.10	< 0.005	< 0.005	< 0.005	0.10

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066

Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.7	25.1	73.6	86.5	0.18	3.19	—	3.19	2.89	—	2.89	—	19,001	19,001	0.77	0.15	—	19,066
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	12.8	12.0	35.3	41.5	0.08	1.53	—	1.53	1.38	—	1.38	—	9,110	9,110	0.37	0.07	—	9,141
Dust From Material Movement	—	—	—	—	—	—	2.56	2.56	—	0.94	0.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.34	2.20	6.44	7.57	0.02	0.28	—	0.28	0.25	—	0.25	—	1,508	1,508	0.06	0.01	—	1,513
Dust From Material Movement	—	—	—	—	—	—	0.47	0.47	—	0.17	0.17	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	3.85	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	754	754	0.02	0.02	2.82	764
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.06	3.96	2.04	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	8.08	3,924
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.23	2.74	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	690	690	0.02	0.02	0.07	698
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.41	0.05	4.13	2.05	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,726	3,726	0.35	0.61	0.21	3,917
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.12	1.40	0.00	0.00	0.34	0.34	0.00	0.08	0.08	—	336	336	0.01	0.01	0.58	340
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.20	0.03	2.01	0.98	0.01	0.02	0.49	0.51	0.02	0.13	0.16	—	1,786	1,786	0.17	0.29	1.68	1,879
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.26	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	55.6	55.6	< 0.005	< 0.005	0.10	56.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.37	0.18	< 0.005	< 0.005	0.09	0.09	< 0.005	0.02	0.03	—	296	296	0.03	0.05	0.28	311

3.3. Site Preparation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	26.4	24.8	67.5	84.7	0.18	2.96	—	2.96	2.67	—	2.67	—	19,004	19,004	0.77	0.15	—	19,069
Dust From Material Movement	—	—	—	—	—	—	5.34	5.34	—	1.96	1.96	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	14.8	13.9	37.9	47.6	0.10	1.66	—	1.66	1.50	—	1.50	—	10,673	10,673	0.43	0.09	—	10,710
Dust From Material Movement	—	—	—	—	—	—	3.00	3.00	—	1.10	1.10	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.70	2.54	6.92	8.68	0.02	0.30	—	0.30	0.27	—	0.27	—	1,767	1,767	0.07	0.01	—	1,773
Dust From Material Movement	—	—	—	—	—	—	0.55	0.55	—	0.20	0.20	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.18	3.56	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	738	738	0.02	0.02	2.55	748
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.81	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	7.59	3,848
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.21	2.54	0.00	0.00	0.71	0.71	0.00	0.17	0.17	—	677	677	< 0.005	0.02	0.07	683
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.38	0.03	3.96	2.00	0.02	0.05	1.02	1.07	0.05	0.28	0.33	—	3,658	3,658	0.33	0.59	0.20	3,841
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.04	0.13	1.51	0.00	0.00	0.40	0.40	0.00	0.09	0.09	—	385	385	< 0.005	0.01	0.62	390
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.21	0.02	2.25	1.12	0.01	0.03	0.57	0.60	0.03	0.16	0.18	—	2,054	2,054	0.18	0.33	1.84	2,159
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	63.8	63.8	< 0.005	< 0.005	0.10	64.5
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	< 0.005	0.41	0.20	< 0.005	< 0.005	0.10	0.11	< 0.005	0.03	0.03	—	340	340	0.03	0.05	0.30	357

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.38	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.07	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	5/1/2025	10/14/2026	5.00	380	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	2.00	8.00	367	0.40
Site Preparation	Crushing/Proc. Equipment	Gasoline	Average	2.00	2.00	12.0	0.85
Site Preparation	Off-Highway Trucks	Diesel	Average	2.00	8.00	376	0.38
Site Preparation	Scrapers	Diesel	Average	7.00	8.00	423	0.48
Site Preparation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	10.0	100	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	11.0	100	HHDT
Site Preparation	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	175,000	3,040	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Other Non-Asphalt Surfaces	57.0	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	565	0.03	< 0.005
2026	0.00	482	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	3.00	0.00	0.00	0.00	300

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	148,975

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	482	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.6	annual days of extreme heat
Extreme Precipitation	7.50	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	35.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A

Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	97.6
AQ-PM	1.68
AQ-DPM	4.41
Drinking Water	60.7
Lead Risk Housing	11.6
Pesticides	11.0
Toxic Releases	8.39
Traffic	1.35
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	0.00
Impaired Water Bodies	0.00
Solid Waste	11.6
Sensitive Population	—
Asthma	63.6
Cardio-vascular	92.9
Low Birth Weights	66.3
Socioeconomic Factor Indicators	—
Education	33.5
Housing	22.1

Linguistic	8.49
Poverty	67.0
Unemployment	64.5

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	54.07416913
Employed	2.34826126
Median HI	47.09354549
Education	—
Bachelor's or higher	24.38085461
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	86.34672142
Active commuting	8.161170281
Social	—
2-parent households	29.38534582
Voting	73.38637239
Neighborhood	—
Alcohol availability	87.1423072
Park access	51.00731426
Retail density	9.110740408
Supermarket access	10.57359168
Tree canopy	85.29449506

Housing	—
Homeownership	77.15898884
Housing habitability	49.54446298
Low-inc homeowner severe housing cost burden	35.91684845
Low-inc renter severe housing cost burden	3.708456307
Uncrowded housing	96.93314513
Health Outcomes	—
Insured adults	30.92518927
Arthritis	0.0
Asthma ER Admissions	46.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	16.7
Cognitively Disabled	5.2
Physically Disabled	5.0
Heart Attack ER Admissions	10.8
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	59.1
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—

Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	87.1
SLR Inundation Area	0.0
Children	65.5
Elderly	25.8
English Speaking	82.2
Foreign-born	0.7
Outdoor Workers	31.4
Climate Change Adaptive Capacity	—
Impervious Surface Cover	94.7
Traffic Density	3.7
Traffic Access	23.0
Other Indices	—
Hardship	62.9
Other Decision Support	—
2016 Voting	81.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	19.0
Healthy Places Index Score for Project Location (b)	41.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Client Provided schedule
Construction: Off-Road Equipment	Client provided equipment list
Construction: Trips and VMT	Client provided total worker trips and hauling trips which equals 8,000 round trips.

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APPENDIX 3.5:

CALEEMOD REPLENISH BIG BEAR COMPONENT 5 UNMITIGATED EMISSIONS MODEL OUTPUTS

15309-Sand Canyon Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	15309-Sand Canyon
Construction Start Date	5/1/2025
Operational Year	2027
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.224799, -116.85662
County	San Bernardino-South Coast
City	Unincorporated
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5157
EDFZ	10
Electric Utility	Southern California Edison
Gas Utility	Southwest Gas Corp.
App Version	2022.1.1.14

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	1.37	Mile	0.74	0.00	—	—	—	Pipeline
Other Non-Asphalt Surfaces	2.00	Acre	2.00	0.00	0.00	—	—	Pump/Monitoring Wells
Parking Lot	0.50	Acre	0.50	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.86	1.36	0.74	15,893
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.23	1.73	24.2	28.7	0.11	0.60	6.86	7.46	0.56	1.60	2.16	—	16,984	16,984	1.34	2.11	34.1	17,682
2026	1.48	1.14	9.93	20.8	0.04	0.32	2.27	2.59	0.29	0.55	0.85	—	5,995	5,995	0.25	0.34	11.1	6,114
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.54	1.57	19.2	24.2	0.08	0.55	4.01	4.55	0.51	1.02	1.53	—	12,475	12,475	0.86	1.34	0.66	12,898
2026	3.53	2.37	24.7	36.0	0.10	0.73	5.42	6.16	0.68	1.35	2.03	—	15,465	15,465	0.83	1.36	0.74	15,893
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.24	0.75	9.47	11.7	0.04	0.26	2.04	2.31	0.24	0.51	0.76	—	6,132	6,132	0.43	0.68	5.38	6,350
2026	0.74	0.57	4.76	8.65	0.02	0.16	1.05	1.21	0.15	0.25	0.40	—	2,633	2,633	0.09	0.13	2.01	2,678
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.23	0.14	1.73	2.13	0.01	0.05	0.37	0.42	0.04	0.09	0.14	—	1,015	1,015	0.07	0.11	0.89	1,051
2026	0.13	0.10	0.87	1.58	< 0.005	0.03	0.19	0.22	0.03	0.05	0.07	—	436	436	0.02	0.02	0.33	443

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039

Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Stationar	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.99	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,035	1,035	0.04	0.01	0.00	1,039
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Water	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Waste	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Stationary	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	171	171	0.01	< 0.005	0.00	172

3. Construction Emissions Details

3.1. Linear, Grading & Excavation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	8.12	9.44	0.02	0.37	—	0.37	0.34	—	0.34	—	2,285	2,285	0.09	0.02	—	2,293
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.60	0.51	3.88	4.51	0.01	0.18	—	0.18	0.16	—	0.16	—	1,091	1,091	0.04	0.01	—	1,095
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.71	0.82	< 0.005	0.03	—	0.03	0.03	—	0.03	—	181	181	0.01	< 0.005	—	181

Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.21	0.16	0.41	7.70	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,508	1,508	0.05	0.05	5.65	1,528
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.48	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	13.2	6,422
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.46	5.49	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,381	1,381	0.05	0.05	0.15	1,396
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.67	0.09	6.76	3.35	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	6,097	6,097	0.58	1.00	0.34	6,409
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.07	0.24	2.79	0.00	0.00	0.67	0.67	0.00	0.16	0.16	—	669	669	0.02	0.02	1.17	677
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.32	0.04	3.28	1.60	0.02	0.04	0.80	0.83	0.04	0.22	0.26	—	2,911	2,911	0.27	0.48	2.74	3,063
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	111	111	< 0.005	< 0.005	0.19	112
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.06	0.01	0.60	0.29	< 0.005	0.01	0.15	0.15	0.01	0.04	0.05	—	482	482	0.05	0.08	0.45	507

3.3. Linear, Grading & Excavation (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.23	1.03	7.73	9.43	0.02	0.34	—	0.34	0.31	—	0.31	—	2,286	2,286	0.09	0.02	—	2,294
Dust From Material Movement	—	—	—	—	—	—	0.07	0.07	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.33	0.41	< 0.005	0.01	—	0.01	0.01	—	0.01	—	98.4	98.4	< 0.005	< 0.005	—	98.8
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.3	16.3	< 0.005	< 0.005	—	16.4
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.63	0.05	6.48	3.27	0.04	0.08	1.67	1.75	0.08	0.46	0.54	—	5,986	5,986	0.53	0.96	0.32	6,285
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.23	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	59.1	59.1	< 0.005	< 0.005	0.10	59.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.03	< 0.005	0.28	0.14	< 0.005	< 0.005	0.07	0.08	< 0.005	0.02	0.02	—	258	258	0.02	0.04	0.23	271
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	9.89
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.05	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.04	44.8

3.5. Linear, Drainage, Utilities, & Sub-Grade (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.89	0.75	6.00	7.37	0.02	0.23	—	0.23	0.21	—	0.21	—	1,810	1,810	0.07	0.01	—	1,816
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.46	0.39	3.12	3.84	0.01	0.12	—	0.12	0.11	—	0.11	—	942	942	0.04	0.01	—	945
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.08	0.07	0.57	0.70	< 0.005	0.02	—	0.02	0.02	—	0.02	—	156	156	0.01	< 0.005	—	157
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.16	0.37	7.12	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,477	1,477	0.05	0.05	5.11	1,497
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.20	0.15	0.41	5.08	0.00	0.00	1.41	1.41	0.00	0.33	0.33	—	1,353	1,353	< 0.005	0.05	0.13	1,367
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.08	0.24	2.80	0.00	0.00	0.73	0.73	0.00	0.17	0.17	—	714	714	< 0.005	0.02	1.15	723
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.04	0.51	0.00	0.00	0.13	0.13	0.00	0.03	0.03	—	118	118	< 0.005	< 0.005	0.19	120
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Demolition (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.34	0.28	2.32	2.77	< 0.005	0.06	—	0.06	0.06	—	0.06	—	366	366	0.01	< 0.005	—	368
Demolition	—	—	—	—	—	—	1.62	1.62	—	0.25	0.25	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	20.1	20.1	< 0.005	< 0.005	—	20.1
Demolition	—	—	—	—	—	—	0.09	0.09	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.32	3.32	< 0.005	< 0.005	—	3.34
Demolition	—	—	—	—	—	—	0.02	0.02	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.69	0.09	6.75	3.49	0.04	0.08	1.74	1.82	0.08	0.48	0.56	—	6,351	6,351	0.60	1.04	13.8	6,689
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.08	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	19.2	19.2	< 0.005	< 0.005	0.03	19.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.04	0.01	0.39	0.19	< 0.005	< 0.005	0.10	0.10	< 0.005	0.03	0.03	—	348	348	0.03	0.06	0.33	366
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.18	3.18	< 0.005	< 0.005	0.01	3.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.07	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	0.01	—	57.6	57.6	0.01	0.01	0.05	60.6

3.9. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.23	0.19	2.17	3.86	0.01	0.07	—	0.07	0.07	—	0.07	—	609	609	0.02	< 0.005	—	611

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.08	0.86	1.53	< 0.005	0.03	—	0.03	0.03	—	0.03	—	241	241	0.01	< 0.005	—	242
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.16	0.28	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	39.9	39.9	< 0.005	< 0.005	—	40.0
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.93	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	377	377	0.01	0.01	1.41	382
Vendor	0.13	0.03	1.51	0.71	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	5.11	1,844
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.11	1.37	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	345	345	0.01	0.01	0.04	349
Vendor	0.13	0.03	1.58	0.69	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,757	1,757	0.11	0.27	0.13	1,839
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.05	0.58	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	138	138	< 0.005	< 0.005	0.24	140
Vendor	0.05	0.01	0.63	0.27	0.01	0.01	0.20	0.21	0.01	0.05	0.07	—	695	695	0.04	0.10	0.87	728
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	0.01	0.11	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	22.9	22.9	< 0.005	< 0.005	0.04	23.2
Vendor	0.01	< 0.005	0.12	0.05	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	115	115	0.01	0.02	0.14	121
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.11. Building Construction (2026) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.21	0.18	2.04	3.86	0.01	0.06	—	0.06	0.05	—	0.05	—	611	611	0.02	< 0.005	—	613
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.04	0.43	0.81	< 0.005	0.01	—	0.01	0.01	—	0.01	—	128	128	0.01	< 0.005	—	128
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.15	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	21.2	21.2	< 0.005	< 0.005	—	21.2

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.09	1.78	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	369	369	0.01	0.01	1.28	374
Vendor	0.13	0.02	1.43	0.66	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	4.71	1,814
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.10	1.27	0.00	0.00	0.35	0.35	0.00	0.08	0.08	—	338	338	< 0.005	0.01	0.03	342
Vendor	0.12	0.02	1.49	0.67	0.01	0.03	0.50	0.53	0.03	0.14	0.17	—	1,728	1,728	0.10	0.27	0.12	1,809
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.02	0.28	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	71.8	71.8	< 0.005	< 0.005	0.12	72.7
Vendor	0.03	< 0.005	0.32	0.14	< 0.005	0.01	0.11	0.11	0.01	0.03	0.03	—	362	362	0.02	0.06	0.42	379
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.9	11.9	< 0.005	< 0.005	0.02	12.0
Vendor	< 0.005	< 0.005	0.06	0.03	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	59.9	59.9	< 0.005	0.01	0.07	62.8
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Total	—	—	—	—	—	—	—	—	—	—	—	—	27.8	27.8	< 0.005	< 0.005	—	27.9
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62
Total	—	—	—	—	—	—	—	—	—	—	—	—	4.60	4.60	< 0.005	< 0.005	—	4.62

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	0.02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	< 0.005	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Total	2.16	1.97	10.3	8.72	0.01	1.01	0.00	1.01	1.01	0.00	1.01	0.00	1,007	1,007	0.04	0.01	0.00	1,011
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fire Pump	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167
Total	0.39	0.36	1.87	1.59	< 0.005	0.18	0.00	0.18	0.18	0.00	0.18	0.00	167	167	0.01	< 0.005	0.00	167

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Linear, Grading & Excavation	Linear, Grading & Excavation	5/2/2025	1/22/2026	5.00	190	—

Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	1/22/2026	10/14/2026	5.00	190	—
Demolition	Demolition	5/1/2025	5/29/2025	5.00	20.0	—
Building Construction	Building Construction	6/13/2025	4/17/2026	5.00	220	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Linear, Grading & Excavation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	4.00	84.0	0.37
Linear, Grading & Excavation	Crawler Tractors	Diesel	Average	1.00	4.00	87.0	0.43
Linear, Grading & Excavation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Linear, Grading & Excavation	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Linear, Grading & Excavation	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Linear, Grading & Excavation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Linear, Grading & Excavation	Signal Boards	Electric	Average	1.00	8.00	6.00	0.82
Linear, Drainage, Utilities, & Sub-Grade	Cranes	Diesel	Average	1.00	4.00	367	0.29
Linear, Drainage, Utilities, & Sub-Grade	Forklifts	Diesel	Average	1.00	4.00	82.0	0.20
Linear, Drainage, Utilities, & Sub-Grade	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37

Linear, Drainage, Utilities, & Sub-Grade	Plate Compactors	Diesel	Average	1.00	6.00	8.00	0.43
Linear, Drainage, Utilities, & Sub-Grade	Rollers	Diesel	Average	1.00	6.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Excavators	Diesel	Average	1.00	4.00	36.0	0.38
Linear, Drainage, Utilities, & Sub-Grade	Off-Highway Trucks	Diesel	Average	1.00	4.00	376	0.38
Linear, Drainage, Utilities, & Sub-Grade	Pavers	Diesel	Average	1.00	2.00	81.0	0.42
Demolition	Concrete/Industrial Saws	Diesel	Average	2.00	6.00	33.0	0.73
Building Construction	Bore/Drill Rigs	Diesel	Average	1.00	8.00	83.0	0.50
Building Construction	Plate Compactors	Diesel	Average	1.00	2.00	8.00	0.43
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	5.00	100	LDA,LDT1,LDT2
Demolition	Vendor	—	10.2	HHDT,MHDT
Demolition	Hauling	18.8	100	HHDT
Demolition	Onsite truck	—	—	HHDT
Linear, Grading & Excavation	—	—	—	—
Linear, Grading & Excavation	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Grading & Excavation	Vendor	0.00	10.2	HHDT,MHDT
Linear, Grading & Excavation	Hauling	18.0	100	HHDT

Linear, Grading & Excavation	Onsite truck	—	—	HHDT
Linear, Drainage, Utilities, & Sub-Grade	—	—	—	—
Linear, Drainage, Utilities, & Sub-Grade	Worker	20.0	100	LDA,LDT1,LDT2
Linear, Drainage, Utilities, & Sub-Grade	Vendor	0.00	10.2	HHDT,MHDT
Linear, Drainage, Utilities, & Sub-Grade	Hauling	0.00	20.0	HHDT
Linear, Drainage, Utilities, & Sub-Grade	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	5.00	100	LDA,LDT1,LDT2
Building Construction	Vendor	6.00	100	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Ton of Debris)	Acres Paved (acres)
Linear, Grading & Excavation	—	7,210	0.74	0.00	—
Linear, Drainage, Utilities, & Sub-Grade	—	—	0.74	0.00	—

Demolition	0.00	0.00	0.00	1,500	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	3	74%	74%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
User Defined Linear	0.74	100%
Other Non-Asphalt Surfaces	2.00	0%
Parking Lot	0.50	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	29.4	349	0.03	< 0.005
2026	29.4	346	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Total all Land Uses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	0.00	0.00	6,534

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Other Non-Asphalt Surfaces	0.00	532	0.0330	0.0040	0.00
Parking Lot	19,079	532	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Other Non-Asphalt Surfaces	0.00	0.00

Parking Lot	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Other Non-Asphalt Surfaces	0.00	—
Parking Lot	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor
Fire Pump	Diesel	1.00	24.0	8,760	25.0	0.73

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.1	annual days of extreme heat
Extreme Precipitation	8.60	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	32.4	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.

The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	98.7
AQ-PM	4.43
AQ-DPM	1.14

Drinking Water	70.5
Lead Risk Housing	65.1
Pesticides	4.55
Toxic Releases	18.1
Traffic	3.04
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	0.00
Haz Waste Facilities/Generators	1.80
Impaired Water Bodies	90.1
Solid Waste	75.7
Sensitive Population	—
Asthma	26.6
Cardio-vascular	44.6
Low Birth Weights	67.2
Socioeconomic Factor Indicators	—
Education	9.73
Housing	12.8
Linguistic	0.26
Poverty	55.9
Unemployment	35.0

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	53.62504812

Employed	15.8475555
Median HI	38.16245348
Education	—
Bachelor's or higher	57.65430515
High school enrollment	0.372128834
Preschool enrollment	1.873476197
Transportation	—
Auto Access	44.50147568
Active commuting	57.28217631
Social	—
2-parent households	49.63428718
Voting	87.82240472
Neighborhood	—
Alcohol availability	85.88476838
Park access	61.54240985
Retail density	2.078788656
Supermarket access	11.39484152
Tree canopy	94.22558707
Housing	—
Homeownership	62.4534839
Housing habitability	66.86770178
Low-inc homeowner severe housing cost burden	47.83780316
Low-inc renter severe housing cost burden	50.78916977
Uncrowded housing	77.4541255
Health Outcomes	—
Insured adults	70.78147055
Arthritis	0.0

Asthma ER Admissions	68.5
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	87.1
Cognitively Disabled	32.0
Physically Disabled	7.5
Heart Attack ER Admissions	26.6
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	97.6
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	72.7
SLR Inundation Area	0.0
Children	75.0
Elderly	8.4
English Speaking	75.9

Foreign-born	3.5
Outdoor Workers	55.8
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.3
Traffic Density	2.9
Traffic Access	23.0
Other Indices	—
Hardship	33.2
Other Decision Support	—
2016 Voting	97.1

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	24.0
Healthy Places Index Score for Project Location (b)	21.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Characteristics: Project Details	Rural Big Bear
Construction: Construction Phases	Client Provided Schedule
Construction: Off-Road Equipment	Client provided schedule
Construction: Trips and VMT	Client provided pump station trips

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STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

MOONRIDGE SERVICE STATION (T0607124341) - (MAP)

SIGN UP FOR EMAIL ALERTS

42081 BIG BEAR BOULEVARD
BIG BEAR LAKE, CA 92315
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - SITE ASSESSMENT AS OF 5/2/2018 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083604001T*
CASEWORKER: *MIGUEL OVIEDO*
SAN BERNARDINO COUNTY

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - SITE ASSESSMENT AS OF 5/2/2018 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
REGIONAL BOARD

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Bear Valley (801.71)

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

MOONRIDGE SERVICE STATION (T0607100237) - (MAP)

SIGN UP FOR EMAIL ALERTS

42081 BIG BEAR BLVD
BIG BEAR LAKE, CA 92315
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - SITE ASSESSMENT AS OF 5/2/2018 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CUF Claim #: 2103, 17778
CUF Priority Assigned: B
CUF Amount Paid: $2,074,912

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083601904T*
CASEWORKER: *MIGUEL OVIEDO*
SAN BERNARDINO COUNTY

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases | LUST CUF Data

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - SITE ASSESSMENT AS OF 5/2/2018 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
REGIONAL BOARD

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Bear Valley (801.71)

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

CROSSROAD FUEL (T0607145144) - (MAP)

SIGN UP FOR EMAIL ALERTS

101 BIG BEAR BOULEVARD, WEST
BIG BEAR CITY, CA 92314
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - SITE ASSESSMENT AS OF 12/3/2020 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CUF Claim #: 17992
CUF Priority Assigned: B
CUF Amount Paid: $1,494,604

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083604080T*
CASEWORKER: *KYLE WRIGHT*
SAN BERNARDINO COUNTY - *CASE #: 2003030*

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases | LUST CUF Data

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - SITE ASSESSMENT AS OF 12/3/2020 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE, MTBE / TBA / OTHER FUEL OXYGENATES, TERT-BUTYL ALCOHOL (TBA)

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
REGIONAL BOARD

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Baldwin (801.73)

GROUNDWATER MONITORING FREQUENCY
OF WELLS MONITORED - QUARTERLY : 7, SEMI-ANNUALLY : 8, ANNUALLY : 15, OTHER : 3
REASONS FOR QUARTERLY OR MONTHLY OR OTHER GROUNDWATER MONITORING:

- Assessment Incomplete - *MtBE plume has migrated offsite proximate to large-production water supply well*
- Well Being Sampled During Remedial Action for Progress Assessment - *MtBE plume has migrated offsite proximate to large-production water supply well*
- Well Has Not Shown Reliable Consistency Yet To Warrant Reduction in Sampling Frequency - *Drastic concs fluctuations as a result of mountain snow melt/seasonal water table rises & falls*
- Well Is Last Point of Monitoring Prior to possible impact to Receptor - *MtBE plume has migrated offsite proximate to large-production water supply well*

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

BEAR VALLEY PAVING (T0607100630) - (MAP)

SIGN UP FOR EMAIL ALERTS

41841 GARSTIN DRIVE
BIG BEAR LAKE, CA 92315
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - ELIGIBLE FOR CLOSURE AS OF 3/23/2021 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083603641T*
CASEWORKER: *KYLE WRIGHT*
SAN BERNARDINO COUNTY - *CASE #: 99103*

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - ELIGIBLE FOR CLOSURE AS OF 3/23/2021 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE, MTBE / TBA / OTHER FUEL OXYGENATES

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
REGIONAL BOARD

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Bear Valley (801.71)

GROUNDWATER MONITORING FREQUENCY
OF WELLS MONITORED - OTHER : 5

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

BIG BEAR MARINA (T0607100283) - (MAP)

SIGN UP FOR EMAIL ALERTS

500 PAINE RD
BIG BEAR LAKE, CA 92315
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - REMEDIATION AS OF 11/8/2010 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CUF Claim #: 12126
CUF Priority Assigned: B
CUF Amount Paid: $897,120

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083602283T*
CASEWORKER: *MIGUEL OVIEDO*
SAN BERNARDINO COUNTY - *CASE #: 93027*

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases | LUST CUF Data

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - REMEDIATION AS OF 11/8/2010 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE, MTBE / TBA / OTHER FUEL OXYGENATES

FILE LOCATION
REGIONAL BOARD

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

GROUNDWATER MONITORING FREQUENCY
OF WELLS MONITORED - SEMI-ANNUALLY : 5, OTHER : 1

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY, SURFACE WATER

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Bear Valley (801.71)

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

WAHL'S TEXACO (T0607100176) - (MAP)

SIGN UP FOR EMAIL ALERTS

40553 BIG BEAR BLVD
BIG BEAR LAKE, CA 92513
SAN BERNARDINO COUNTY
LUST CLEANUP SITE (INFO)
OPEN - ELIGIBLE FOR CLOSURE AS OF 9/19/2017 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CUF Claim #: 3226
CUF Priority Assigned: B
CUF Amount Paid: $1,495,000

CLEANUP OVERSIGHT AGENCIES
SANTA ANA RWQCB (REGION 8) *(LEAD)* - *CASE #: 083601573T*
CASEWORKER: *KYLE WRIGHT*
SAN BERNARDINO COUNTY - *CASE #: 90156*

Summary | Case Reviews | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | *Related Cases* | LUST CUF Data

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - ELIGIBLE FOR CLOSURE AS OF 9/19/2017 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
GASOLINE

POTENTIAL MEDIA OF CONCERN
AQUIFER USED FOR DRINKING WATER SUPPLY

FILE LOCATION
REGIONAL BOARD

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

DWR GROUNDWATER SUB-BASIN NAME
Bear Valley (8-009)

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Bear Valley (801.71)

GROUNDWATER MONITORING FREQUENCY
OF WELLS MONITORED - QUARTERLY : 10, SEMI-ANNUALLY : 9, OTHER : 5
REASONS FOR QUARTERLY OR MONTHLY OR OTHER GROUNDWATER MONITORING:

- Assessment Incomplete - *access issues due to bldgs./structures*
- Well Being Sampled During Remedial Action for Progress Assessment - *Ongoing remediation/expansion under CAO 98-112*
- Well Has Not Shown Reliable Consistency Yet To Warrant Reduction in Sampling Frequency - *Drastic fluctuation in contaminat concentrations seasonally*

Site History

Environmental reports pertaining to subsurface investigations/testing and site remediation performed in conjunction with this project, as well as the Regional Board case file, should be reviewed in their entirety to obtain further details regarding this cleanup effort. Regional Board staff are not responsible for the accuracy of any professional interpretations provided in reports submitted by consultants working for the responsible party.

STATE WATER RESOURCES CONTROL BOARD
GEOTRACKER

BIG BEAR CLS III WMF (L10007155213) - (MAP)

SIGN UP FOR EMAIL ALERTS

1.5 MILE OF BALDWIN LAKE
BIG BEAR, CA
SAN BERNARDINO COUNTY
LAND DISPOSAL SITE (INFO)
OPEN - CLOSED/WITH MONITORING AS OF 6/20/2013 - DEFINITION
PRINTABLE CASE SUMMARY / CSM REPORT

CLEANUP OVERSIGHT AGENCIES
COLORADO RIVER BASIN RWQCB (REGION 7) *(LEAD)* - *CASE #: 7A360304281*
CASEWORKER: *SCOT STORMO*

Summary | Cleanup Action Report | Regulatory Activities | Environmental Data (ESI) | Site Maps / Documents | Community Involvement | Related Cases

Regulatory Profile

PRINTABLE CASE SUMMARY

CLEANUP STATUS - DEFINITIONS
OPEN - CLOSED/WITH MONITORING AS OF 6/20/2013 - CLEANUP STATUS HISTORY

POTENTIAL CONTAMINANTS OF CONCERN
NONE SPECIFIED

FILE LOCATION

DWR GROUNDWATER SUB-BASIN NAME

FACILITY TYPE
TITLE 27 - MUNICIPAL SOLID WASTE LANDFILL

POTENTIAL MEDIA OF CONCERN
NONE SPECIFIED

DESIGNATED GROUNDWATER BENEFICIAL USE(S) - DEFINITIONS
MUN, PROC - Note: Also incl all of 801.73.

CALWATER WATERSHED NAME
Santa Ana River - San Bernardino Mountain - Baldwin (801.73)

Site History

The Facility was originally permitted by the Regional Water Board on June 28, 1973. The types of waste that have been accepted at the BBSL include residential, commercial, demolition/construction, and agricultural. The Discharger submitted a report of waste discharge (ROWD), dated March 12, 2013, to update the WDRs for the Facility to incorporate changes resulting from the final closure of the landfill and to comply with current laws and regulations, as set forth in the California Water Code and the California Code of Regulations, Title 27. The Discharger currently operates a refuse transfer station at the Facility. The discharge or deposit of any solid waste at this site is prohibited.

DEPARTMENT OF TOXIC SUBSTANCES CONTROL
ENVIROSTOR

BIG BEAR AUXILIARY AIRPORT (80000973)

SIGN UP FOR EMAIL ALERTS

BIG BEAR, CA
SAN BERNARDINO COUNTY
SITE TYPE: FUDS

SUPERVISOR: DOUGLAS BAUTISTA
OFFICE: CLEANUP CYPRESS
CENSUS TRACT: 6071011300
CALENVIROSCREEN PERCENTILE SCORE: 50-55%

Summary | Sub-Areas | Map | Related Sites | CalEnviroScreen

Site Information

CLEANUP STATUS
INACTIVE - NEEDS EVALUATION AS OF 7/1/2005

SITE TYPE: FUDS
NATIONAL PRIORITIES LIST: NO
ACRES: NONE SPECIFIED
APN: NONE SPECIFIED
CLEANUP OVERSIGHT AGENCIES:
DTSC - SITE CLEANUP PROGRAM - LEAD AGENCY

ENVIROSTOR ID: 80000973
SITE CODE:
SPECIAL PROGRAM:
FUNDING: DERA
ASSEMBLY DISTRICT: 34
SENATE DISTRICT: 19

Regulatory Profile

PAST USE(S) THAT CAUSED CONTAMINATION
NONE SPECIFIED

POTENTIAL CONTAMINANTS OF CONCERN
NONE SPECIFIED

POTENTIAL MEDIA AFFECTED
NONE SPECIFIED

Site History

Back to Top | Help

TECH MEMO

REPLENISH
Big Bear

Date:	10/1/2023
To:	Tom Dodson and Kaitlyn Dodson, TDA
Prepared by:	Michael A. Anderson, Antonia Estevez-Olea, PE - Water Systems Consulting, Inc. (WSC)
Reviewed By:	Laine Carlson, PE (WSC)
Project:	Replenish Big Bear Program
Subject:	Water Quality Analysis for the Sand Canyon Recharge Area

Introduction

As part of the Replenish Big Bear Program (Program), up to 380 acre-feet per year (AFY) of Program Water stored in Big Bear Lake will be used for groundwater recharge at the Sand Canyon Recharge Area over a six-month dry weather period. In addition, Program Water stored in Big Bear Lake could also be extracted to irrigate Bear Mountain Golf Course (up to 120 AFY) and for dust control of a bike park at the Snow Summit Ski Resort (up to 120 AFY). This technical memorandum evaluates whether these proposed uses of the blended Program Water stored in Big Bear Lake have the potential to cause violations of any water quality standards in Big Bear Valley Basin, violations of expected waste discharge requirements or otherwise degrade surface or groundwater quality.

Per the Santa Ana River Basin Plan (Basin Plan), the Big Bear Valley Basin has a total dissolved solids (TDS) objective of 300 mg/L, a hardness objective of 225 mg/L, a sodium objective of 20 mg/L, a chloride objective of 10 mg/L, a nitrate as N objective of 5 mg/L, and a sulfate objective of 20 mg/L. As shown in **Table 1**, Big Bear Lake has more stringent water quality objectives, so the proposed use of Program Water (which is purified water) is estimated to improve water quality in Big Bear Lake for TDS, total nitrogen (TN), and maintain similar water quality for total inorganic nitrogen (TIN) as discussed in the Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/ Big Bear Lake and Shay Pond (WSC/LWA, 2022).

Table 1. Water Quality Objectives for Receiving Waters

Water Quality Objective (WQO)	Big Bear Lake	Big Bear Valley
Total Dissolved Solids (TDS), mg/L	175	300
Hardness, mg/L	125	225
Sodium, mg/L	20	20
Chloride, mg/L	10	10
Total Inorganic Nitrogen, mg/L	0.15	--
Nitrate as N	--	5
Sulfate, mg/L	10	20
Total Phosphorus, mg/L (TMDL Objective)	0.035	--
Chlorophyll-a, mg/L (TMDL Objective)	0.014	--

Per conversations with DDW, Big Bear Lake may be designated as a non-restricted recycled water impoundment, and the subsequent use of Program Water stored in Big Bear Lake water for snowmaking, landscape irrigation, dust control, and groundwater recharge via surface application would be subject to recycled water regulations. The non-potable recycled water uses for landscape irrigation, dust control, snowmaking, and nonrestricted impoundment are anticipated to be regulated under the Statewide Water Reclamation Requirements for Recycled Water Use (Oder WQ 2016-0068-DDW). This Order sets rules for recycled water users to avoid the overapplication of recycled water that would result in runoff or groundwater recharge. Therefore, it can be assumed that these proposed uses will not impact the water quality of the Big Bear Valley Basin.

To permit the Sand Canyon groundwater recharge project via surface application, the City of Big Bear Lake Department of Water (BBLDWP), the lead proponent for that portion of the Program, will need to submit a Report of Waste Discharge (ROWD) and technical studies to the Santa Ana Regional Water Quality Control Board to obtain a Waste Discharge Requirements (WDR) permit to implement the proposed uses in the Sand Canyon Recharge Area. As part of the WDR permit process, an antidegradation analysis will be prepared to evaluate the water quality impacts in more detail than this technical memorandum to demonstrate that the project is consistent with state antidegradation policy. An antidegradation analysis is robust and is used by regulators to set permit conditions. Another study that will be completed as part of the ROWD is a Title 22 Engineering Report. This report will describe how the permittee will comply with the regulations applicable to a surface application groundwater recharge project. Overall, the WDR permitting process ensures that the beneficial uses of Big Bear Valley Basin are protected by setting permit requirements to mitigate and/or avoid impacts. These studies will be completed once the design of the advanced water purification facility (AWPF) and Sand Canyon recharge facilities are more developed to provide the necessary information.

Predicted Concentrations of TDS and Selected Constituents in Sand Canyon Recharge

To evaluate the potential impacts that the Program Water stored in Big Bear Lake will have on Big Bear Valley Basin, the same CE-QUAL-W2 model used for Big Bear Lake Analysis (Anderson 2021) was used to simulate the water quality of the blended Program Water and Big Bear Lake at the extraction point. The extraction point is located near Rathbun Creek, and Program Water would be extracted using an existing pump station and pipeline used by the Bear Mountain and Snow Summit Resorts to extract lake water for snowmaking. The model simulated the extraction of Program Water stored in Big Bear Lake for groundwater recharge (380 AFY) and landscape irrigation (120 AFY). The extraction for dust control was not accounted for in the model since the model showed that Big Bear Lake extractions improved water quality (at least for TDS), so this scenario is more conservative as additional extraction would yield better water quality results. This simulation evaluated predicted conditions for a 41-year time period using available meteorological and hydrologic data for 2009-2019 and a probability-based forward forecast using the median hydrologic scenario with about 2,200 AFY of Program Water being discharged into Big Bear Lake. These assumptions are consistent with the assumptions used to evaluate the impacts on Big Bear Lake without the extractions.

The model explicitly calculated TDS and nitrate as N concentrations at the withdrawal segment in the model where Program Water would be extracted for groundwater recharge and landscape irrigation. The concentrations of sodium, chloride, sulfate, and hardness were not explicitly predicted by this model. While the Big Bear Lake Analysis model could be set up to simulate these additional chemical species by assigning them as generic constituents, there is a lack of necessary watershed runoff and Big Bear Lake concentration data upon which to develop such a model. As a result, sodium, chloride, sulfate, and hardness concentrations in Program Water extracted for recharge and landscape irrigation were estimated from model-predicted TDS concentrations based upon chemical data for Big Bear Lake water collected on December 12, 2021 and July 27, 2023 at TMDL Station #9[1] (**Table 2**) and chemical data collected from the effluent of an ongoing pilot treatment facility that is expected to be representative of the purified water ultimately discharged to Big Bear Lake (**Table 3**).

Table 2. MAJOR ION CHEMISTRY IN BIG BEAR LAKE AS MEASURED ON 12/12/2021 AND 7/27/2023 (TMDL STATION #9)

Date	TDS (mg/L)	Hardness [a] (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)
12 Dec 2021	251	157	33	26	18
27 Jul 2023	230	140	23	21	12
Average	***241***	***149***	***28***	***24***	***15***

[1] Per the Big Bear Lake Nutrient Total Maximum Daily Load (Nutrient TMDL) for Dry Hydrologic Conditions (Resolution No. R8-2006-0023), the Stanfield Middle TMDL monitoring is located closest to the discharge and extraction points. Therefore, the water quality at this location was used. This location is at N 34° 15' 25.9" W 116° 53' 56.0".

[a] Hardness presented as mg/L $CaCO_3$

Table 3. MAJOR ION CHEMISTRY IN PROGRAM WATER BASED UPON PILOT PLANT EFFLUENT, TDS CONCENTRATION AS REPRESENTED IN BIG BEAR LAKE ANALYSIS MODELING AND ASSUMED RO EFFLUENT STABILIZATION USING 10 mg/L Calcium (Ca2+)

Date	TDS [a]	Hardness [b]	Sodium	Chloride	Sulfate
22 Jun 2023	50	25	3.7	2.3	<0.03
29 Jun 2023	50	25	3.8	2.3	<0.03
7 Jul 2023	50	25	NA	2.2	0.03
Average	***50***	***25***	***3.8***	***2.3***	***0.03***

[a] TDS as modeled; [b] hardness presented as mg/L $CaCO_3$. A TDS of 50 mg/L was used to be consistent with previous model runs. Based on pilot data, the TDS content is expected to be lower.

[b] Hardness presented as mg/L CaCO3.

Concentrations of sodium, chloride, sulfate, and hardness were estimated from the Big Bear Lake Analysis model predicted TDS values over time using a ratio approach in which the relative contributions of these ions to TDS were assumed to be fixed at values derived from **Table 2** and **Table 3.** The resulting ratios are shown in **Table 4**. For example, sodium at an average concentration of 28 mg/L under natural runoff conditions (i.e., no Program Water) represented 12% of TDS ($R_{Big\ Bear\ Lake}$=28/241=0.12) in Big Bear Lake and 8% ($R_{Effluent}$=3.8/50=0.08) in Program Water. A simple mixing model, in which natural runoff and Program Water represented about 75% and 25% of total runoff under average conditions, respectively, allows for calculation of approximate flow-weighted average concentration ratios (R) via an equation of the form:

$$R = R_{Big\ Bear\ Lake} * 0.75 + R_{Effluent} * 0.25$$

Concentrations (C) of sodium, chloride, sulfate and hardness in Program Water withdrawn from Big Bear Lake for recharge were then estimated from Big Bear Lake Analysis predicted TDS values at the withdrawal location simply as:

$$C = R * TDS$$

Table 4. CONCENTRATION RATIOS BASED UPON AVERAGE VALUES IN BIG BEAR LAKE AND PILOT PLANT EFFLUENT

Date	Hardness [a]	Sodium	Chloride	Sulfate
Big Bear Lake ($R_{Big\ Bear\ Lake}$)	0.65	0.12	0.10	0.06
Pilot Effluent ($R_{Effluent}$)	0.50	0.08	0.05	0.00
Weighted Average (R)	***0.59***	***0.11***	***0.08***	***0.05***

[a] Hardness presented as mg/L $CaCO_3$

The Big Bear Lake Analysis model previously simulated TDS and nitrate as N concentrations at the withdrawal location in Big Bear Lake supplemented with about 2,200 AFY Program Water (Anderson, 2022). The mean, median, minimum, and maximum concentrations from the model simulation are summarized in **Table 5**. The concentrations of TDS and nitrate as N in the Program Water withdrawn from Big Bear Lake for recharge and irrigation averaged 165.8±37.7 and 0.029±0.059 mg/L, respectively.

As noted previously, the lack of information about concentrations of sodium, chloride, sulfate, and hardness in runoff and Big Bear Lake precluded their direct modeling in recharge flows and necessitated projecting their concentrations. Thus, it was assumed that changes in TDS yield corresponding changes in the concentrations of these constituent ions at the flow-weighted average concentrations ratios provided in **Table 4**. While this represents an approximation, it is geochemically consistent with the conservative behavior of sodium and chloride in all natural waters except hypersaline brines. Sulfate is geochemically conservative up to the solubility limit for gypsum in most natural waters, but is subject to microbial reduction under strongly reducing conditions (which are not widely present in Big Bear Lake) as well as reoxidation. Like sulfate, hardness is not likely to be perfectly conservative, owing in this case to some potential for precipitation of calcium carbonate ($CaCO_3$), although redissolution from bottom sediments can also occur; nonetheless Magnesium(2+) would under most conditions would be conservative, so substantial deviations in the relative concentration of hardness with TDS seems unlikely.

Overall, water withdrawn from Big Bear Lake and used for recharge of Sand Canyon and landscape irrigation is predicted to have mean concentrations of 18.2, 13.3 and 8.3 mg/L for sodium, chloride, and sulfate, respectively, and a mean hardness value of about 97.8 mg/L $CaCO_3$ (**Table 5**). Maximum concentrations of these ions that would be present in recharge water under protracted drought were on the order of about 50% higher than mean values, although the use of average relative flows would be expected to skew somewhat predicted concentrations under both extreme runoff and drought conditions. The Program Team will work with the Santa Ana Regional Water Board during the development of the WDR permit for Sand Canyon Recharge Area to consider the possibility of using extended averaging periods (such as a 5-year or 10-year average) for compliance for some constituents, recognizing that variable local hydrology may result in short term changes in recharge water quality that may balance out over a longer period and still maintain compliance with water quality objectives. In addition, the recharge operation will be operated adaptively based on groundwater levels and water quality trends and can be paused if needed to ensure compliance with permitted water quality limits.

Table 5. MODEL-PREDICTED (TDS AND NITRATE AS N) AND PROJECTED (SODIUM, CHLORIDE, SULFATE, AND HARDNESS) CONCENTRATIONS (mg/L) IN RECHARGE AND IRRIGATION PROGRAM WATER WITHDRAWN FROM BIG BEAR LAKE UNDER THE MEDIAN HYDROLOGIC SCENARIO SUPPLEMENTED WITH ABOUT 2,200 AFY OF PROGRAM WATER

Parameter	TDS	Nitrate as N	Sodium	Chloride	Sulfate	Hardness [a]
Mean ± sd	165.8 ± 37.7	0.029 ± 0.059	18.2 ± 4.1	13.3 ± 3.0	8.3 ± 1.9	97.8 ± 22.2
Median	159.7	<0.001	17.6	12.8	8.0	94.2
Minimum	105.4	<0.001	11.6	8.4	5.3	62.2
Maximum	258.2	0.3	28.4	20.7	12.9	152.4

[a] Hardness presented as mg/L $CaCO_3$

Assessment of Water Quality Impacts

Table 6 presents a water quality comparison of the Program Water stored in Big Bear Lake that would be used for groundwater recharge at Sand Canyon and/or irrigate the projected recharge and irrigation Bear Mountain Golf Course, the mean values from **Table 5**, Big Bear Basin water quality objectives, and the ambient water quality of Big Bear Valley Groundwater basin in the Sand Canyon Recharge Area. The ambient water quality of the Sand Canyon Recharge Area was estimated by averaging water quality data from five drinking water wells near the Sand Canyon Recharge Area. The groundwater quality data were collected in 2014, 2017, and 2021.

The projected Program Water stored in Big Bear Lake for subsequent Lake uses and the ambient water quality near the Sand Canyon Recharge Area were assessed to determine if the proposed future uses of Program Water stored in Big Bear Lake would result in concentrations that exceed existing ambient water quality and/or relevant WQOs or criteria. In order to determine whether the Sand Canyon Recharge Area Project would violate water quality standards, the model predicted mean concentrations for the Program Water stored in Big Bear Lake that would be used for groundwater recharge and/or irrigation were compared against the following:

- If the Project Water stored in Big Bear Lake is below the ambient and most stringent WQO or criterion, no degradation is anticipated.
- If the Program Water stored in Big Bear Lake is above the ambient water quality, but below the most stringent WQO or criterion, there is assimilative capacity available, which would indicate that the WQO would not be violated.
- If the Program Water stored in Big Bear Lake is above the most stringent WQO or criterion, but below the ambient water quality, there is a possibility of water quality improvements, which would provide benefit by improving conditions and help improve conditions to help attain the WQO.

- Finally, if the Program Water stored in Big Bear Lake is above ambient water quality and the most stringent WQO or criterion degradation is anticipated, a complete analysis may be required.

Table 6. COMPARISON OF MOST STRINGENT WATER QUALITY OBJECTIVE OR CRITERION TO THE SAND CANYON RECHARGE GENERAL AREA WATER QUALITY AND PROJECTED PROGRAM WATER IN RECHARGE AND IRRIGATION WITHDRAWN FROM BIG BEAR LAKE UNDER THE MEAN HYDROLOGIC SCENARIO SUPPLEMENTED WITH ABOUT 2,200 AFY

Parameter	TDS	Nitrate as N	Sodium	Chloride	Sulfate	Hardness
Big Bear Valley WQO	300	5	20	10	20	225
Big Bear Valley Average Concentration in Sand Canyon Recharge Area	324	4	17	15	35	277
Model Predicted Mean for Recharge/Irrigation Program Water ± sd	165.8 ± 37.7	0.029 ± 0.059	***18.2 ± 4.1***	***13.3 ± 3.0***	8.3 ± 1.9	97.8 ± 22.2

Note:
Blue – Projected Program Water stored in Big Bear Lake quality is below the ambient and most stringent WQO or criterion. No degradation is anticipated.
Black – Projected Program Water stored in Big Bear Lake quality is above the ambient, but below the most stringent WQO or criterion. Further analysis may be needed to determine impacts on water quality.

As shown in **Table 6,** the existing water quality of the Basin near the Sand Canyon recharge area exceeds the WQOs for TDS, chloride, sulfate, and hardness. The Program Water stored in Big Bear Lake is estimated to be of better quality than ambient and the most stringent WQO for TDS, nitrate as N, sulfate, and hardness, so no degradation is predicted since the Program Water is anticipated to improve water quality conditions and comply with WQOs. The sodium concentration in the Program Water stored in Big Bear Lake is estimated to be above the ambient water quality but below the WQO. Therefore, there is some limited assimilative capacity. The estimated chloride concentration in the Program Water stored in Big Bear Lake is estimated to be below the ambient water quality, but above the WQO. Therefore, the project has the potential to improve or maintain the existing water quality conditions of the basin near the Sand Canyon recharge area, even though the WQO for chloride is exceeded.

Per the Basin Plan, the presence of sodium in drinking water may be harmful to persons suffering from cardiac, renal, and circulatory diseases. As noted in the Basin Plan, the California Department of Health Services (now Division of Drinking Water) and the EPA have not established a limit on the concentration of sodium in drinking water, but recommend for sodium concentrations to not exceed 180 mg/L in groundwaters designated MUN (municipal use) as a result of controllable water quality factors. As shown in **Table 6**, the sodium concentration in the Program Water stored in Big Bear Lake is less than 20 mg/l, well below this threshold and therefore would not be harmful to the MUN use of this Basin. Excess concentrations of sodium in irrigation water reduce soil permeability to water and air. The Basin Plan,

groundwaters designated as AGR (agricultural) must not exceed a sodium absorption ratio (SAR[2]) of 9 as a result of controllable water quality factors. The groundwater basin is not designated as an AGR therefore, this threshold is not applicable, however, the water from the Basin is used to irrigate a golf course. For comparison purposes, the SAR for the Program Water stored in Big Bear Lake is 0.8, so using the Program Water for irrigation is not expected to be problematic.

Per the Basin Plan, excess chloride concentrations lead primarily to economic damage rather than public health hazards. Excess Chlorides can significantly affect the corrosion rate of steel and aluminum and can be toxic to plants. Per the Basin Plan, a safe value for irrigation is considered to be less than 175 mg/L of chloride. Excess chlorides affect the taste of potable water, so drinking water standards are generally based on potability rather than on health. The secondary maximum contaminant upper limit for chloride is 500 mg/L (CCR, Division 4, Chapter 15, Article 16, § 64449), so chloride concentrations should not exceed this limit in groundwaters designated as MUN. As shown in **Table 6**, the chloride concentrations in the Basin and the Program Water stored in Big Bear Lake are approximately 15 mg/l, far below the 500 mg/L and 175 mg/L thresholds discussed above, and therefore the Program Water stored in Big Bear Lake would not be harmful to the MUN use of the Basin and would be suitable for irrigation use.

Conclusions

The Program Water stored in Big Bear Lake is estimated to be of better quality than ambient and the most stringent WQO for TDS, nitrate as N, sulfate, and hardness and is therefore anticipated to improve water quality conditions in the Basin. Although the Program Water stored in Big Bear Lake is projected to have a higher concentration than the established chloride WQO objective, the discharge is necessary to provide important economic and social benefits, the discharge may help reduce current ambient chloride concentrations in the Basin, and the beneficial uses of the Basin would be protected.

As part of the WDR permit process, an antidegradation analysis will be prepared to evaluate the water quality impacts in more detail than this technical memorandum and demonstrate that the project is consistent with state antidegradation policy.

[2] Sodium absorption ratio (SAR) = $\frac{Sodium}{[0.5(calcium+magnesium)]\text{^}0.5}$, in Meq/L

References

Anderson, M.A. 2021. *Big Bear Lake Analysis: Replenish Big Bear*. Final Report.

Anderson, M.A. 2022. *Replenish Big Bear: Modeling of Higher Flows and with Zero TP Load*. Final Report.

Santa Ana Regional Water Quality Control Board. Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin. Updated June 2019.

Water Systems Consulting (WSC) and Larry Walker Associates (LWA), 2022. Antidegradation Analysis for Proposed Discharges to Stanfield Marsh/Big Bear Lake and Shay Pond. February 2022.

Memo

To: Tom Dodson and Kaitlyn Dodson, TDA

From: Ashley Ficke, Mark Ashenfelter, and Jackie Takeda, GEI Consultants

Date: October 19, 2023

Re: Analysis of Aquatic Life Effects and Water Quality of Replenish Big Bear Program's Discharge to Stanfield Marsh and Big Bear Lake

Introduction

In 1982, Big Bear Municipal Water District (BBMWD) and the California Department of Fish and Wildlife (CDFW) dredged a basin on the eastern end of Big Bear Lake and created a culverted connection to the lake. The shoreline was planted, with the goal of creating a wildlife and waterfowl preserve. Stanfield Marsh is 145 acres and has supported a rich assemblage of birds, fish, amphibians, and mammals, some of which are rare. However, Stanfield Marsh has been mostly dry due to the prolonged drought.

As part of the Replenish Big Bear Program (Program), the Big Bear Area Regional Wastewater Agency (BBARWA) will discharge full advanced treated water (purified water) to the east end of Stanfield Marsh, which is hydrologically connected to Big Bear Lake through a set of culverts under the Stanfield Cutoff. The discharge to Shay Pond was not evaluated since this Program component will not be implemented in the near future.

GEI was retained by Tom Dodson and Associates to determine the projected effects of the discharge of purified water to aquatic life in Stanfield Marsh and Big Bear Lake. The memo evaluates the available water quality results and describes the data gaps that limit our understanding of how Program implementation will affect beneficial uses related to aquatic life and how these beneficial uses of Stanfield Marsh and Big Bear Lake will be protected through the implementation of the Program.

This memorandum summarizes and analyzes potential impacts to the water quality, aquatic life, and beneficial uses as a result of the Program's discharge to Stanfield Marsh and Big Bear Lake. The analysis uses modeled outputs specific to Big Bear Lake, and partial BBARWA advanced water purification facility pilot data for the Replenish Big Bear Pilot Study collected from June through September 2023, and the Antidegradation Analysis (WSC 2022) to anticipate potential impacts. The Memo also described the data gaps that limit our understanding of how the Stanfield Marsh/Big Bear Lake discharge will affect beneficial uses related to aquatic life and how these beneficial uses of Stanfield Marsh and Big Bear Lake will be protected through the implementation of the Program. Data gaps and sources of uncertainty are addressed as part of an adaptive management and monitoring plan.

Replenish Big Bear Program

BBARWA operates an existing regional wastewater treatment plant (WWTP) and related facilities in Big Bear Valley. BBARWA has partnered with Big Bear City Community Service District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), BBMWD, and Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), collectively known as the Agency Team, to develop the Replenish Big Bear Program. The Replenish Big Bear Program is intended to help protect Big Bear Valley and the Santa Ana Watershed from the impacts of drought and variable precipitation by recovering a water resource currently discharged outside of the watershed. The Replenish Big Bear Program is comprised of three independent projects:

1) Discharge of the Program's purified water to Stanfield Marsh, which is a tributary to Big Bear Lake, and a separate discharge to Shay Pond, which will not be implemented in the near future;
2) Use Program water stored in Big Bear Lake for purposes such as landscape irrigation of the local golf course, dust control, and snowmaking; and
3) Use Program water stored in Big Bear Lake for groundwater recharge in Sand Canyon.

The discharge to Stanfield Marsh is the focus of this analysis. This discharge has been proposed to recover up to 2,200 acre-feet per year (AFY) of treated wastewater that is currently exported to Lucerne Valley. Treatment upgrades at the BBARWA WWTP would include tertiary filtration, nutrient removal, ultra filtration, reverse osmosis, and ultraviolet disinfection and advanced oxidation process for 100 percent of the effluent. The proposed location for discharge is the upstream end of Stanfield Marsh (WSC 2022). Impacts on Shay Pond were not evaluated since this discharge is not presently planned to be implemented in the near future.

Beneficial Uses of Stanfield Marsh and Big Bear Lake

Santa Ana River Basin Water Quality Control Plan

The Water Quality Control Plans contain descriptions of the legal, technical, and programmatic bases for water quality regulation. They describe the beneficial uses of major surface waters, their tributaries, and the corresponding water quality objectives (WQOs) put into effect to protect these beneficial uses. Water Quality Control Plans must be updated every three years in compliance with the Porter-Cologne Act. The Santa Ana Regional Water Quality Control Plan: Santa Ana River Basin Plan (Basin Plan) designates lakes and reservoirs and inland wetlands in the Program area along with their associated beneficial uses for each water body as summarized in **Table 1** (San Bernardino Mountain Hydrologic Area, Bear Valley Hydrologic Subarea, Hydrologic Unit #801.71). Designated beneficial uses for specific surface water and groundwater resources and the enforceable water quality objectives necessary to protect those beneficial uses are defined in the Basin Plan.

The Basin Plan includes numerical and narrative water quality objectives for microbiological, physical, and chemical water quality constituents. In the Santa Ana River Region, regional objectives are set for ocean waters, enclosed bays and estuaries, inland surface waters, and groundwaters. Since Stanfield Marsh and Big Bear Lake are identified as the discharge locations for the Program's purified water, regional objectives for lakes and reservoirs and inland wetlands as outlined in Chapter 4 of the Basin Plan are considered as there are several identified designated beneficial uses.

Table 1. Designated Beneficial Uses within Program Area.

Waterbody	Beneficial Uses									
	MUN	AGR	GWR	REC1	REC2	COMM	WARM	COLD	WILD	RARE
Lakes and Reservoirs – Upper Santa Ana River Basin[1]										
Big Bear Lake	X	X	X	X	X	X	X	X	X	X
Inland Wetlands[1]										
Stanfield Marsh[2]	X			X	X			X	X	X

[1] Basin Plan – Table 3-1
[2] This is a created wetland as defined in the wetland discussion of the Basin Plan
Source: Santa Ana River Basin Plan 2019

Beneficial uses as identified in **Table 1** are defined below. The focus of this memo will be evaluating the designated beneficial uses that may impact aquatic wildlife in Big Bear Lake and Stanfield Marsh, which are COMM, WARM, COLD, WILD, and RARE.

- **Municipal and Domestic Supply (MUN)** Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- **Agricultural Supply (AGR)** Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
- **Groundwater Recharge (GWR)** Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
- **Water Contact Recreation (REC-1)** Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white-water activities, fishing, or use of natural hot springs.
- **Non-Contact Water Recreation (REC-2)** Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- **Commercial and Sport Fishing (COMM)** Uses of water for commercial or recreational collection of fish and shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
- **Warm Freshwater Habitat (WARM)** Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- **Cold Freshwater Habitat (COLD)** Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- **Wildlife Habitat (WILD**) Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

- **Rare, Threatened, or Endangered Species (RARE)** Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

Water Quality Objectives

Water quality objectives for all inland surface water, which includes streams, rivers, lakes, and wetlands within the region are discussed in Chapter 4 of the Basin Plan and summarized in **Table 2**. This would apply to the Program area, particularly where the Program's purified water will be discharged into Stanfield Marsh. Although Stanfield Marsh does not have numerical water quality objectives, the numerical water quality objectives for Big Bear Lake are applied to this discharge as the water quality objectives are more stringent, and Stanfield Marsh has been mostly dry since 2015.

Table 2. Basin Plan Water Quality Objectives for Inland Surface Waters.

Constituents	Basin Plan Water Quality Objective
Algae	Waste discharges shall not contribute to excessive algal growth in inland surface receiving waters.
Ammonia, Un-ionized	Un-ionized ammonia objectives for WARM and COLD designated waterbodies in the Region. Calculated numerical Un-ionized ammonia as N objectives as well as corresponding total ammonia nitrogen concentration for various pH and temperature conditions are shown in Tables 4-2 and 4-3 of the Basin Plan.
Boron	Controllable water quality factors shall not exceed 0.75 ppm.
Chemical Oxygen Demand	Waste discharges shall not result in increases in Chemical Oxygen Demand levels, which adversely affect beneficial uses.
Chloride	Water shall not exceed 10 ppm for Big Bear Lake as a result of controllable water quality factors.
Chlorine Residual	Wastewater discharged shall not exceed 0.1 ppm.
Color	Water shall be free of coloration that cause nuisance or adversely affect beneficial uses. The natural color of fish, shellfish, or other inland surface water resources used for human consumption shall not be impaired.
Dissolved Solids, Total	Controllable water quality factors shall not exceed 175 ppm for Big Bear Lake.
Floatables	Water shall not contain floating material, including solids, liquids, foam, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Fluoride	Concentrations shall not exceed the annual average of maximum optimal fluoride ranging from 0.7 ppm to 1.2 ppm when daily air temperature is greater than 32.5 and below 12.0 °C respectively. See page 4-11 of Basin plan for more detail.
Hardness (as $CaCO_3$)	Water shall not exceed 125 ppm for Big Bear Lake as a result of controllable water quality factors. Hardness of receiving waters used for MUN shall not be increased as a result of waste dischargers to levels that adversely affect beneficial uses.
Methylene Blue-Activated Substances (MBAS)	Controllable water quality factors shall not exceed 0.05 ppm in designated MUN waters. Waste discharges shall not contain concentrations of surfactants resulting in foam in the course of flow or use of the receiving water.
Nitrate	Controllable water quality factors shall not exceed 10 ppm (as N) in designated MUN waters.
Total Inorganic Nitrogen	Controllable water quality factors shall not exceed 0.15 ppm for Big Bear Lake.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water

Constituents	Basin Plan Water Quality Objective
	or on objects in the water that cause nuisance, or adversely affect beneficial uses.
Dissolved Oxygen	5.0 ppm minimum for WARM designated waters; 6 ppm for COLD designated waters. In addition, waste discharges shall not cause the median dissolved oxygen concentration to fall below 85 percent of saturation or the below 75 percent of saturation within a 30-day period.
Pathogen Indicator Bacteria	< 126 E. coli organisms/100 mL for REC1 and REC2 designated waters.
pH	Controllable water quality factors shall not be raised above 8.5 or depressed below 6.5.
Radioactivity	Shall not be present in concentrations which are deleterious to human, plant, or animal life. MUN designated waters shall meet Title 22 drinking water standards.
Sodium	Controllable water quality factors shall not exceed 20 ppm for Big Bear Lake.
Solids, Suspended and Settleable	Shall not contain suspended or settleable solids in amounts which cause a nuisance or adversely affect beneficial uses.
Sulfate	Controllable water quality factors shall not exceed 10 ppm for Big Bear Lake.
Sulfide	Shall not be increased as a result of controllable water quality factors.
Tastes and Odors	Waters shall not contain taste or odor producing substances in concentrations that impart undesirable tastes or odor to fish flesh or other edible products of aquatic origin, that cause nuisance, or adversely affect beneficial uses.
Temperature	Temperature of COLD designated waters shall not increase by more than 5°F. Temperature of WARM designated waters shall not be raised above 90°F June through October or above 78°F during the rest of the year. Lake temperatures shall not be raised more than 4°F above established normal values as a results of controllable water quality factors.
Toxic Substances	Shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health. Concentrations of contaminants in existing or potential sources of drinking water shall not occur at levels that are harmful to human health. Concentrations of toxic pollutants in the water column, sediments or biota shall not adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 100 NTU or greater than 20 percent in areas where natural turbidity is 0 – 50 NTU.

Note: ppm = parts per million; NTU = nephelometric turbidity units
Source: Santa Ana River Basin Plan 2019. Chapter 4

Receiving Water Quality Evaluation

To understand potential water quality impacts to the receiving water bodies, Stanfield Marsh and Big Bear Lake, a treatment pilot study was conducted. The Program's pilot study goals are to: (1) demonstrate process performance for site-specific wastewater conditions to regulatory agencies, (2) confirm the proposed treatment process as a viable design approach to meet the target treatment levels, and (3) quantify the total system recovery for product water. During the pilot study, one set of samples was collected on July 20, 2023, from the effluent of the full advanced treatment pilot system (i.e., purified water) to evaluate the following constituents:

- The Santa Ana River Basin Plan (Basin Plan) Water Quality Objectives (WQOs) for Big Bear Lake;
- Priority pollutants from the California Toxic Rule (CTR) per Title 40 of Code of Federal Regulations (40 CFR) Part 131.38;
- The Maximum Contaminant Levels (MCLs) for Inorganic and Organic Chemicals as identified in Table 64431-A and Table 64444-A of the California Code of Regulation (CCR), Title 22, Chapter 15;
- Radionuclide chemicals in Tables 64442 and 64443 of the CCR, Title 22, Chapter 15;
- Disinfection byproducts in Table 64533-A of the CCR, Title 22, Chapter 15.5;
- Division of Drinking Water chemicals with notification levels (NLs);
- Lead and copper;
- Big Bear Lake Nutrient TMDL for Dry Hydrological Conditions;
- State Water Board's Water Quality Goals Online Database; and
- Regional Board and DDW specified chemicals.

In addition, BBARWA collected weekly samples after the wastewater received RO and UVAOP treatment from June through September 2023. The treated effluent results from the RO unit are shown in **Appendix A** and the results from the UVAOP unit in **Appendix B**. **Table 3** provides a summary of detected constituents from both the RO and UVAOP effluents. Both effluents are evaluated against the most stringent water quality standards used to protect the most sensitive designated beneficial uses for Big Bear Lake. As mentioned earlier, since Stanfield Marsh does not have numeric WQOs and has been predominately dry since 2015, the WQOs for Big Bear Lake are utilized. Available water quality data from Big Bear Lake are also included in **Table 3** to represent baseline conditions.

Three constituents exceed Big Bear Lake ambient levels or the most stringent WQO. Although boron does not exceed the most stringent WQO, the pilot study result is above Big Bear Lake ambient boron levels. This is based on a single result; therefore, boron is further discussed in the Data Gaps and Limitations Section. In addition, it is anticipated that boron will consume less than 10% of the assimilative capacity, as discussed in the Draft Environmental Impact Report. Similar to boron, ammonia pilot study results meet the most stringent WQO, however results are above ambient receiving water quality. For total inorganic nitrogen (TIN), the pilot study results exceed the ambient Big Bear Lake levels and the most stringent WQO. As a result of the pilot study results, treatment process optimization for ammonia and TIN are being explored to meet the ambient receiving water quality and the most stringent WQOs. Further discussion on ammonia and TIN is in the Nutrients Section.

Table 3. Summary of Preliminary Water Quality Results.

Parameter	Units	Replenish Big Bear Number of Samples	Replenish Big Bear[1]	Big Bear Lake[2]	Most Stringent WQO or Criterion
13C-2,3,7,8-TCDD	ppb	1	0.0014	n/a	$3x10^{-8}$
1,1,2-Trichloroethane	ppb	1	0.08	n/a	5
1,2,3-Trichloropropane	ppt	1	3.7	n/a	5
Alkalinity as $CaCO_3$	ppm	6	6.16	n/a	n/a

Parameter	Units	Replenish Big Bear Number of Samples	Replenish Big Bear[1]	Big Bear Lake[2]	Most Stringent WQO or Criterion
Ammonia[3, 4]	ppm	9	0.15	0.063	0.49
Boron	ppm	1	0.12	0.054	0.7
Calcium[3]	ppm	9	0.11	n/a	n/a
Chloride[3]	ppm	9	8.3	24 [8]	10
Chlorophyll-a	ppb	n/a	n/a	9.3 [6]	14
Di(2-ethylhexyl)adipate	ppb	1	0.082	n/a	400
Dissolved Organic Carbon	ppm	6	0.32	n/a	n/a
Dissolved Phosphorus[3]	ppm	8	0.2	n/a	n/a
E. coli	CFU/mL	1	Not detected	n/a	< 126
Fluoride	ppm	1	0.023	0.41	0.7
Formaldehyde	ppb	1	19	n/a	100
Gross Beta	pCi/L	1	1.07	n/a	50
Hexavalent Chromium	ppb	1	0.16	n/a	10
Hardness (as $CaCO_3$)[3, 5]	ppm	n/a	25	157	125
Magnesium[3]	ppm	9	0.02	n/a	n/a
Mercury, Total	ppb	1	0.00085	0.270	0.05
Nitrate as N[3]	ppm	9	0.05	n/a	10
Nitrite as N[3]	ppm	9	0.01	n/a	1
Nitrogen, Kjeldahl[3]	ppm	9	0.13	n/a	1
Nitrogen, Total[3]	ppm	8	0.16	0.948 [6]	1
N-Nitrosomorpholine (NMOR)	ppt	2	1.45	n/a	n/a
Phosphorus, Total[3]	ppm	9	0.011	0.037 [6]	0.035
Potassium[3]	ppm	7	0.65	n/a	n/a
Radium 226	pCi/L	1	0.0486	n/a	5 (combined)
Radium 228	pCi/L	1	0.369	n/a	
Silica[3]	ppm	8	0.43	n/a	n/a
Sodium	ppm	1	3.9	28 [8]	20
Specific Conductance[3]	µmhos/cm	9	65	391	700
Strontium[3]	ppb	9	1.71	n/a	4
Sulfate[3]	ppm	9	0.15	15 [8]	10
Total Dissolved Solids[5]	ppm	n/a	50	251[6]	175
Total Inorganic Nitrogen[3, 4]	ppm	9	0.21	0.049 [6]	0.15
Total Organic Carbon	ppm	5	0.28	n/a	n/a
Trichloroacetic acid	ppb	1	0.44	n/a	60 [7]
Turbidity[3]	NTU	9	0.14	n/a	5

Note: ppm = parts per million; ppb = parts per billion; ppt = parts per trillion; CFU/mL = colony forming units per milliliter; pCi/L = picocurries per liter; n/a = not applicable

[1] Results from AWPF-UVAOP-EFF (i.e., purified water without stabilization) sampling location sampled July 20, 2023 and weekly AWPF-UVAOP-EFF weekly samples. Average of results reported if multiple samples were collected. Results may change as the Pilot Study is finalized.

[2] Results were extracted from Table 7 of the Antidegradation Analysis (WSC 2022). Data is based on a simple sample taken on December 2, 2021, by BBMWD. For constituents monitored by the Nutrient TMDL, averages and for the Lake-wide results and were calculated using Nutrient TMDL 2009-2019 data.

[3] Sample collected from the AWPF-RO-EFF (i.e., Program water after RO treatment but before disinfection). Results may change as the Pilot Study is finalized

[4] Other nutrient treatment options to attain a higher removal efficiency are being explored to meet the most stringent TIN WQO of 0.15 ppm.

[5] The results of the pilot study are not provided since the concentrations will change after the purified water is stabilized. The purified water will be stabilized to prevent geochemical reactions such as mineral dissolution, oxidation, or desorption in Stanfield Marsh.

[6] TDS average was obtained from the Lake Analysis Table 19 baseline scenario and nutrients and chlorophyll-a averages from the Lake Analysis Table 22 baseline scenario (Anderson 2021).

[7] Part of the sum for five haloacetic acids, which has a drinking water MCL of 60 ppb.

[8] BBMWD collected an additional sample on July 27, 2023 at TMDL Station #9. Therefore, the results from this event and the sample collect in December 2021 were averaged.

Algae

It is possible that the rewetting of Stanfield Marsh will result in an increase in biologically available phosphorus (Surridge et al. 2012), which would increase algal growth in Stanfield Marsh, and in Big Bear Lake, if Stanfield Marsh spilled to the lake during rewetting. The increase in phosphorus depends on interstitial pore size, total organic carbon in soils (Gale et al. 1994), presence of aquatic vegetation, and the extent of the varial zone (Song et al. 2007). A small varial zone may help reduce the amount of phosphorus that is re-released into the aquatic environment. Other factors can include the seasonal timing of rewetting and the amount of uptake and storage by rooted and floating macrophytes – management strategies such as planting of rooted macrophytes can be employed during rewetting, to reduce the amount of phosphorus that remains in Stanfield Marsh and moved into the Big Bear Lake (e.g., Steffenhagen et al. 2012). Limiting the available nutrients in the water column would reduce the probability of nuisance algae blooms. Physical conditions in the rewetted Stanfield Marsh and projected levels of phosphorus in the Replenish Big Bear purified water should not contribute to increased levels of cyanobacteria. The rewetted Stanfield Marsh will be shallow and well-mixed (Anderson, personal communication 08/2023). Cyanobacteria benefit from stratified conditions because of their natural buoyancy but do not thrive in well-mixed water columns.

Temperature

The COLD beneficial use is discussed here because it is more stringent than the WARM beneficial use. Because Stanfield Marsh was mostly dry from 2015 through 2022, temperature modeling was required to estimate Program effects (Anderson 2022a). Dr. Anderson used his Big Bear Lake model to run a five-year simulation period, with minimum effluent temperatures of 12°C, a maximum temperature of 22°C, and a scenario of approximately 2,200 AFY of discharge.

Under the modeling scenario, water temperature excursions over 5°F/2.8°C in Stanfield Marsh only occurred during discrete periods when water levels were exceptionally low (≤ 1 meter). However, because of the frequency at which low water would occur, the number of excursions would be substantial. Results from Anderson 2022a highlighted some important general findings. Stanfield Marsh and Big Bear Lake are hydrologically connected through a set of culverts. For water flows to move from Stanfield Marsh into Big Bear Lake, Stanfield Marsh must first be filled before it starts flowing into the Big Bear Lake. Warm Program purified water discharged to the easternmost section

of Stanfield Marsh will quickly lose heat through exchange with the atmosphere and will be diluted with existing water. Higher lake levels afford greater opportunity for heat loss and dilution such that temperature effects are more likely at low lake levels. As a result of the modeling, the addition of warm purified water to Stanfield Marsh does not alter the heat budget for Big Bear Lake and is not predicted to alter lake temperature, duration, or intensity of thermal stratification. Program-specific information about inflow temperatures is needed to conduct a more complete analysis.

Nutrients

Nutrient constituents are typically TIN, total nitrogen (TN), total phosphorus (TP), and chlorophyll-a. **Table 3** indicates the Program water concentrations for these nutrient constituents generally meet the most stringent WQOs to protect the designated beneficial uses of Stanfield Marsh and Big Bear Lake, except for TIN. In addition, the Antidegradation Analysis (WSC 2022) prepared for the Program, predicted long-term average concentrations of TIN, TN, TP, and chlorophyll-a, which were lower with the proposed Program water discharge at various rates as compared to the predicted baseline condition, except for TIN under the 2,210 AFY + TP Offset. It is unclear why the model predicted increased TIN under this scenario while all other scenarios showed significantly reduced TIN values relative to the modeled baseline; however, the modeled difference in TIN between the Baseline and 2,210 AFY + TP Offset scenarios is approximately 4 percent, which is within the range of model variance and is considered statistically insignificant. Although modeling shows the projected long-term average concentration of TIN is similar to the modeled baseline condition, the pilot study results indicated the average TIN exceeded the Basin Plan WQO. Treatment process optimization is being explored to attain a higher removal efficiency to meet the most stringent TIN WQO of 0.15 ppm, which will also help reduce ammonia concentrations. For the purposes of this analysis, it is assumed that treatment optimization will result in attainment of 0.15 ppm TIN. If additional treatment equipment is needed to meet this objective, or if regulatory mechanisms are pursued to allow discharge above the TIN WQO, consistency with the Replenish Big Bear Program CEQA documentation will be verified, and, if determined necessary to comply with CEQA, subsequent CEQA documentation will be conducted.

Data Gaps and Limitations

Although modeling and a pilot study has been conducted for this Program, there are still some data gaps to better understand the potential impacts to the designated beneficial uses for Stanfield Marsh and Big Bear Lake with respect to aquatic wildlife and plants. These data gaps would be best resolved when Program water is discharged to Stanfield Marsh. Constituents of interest with data gaps are boron, dissolved oxygen, pH, and temperature. These constituents are further explained below.

Boron

Boron is a naturally occurring element, and boron deposits are found in desert areas in California (State Water Board 2017). Anthropogenic sources of boron include industrial wastewater discharges, municipal wastewater discharges, and agricultural practices. As referenced in Schoderboeck et al. (2011), boron does not biodegrade in surface water or sediments in freshwater environments.

California's searchable database for water quality goals also lists an agricultural goal of 0.7 ppm based on tolerance of various crops to boron reported in Ayers and Westcott (1985); this concentration of 0.7 ppm is well above the effluent concentration of 0.12 ppm. Boron toxicity can affect most crops, but there is a wide range of tolerance (Ayers and Westcott 1985); the most sensitive crops are affected

by boron concentrations approaching 0.5 ppm. Schoderboeck et al. (2011) also assessed toxicity data for aquatic environments through two approaches and review of extensive data; these two approaches resulted in predicted no effect concentrations in aquatic environments of 0.18 and 0.34 ppm. Boron is accumulated by rooted aquatic plants and algae; the extent to which this occurs is species-specific. Boron does not biomagnify or bioconcentrate in the food web or become concentrated in fish or invertebrates (CMME 2009).

While boron concentrations in the purified water are below receiving water limits as identified in the Basin Plan, only one pilot study boron result was available, and it exceeds the Big Bear Lake ambient boron levels. In addition, there is uncertainty as to how boron would be assimilated into Stanfield Marsh because there is no data that can be collected until the discharge is initiated. However, it appears that uptake by plants can be a significant source of sequestration of boron, suggesting that management of rooted macrophytes may provide a method of removing excess boron from Stanfield Marsh. To determine potential impacts on aquatic wildlife and plants in Stanfield Marsh and Big Bear Lake, it is recommended to conduct boron monitoring once Program water is discharged to Stanfield Marsh. Quarterly monitoring is recommended of the Program water effluent to observe the boron concentration prior to introduction into Stanfield Marsh and at the existing TMDL Sampling Station MWDL9. This location is already an established sampling station through the Big Bear Lake Nutrient TMDL and is representative of Stanfield Middle. If observed boron levels do not meet the Basin Plan WQO, mitigative actions may include but not be limited to the introduction of native plants to absorb boron in Stanfield Marsh.

Dissolved oxygen

Data is not currently available to predict dissolved oxygen levels in Stanfield Marsh, Big Bear Lake, or purified water. However, low dissolved oxygen levels could be ameliorated through aeration of effluent. Stanfield Marsh is shallow enough that stratification is unlikely to occur (Anderson, personal communication). In other words, the water column in Stanfield Marsh would be mixed through water movement and via wind mixing, which would facilitate roughly equal concentrations of dissolved oxygen throughout the water column. Also, it is possible to speculate on dissolved oxygen levels in the purified water, but there is considerable uncertainty surrounding what will happen when this purified water enters Stanfield Marsh. Low-nutrient water entering the marsh may also suppress dissolved oxygen levels by reducing algae and macrophyte production of dissolved oxygen (Anderson, personal communication). To determine potential impacts to aquatic wildlife, once purified water is discharged into Stanfield Marsh, dissolved oxygen should be monitored during and after re-wetting of Stanfield Marsh at the Program water effluent, in Stanfield Marsh (if permitted), and at existing TMDL Sampling Station MWDL9. If observed dissolved oxygen levels do not meet the Basin Plan WQO designated beneficial uses for COLD and WARM, mitigative actions may include but not be limited to the introduction of mechanical intervention to stabilize dissolved oxygen levels.

pH

The Basin Plan pH of inland surface waters water quality objective cannot have pH levels depressed below 6.5; pH values below this level also tend to be associated with lower fish and macrophyte productivity (Avault 1996). The volume of water entering Stanfield Marsh is significant (up to 2.2 MGD, or 3.4 cfs), so the entire volume of the marsh will likely turn over multiple times in a year. Pilot study results were non-detect due to the purified water not being stabilized yet. Based on modeling efforts, the Program’s water hardness is estimated to be around 25 ppm after stabilization.

The low alkalinity and hardness values of the effluent suggest a low buffering capacity and susceptibility to a change in pH upon entering Stanfield Marsh. The buffering capacity of Stanfield Marsh itself is currently unknown because it has been mostly dry since 2015, but soil chemistry has a large effect on the pH of small bodies of water. Despite minor potential pH concerns in Stanfield Marsh, the low hardness of the effluent suggests that it would likely have a negligible effect on the pH of Big Bear Lake, given its large relative volume to the purified water and its higher hardness of 157 ppm.

Since the treatment process maintains a neutral pH between 7 and 8 upstream of the reverse osmosis process, and then become slightly acidic downstream of reverse osmosis, post-treatment chemical addition will be employed to adjust the pH to a neutral level such that the effluent is within the Basin Plan water quality numerical objectives for pH. To determine potential impacts to aquatic wildlife, once purified water is discharged into Stanfield Marsh, pH should be monitored during and after re-wetting of Stanfield Marsh at the Program water effluent and at existing TMDL Sampling Station MWDL9. If observed pH levels do not meet the Basin Plan WQO for inland surface waters, mitigative actions may include but not be limited to introduction of a chemical intervention to stabilize pH levels.

Temperature

Temperature modeling data show that excursions of the COLD standard occurred 44 percent of the time, during low water, when Stanfield Marsh might otherwise be dry. While it is suspected that maintenance of flows and the presence of water are preferable in dry years, even if the COLD standards are not met, this could be confirmed with an adaptive management plan. Additional uncertainty about predicted temperatures arise because no temperature data are available for the Program's purified water - theoretical temperature ranges were developed using data from a pilot Program near sea level and corrected for elevation. As indicated in earlier discussions on the temperature modeling data, additional monitoring is recommended once the Program's purified water is discharged into Stanfield Marsh. Temperature modeling is recommended to be conducted using an online analyzer to obtain continuous readings of the Program water effluent and in Stanfield Marsh. Similar to previous discussions on location of monitoring, the existing TMDL Sampling Station MWDL9 can be utilized. If observed temperature levels do not meet the Basin Plan WQO designated beneficial uses for COLD and WARM, mitigative actions may include but not be limited to introduction of a temperature cooling mechanism to lower the temperature of the Program water before it is introduced into Stanfield Marsh.

Reinvasion by Undesirable Species

Invasive plants and aquatic animals (vertebrate or otherwise) will be able to access Stanfield Marsh when it is rewetted. Because it is upstream of Big Bear Lake, it may be desirable to prevent contamination of the marsh by species such as Eurasian Watermilfoil (*Myriophyllum spicatum*) and Common Carp (*Cyprinus carpio*). Proliferation of Eurasian Watermilfoil can cause periodic depression in dissolved oxygen levels, and this species adversely affects all beneficial uses relating to the protection of aquatic life. It is recommended for monitoring to be conducted at least on a bi-yearly basis to observe the presence of invasive plants and aquatic animals within Stanfield Marsh and Big Bear Lake.

Programed Beneficial Impacts

Big Bear Lake is an important resource that provides extensive recreational, economic, ecological, and aesthetic benefits for the local community as well as the larger inland southern California region. The beneficial uses of Big Bear Lake and Stanfield Marsh are presented in **Table 1.**

Precipitation and snowmelt runoff are the only water sources for Stanfield Marsh and Big Bear Lake, which causes variable water levels on a seasonal and annual basis. When water levels are low, local populations of flora and fauna decrease dramatically through mortality, emigration from the site, or both. Stanfield Marsh has been mostly dry since 2015. Due to the recent rains in 2023, Stanfield Marsh is currently wet.

Beneficial Uses for Rare and Common Wildlife Species

Stanfield Marsh occupies the eastern edge of Big Bear Lake. Because much of the existing marshland in the Big Bear Valley was inundated after the construction of Bear Creek Dam, Stanfield Marsh is critical to replacing wetland habitat that was lost in the late 1800s. However, water levels in the marsh fluctuate widely in response to available snowmelt and precipitation. Although BBMWD and the Natural Heritage Foundation have put significant effort into enhancing 148 acres of wetland vegetation, low water levels have prevented the successful establishment of a lakeshore fringe habitat and/or a wetland plant and animal community (BBL 1999).

The Program's effluent would help support the RARE and WILD beneficial uses simply by re-wetting the area. **Figure 1** shows Big Bear Lake area was at a record low in 2018 and Stanfield Marsh was dry. Extensive modeling by Anderson (2022a) showed that the release of water into Big Bear Lake through Stanfield Marsh would result in large increases in lake water surface elevation and lake water surface area. **Figure 2** shows this increase in inundated area would extend into Stanfield Marsh. Even under a scenario of protracted drought, defined as the fifth percentile of flows entering Stanfield Marsh and Big Bear Lake, at least some water would remain in Stanfield Marsh. This is in stark contrast to existing conditions, wherein the Stanfield Marsh has been mostly dry for several years. Some potential benefits are outlined below.

- Availability of water will allow the establishment of riparian plants, macrophytes, and algae, as well as the invertebrate and vertebrate fauna that rely upon them.
- Some organisms have the ability to adapt to extremely variable environments. For example, highly mobile animals (e.g., waterfowl) will avoid or emigrate from dry areas, and drought-tolerant plants can survive in a wide variety of moisture regimes or can remain dormant for long periods of time. However, less mobile/more specialized species are excluded from highly unpredictable environments. Reducing the degree of disturbance (i.e., episodic drying) will allow more species to utilize the area.
- Maintaining water levels in Stanfield Marsh may also increase lakeshore fringe habitat, which is currently limited due to water level fluctuations. This habitat type is utilized by rare birds (American Bald Eagle *Haliaeetus leucocephalus*, Southwestern Willow Flycatcher *Empidonax trailii extimus*), rare mammals (San Bernardino Flying Squirrel *Glaucomys sarinus*), and rare plants (Slender-petaled Thelypodium *Thelypodium stenopetalum*). Other more common species would benefit from the presence of lakeshore fringe and open water habitat as well. These include amphibians, ducks/wading birds, and bats that forage over open water (BBL 1999).

Returning a reliable source of water to Stanfield Marsh would unequivocally benefit wildlife, particularly aquatic or semi-aquatic species. However, the water quality in Stanfield Marsh is unknown, because while it is simple to characterize purified water, it may change substantially once Stanfield Marsh is rewetted and biological processes become established.

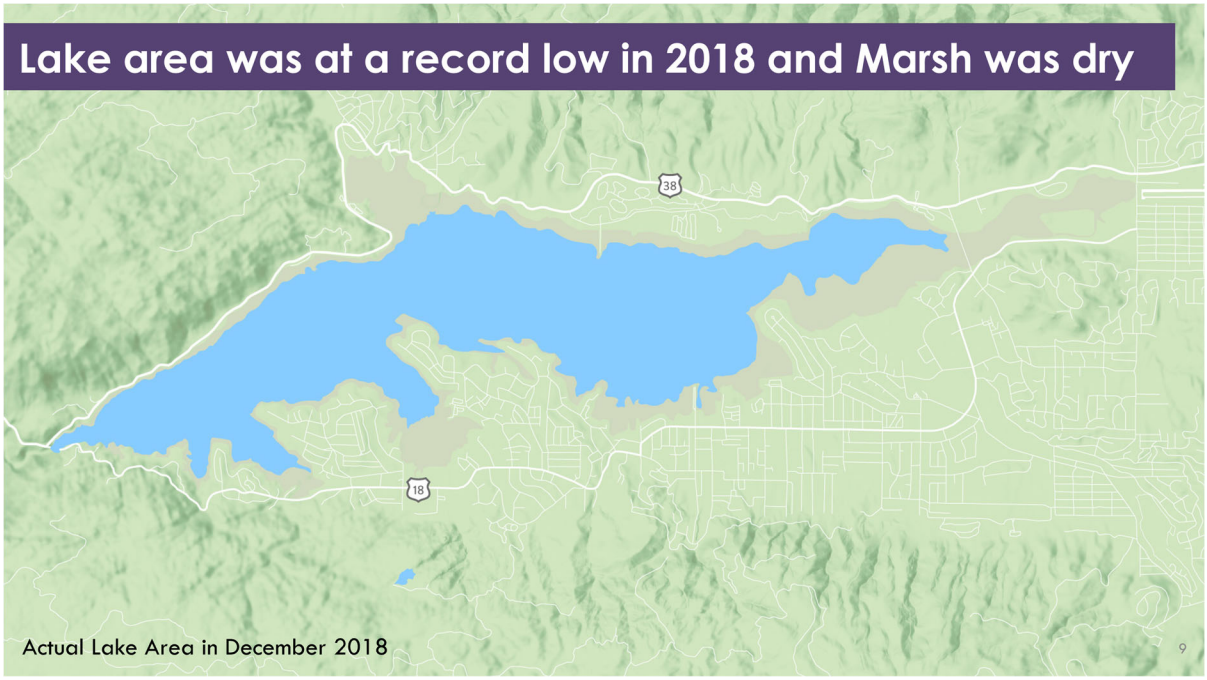

Figure 1. Big Bear Lake Area in December 2018.

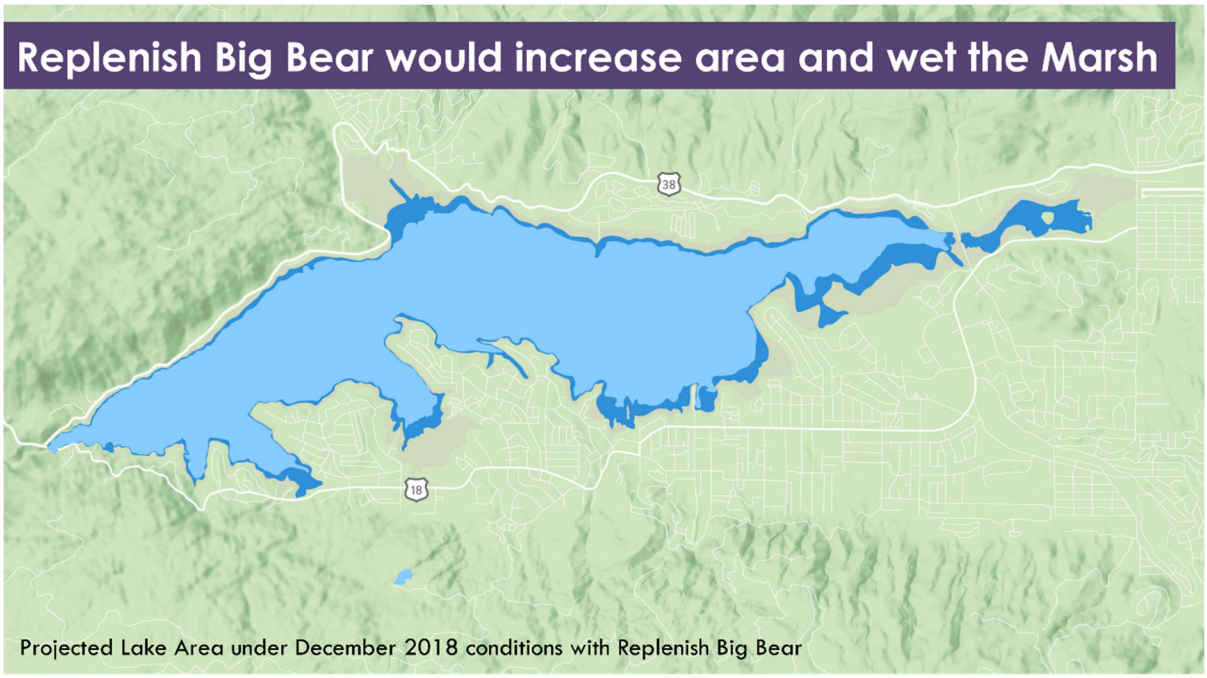

Figure 2. Projections under December 2018 Conditions with Replenish Big Bear Program.

The Lake Analysis (Anderson 2021) simulations for the 2009-2019 evaluation period demonstrated that the Replenish Big Bear Program Lake discharge would result in significant increases in predicted lake levels, volumes, and surface areas relative to baseline conditions. Long-term (2009 to 2050) simulations of the proposed Program water discharge under three different hydrologic scenarios indicate that the discharge would be especially beneficial under an "extended drought" scenario where the discharge is predicted to increase the median lake level by more than 10 feet and the median lake area by nearly 600 acres, which in turn would improve recreational access and provide additional Big Bear Lake habitat as compared to modeled baseline (no Program) conditions. The increased lake level and area benefits provided by the Program water discharge would be more modest under the "prolonged above average rainfall" scenario because higher natural inflows would result in higher lake levels. Error! Reference source not found. summarizes the projected impacts on Big Bear Lake level, area, and volume under three hydrologic conditions modeled in the 2021 Lake Analysis (Anderson 2021).

Table 4. Hydrologic Summary of Projected Impacts on Big Bear Lake.

Lake Physical Parameter (median values shown)	Scenario	Hydrologic Scenario		
		Extended Drought (5th Percentile)	Median Hydrologic Condition (50th Percentile)	Prolonged Above Average Rainfall (95th Percentile)
Lake Level (ft) (Lake max 6,743 ft)	Baseline	6,722	6,733	6,736
	+Program	6,732 (+10.5)	6,738 (+7.2)	6,740 (+5.2)
Volume (AF)	Baseline	23,400	47,536	54,724
	+Program	45,750 (+22,340)	59,664 (+12,128)	65,204 (+10,480)
Area (acres)	Baseline	1,720	2,328	2,474
	+Program	2,290 (+572)	2,568 (+240)	2,669 (+195)

Notes: Data taken from Table 24 of Lake Analysis report. Assumed a discharge rate of 1,920 AFY. Additional benefit is expected with a higher discharge rate.

Nutrients

As discussed in the Antidegradation Analysis (WSC 2022), TDS, TIN, TN, TP, and chlorophyll-a were evaluated using a two-dimensional (2D) hydrodynamic-water quality model (CE-QUAL-W2) developed for Big Bear Lake by Dr. Michael A. Anderson (Dr. Anderson), a limnologist who has in-depth knowledge of the lake. The model was used to predict the long-term average water quality of these constituents in Big Bear Lake under the average hydrologic conditions (50th percentile) and under increased and time-varying flows. The model simulation also assessed the impact of a TP offset program, which is being proposed to treat all the TP loads that will be added as a result of the discharge. For comparison, the model also simulated a no Program alternative to the predicted baseline condition. The predicted concentrations are presented in **Table 5**. Please note that this model run did not account for Program water extractions, which are discussed because extractions were predicted to improve the water quality of the Lake. Therefore, this analysis concludes that the projected long-term average concentration of TIN is similar to the modeled baseline condition.

Table 5. Predicted Long-term Average Lake Concentrations for TDS, TIN, TN, TP, and Chlorophyll-a Under Different Operational Scenarios

Operational Scenario (a) (All at 50th percentile hydrologic condition)	TDS (b) (mg/L)	TIN (b) (mg/L)	TP (b) (µg/L)	TN (b) (mg/L)	Chlorophyll-a (c) (µg/L)
WQO (TMDL target)	**175**	**0.15**	**0.15 (35.0)**	**n/a**	**(14.0)**
Baseline (No Program)	195	0.069	47.7	1.15	14.1
2,200 AFY (99% recovery)	179	0.045	42.3	1.04	13.1
2,000 AFY (90% recovery)	180	0.041	43.4	1.06	12.9
2,200 AFY + TP Offset	179	0.072	39.9	1.00	10.2
2,000 AFY + TP Offset	180	0.040	40.9	1.00	9.5

Notes:

a) The Baseline was evaluated in the 2021 Lake Analysis. The other operational scenarios were evaluated in the 2022 Lake Analysis Update and assume no discharge to Shay Pond. The TP Offset scenarios assume a TP Offset Program is implemented.

b) Expressed as annual average concentrations.

c) Chlorophyll-a shown as growing season average concentrations.

Conclusion

The Program's purified water effluent water quality was evaluated to assess the potential impacts to the water quality, aquatic life, and designated beneficial uses for Stanfield Marsh and Big Bear Lake. Available water quality from the Program's modeling study, BBARWA advanced water purification facility pilot data for the Replenish Big Bear Pilot Study, and antidegradation analyses conducted for this Program were utilized. Although multiple designated beneficial uses have been identified in the Basin Plan for Stanfield Marsh and Big Bear Lake, the designated beneficial uses applicable to aquatic life (COMM, WARM, COLD, WILD, and RARE) were evaluated here as the other beneficial uses have been previously evaluated in other studies.

Available water quality data were compared against the most stringent WQOs applicable to this Program. Based on the pilot study results, all constituents of concern related to this Program are within Big Bear Lake ambient water quality and meet the identified WQOs in Table 3 except for boron, ammonia, and TIN. Conducted modeling studies did not identify TIN as an exceedance but did note the Program needing to implement a TP Offset Program for the Program discharge to attain net zero TP loads to Big Bear Lake to be consistent with the assumptions of the Big Bear Lake Nutrient TMDL for Dry Hydrologic Conditions.

Data gaps were identified for boron, dissolved oxygen, pH, and temperature. To close the data gap, monitoring is recommended once the Program's discharge is introduced to Stanfield Marsh/Big Bear Lake. The Program's discharge effluent would be monitored along with utilizing the existing Nutrient TMDL Sampling Station MWDL9. In addition to the identified water quality constituents, at a minimum bi-yearly monitoring is recommended to observe the presence of invasive plants and aquatic animals within Stanfield Marsh and Big Bear Lake.

This Program is anticipated to provide beneficial impacts to the region. In addition to providing a sustainable water supply to the area and increasing lake levels, rewetting of Stanfield Marsh will be critical to replacing the wetland habitat that was lost in the late 1800s with the construction of the Bear Creek Dam. Thus, the Program would help support the WILD and RARE designated beneficial uses for Stanfield Marsh and Big Bear Lake. The introduction of a TP Offset Program will assist with meeting the Big Bear Lake Nutrient TMDLs.

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Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	6/22/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	6/29/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	7/7/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	7/20/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	7/27/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	8/3/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	8/10/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	8/17/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	8/24/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-RO-EFF	6/22/2023	350.1	7664-41-7	Ammonia	0.19	mg/L
AWPF-RO-EFF	6/29/2023	350.1	7664-41-7	Ammonia	0.12	mg/L
AWPF-RO-EFF	7/7/2023	350.1	7664-41-7	Ammonia	0.17	mg/L
AWPF-RO-EFF	7/20/2023	350.1	7664-41-7	Ammonia	0.13	mg/L
AWPF-RO-EFF	7/27/2023	350.1	7664-41-7	Ammonia	0.17	mg/L
AWPF-RO-EFF	8/3/2023	350.1	7664-41-7	Ammonia	0.14	mg/L
AWPF-RO-EFF	8/10/2023	350.1	7664-41-7	Ammonia	0.14	mg/L
AWPF-RO-EFF	8/17/2023	350.1	7664-41-7	Ammonia	0.071	mg/L
AWPF-RO-EFF	8/24/2023	350.1	7664-41-7	Ammonia	0.21	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7440-42-8	Boron	0.14	mg/L
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.075	mg/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.093	mg/L
AWPF-RO-EFF	7/7/2023	200.7 Rev 4.4	7440-70-2	Calcium	ND	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.077	mg/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.082	mg/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.11	mg/L
AWPF-RO-EFF	8/10/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.16	mg/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.11	mg/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	7440-70-2	Calcium	0.17	mg/L
AWPF-RO-EFF	6/22/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	6/29/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	7/7/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	7/20/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	7/27/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L

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Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	8/3/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	8/10/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	8/17/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	8/24/2023	SM 2340B		Calcium hardness as CaCO3	ND	mg/L
AWPF-RO-EFF	7/27/2023	410.4		Chemical Oxygen Demand	ND	mg/L
AWPF-RO-EFF	6/22/2023	300	16887-00-6	Chloride	2.3	mg/L
AWPF-RO-EFF	6/29/2023	300	16887-00-6	Chloride	2.3	mg/L
AWPF-RO-EFF	7/7/2023	300	16887-00-6	Chloride	2.2	mg/L
AWPF-RO-EFF	7/20/2023	300	16887-00-6	Chloride	1.8	mg/L
AWPF-RO-EFF	7/27/2023	300	16887-00-6	Chloride	2.8	mg/L
AWPF-RO-EFF	8/3/2023	300	16887-00-6	Chloride	27	mg/L
AWPF-RO-EFF	8/10/2023	300	16887-00-6	Chloride	3	mg/L
AWPF-RO-EFF	8/17/2023	300	16887-00-6	Chloride	15	mg/L
AWPF-RO-EFF	8/24/2023	300	16887-00-6	Chloride	18	mg/L
AWPF-RO-EFF	7/20/2023	410.4		COD, Dissolved	ND	mg/L
AWPF-RO-EFF	7/27/2023	410.4		COD, Dissolved	ND	mg/L
AWPF-RO-EFF	6/22/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.34	mg/L
AWPF-RO-EFF	6/29/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.25	mg/L
AWPF-RO-EFF	7/7/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.25	mg/L
AWPF-RO-EFF	7/20/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.33	mg/L
AWPF-RO-EFF	7/27/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.36	mg/L
AWPF-RO-EFF	8/3/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.67	mg/L
AWPF-RO-EFF	8/10/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.34	mg/L
AWPF-RO-EFF	8/17/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.62	mg/L
AWPF-RO-EFF	8/24/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.56	mg/L
AWPF-RO-EFF	6/22/2023	SM 4500 P E	7723-14-0	Dissolved Phosphorus	ND	mg/L
AWPF-RO-EFF	7/7/2023	365.1	7723-14-0	Dissolved Phosphorus	ND	mg/L
AWPF-RO-EFF	7/20/2023	365.1	7723-14-0	Dissolved Phosphorus	ND	mg/L
AWPF-RO-EFF	7/27/2023	365.1	7723-14-0	Dissolved Phosphorus	0.047	mg/L
AWPF-RO-EFF	8/3/2023	365.1	7723-14-0	Dissolved Phosphorus	ND	mg/L
AWPF-RO-EFF	8/10/2023	365.1	7723-14-0	Dissolved Phosphorus	ND	mg/L
AWPF-RO-EFF	8/17/2023	365.1	7723-14-0	Dissolved Phosphorus	0.013	mg/L
AWPF-RO-EFF	8/24/2023	365.1	7723-14-0	Dissolved Phosphorus	ND	mg/L

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	6/22/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	6/29/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	7/7/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	7/20/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	7/27/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	8/3/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	8/10/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	8/17/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	8/24/2023	SM 2340B		Hardness (as CaCO3)	ND	mg/L
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.012	mg/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.019	mg/L
AWPF-RO-EFF	7/7/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.014	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.015	mg/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.017	mg/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.034	mg/L
AWPF-RO-EFF	8/10/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.035	mg/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.028	mg/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	7439-95-4	Magnesium	0.033	mg/L
AWPF-RO-EFF	6/22/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	6/29/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	7/7/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	7/20/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	7/27/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	8/3/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	8/10/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	8/17/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	8/24/2023	SM 2340B		Magnesium hardness as calcium carbonate	ND	mg/L
AWPF-RO-EFF	6/22/2023	Nitrate by calc	14797-55-8	Nitrate as N	0.23	mg/L
AWPF-RO-EFF	6/29/2023	Nitrate by calc	14797-55-8	Nitrate as N	ND	mg/L
AWPF-RO-EFF	7/7/2023	Nitrate by calc	14797-55-8	Nitrate as N	0.051	mg/L
AWPF-RO-EFF	7/20/2023	300	14797-55-8	Nitrate as N	0.0061	mg/L
AWPF-RO-EFF	7/27/2023	300	14797-55-8	Nitrate as N	0.013	mg/L
AWPF-RO-EFF	8/3/2023	300	14797-55-8	Nitrate as N	0.023	mg/L

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	8/10/2023	300	14797-55-8	Nitrate as N	0.068	mg/L
AWPF-RO-EFF	8/17/2023	300	14797-55-8	Nitrate as N	0.038	mg/L
AWPF-RO-EFF	8/24/2023	300	14797-55-8	Nitrate as N	0.027	mg/L
AWPF-RO-EFF	6/22/2023	353.2		Nitrate Nitrite as N	0.26	mg/L
AWPF-RO-EFF	6/29/2023	353.2		Nitrate Nitrite as N	0.053	mg/L
AWPF-RO-EFF	7/7/2023	353.2		Nitrate Nitrite as N	0.068	mg/L
AWPF-RO-EFF	6/22/2023	353.2	14797-65-0	Nitrite as N	0.029	mg/L
AWPF-RO-EFF	6/29/2023	353.2	14797-65-0	Nitrite as N	0.022	mg/L
AWPF-RO-EFF	7/7/2023	353.2	14797-65-0	Nitrite as N	0.017	mg/L
AWPF-RO-EFF	7/20/2023	300	14797-65-0	Nitrite as N	ND	mg/L
AWPF-RO-EFF	7/27/2023	300	14797-65-0	Nitrite as N	0.0045	mg/L
AWPF-RO-EFF	8/3/2023	300	14797-65-0	Nitrite as N	ND	mg/L
AWPF-RO-EFF	8/10/2023	300	14797-65-0	Nitrite as N	0.016	mg/L
AWPF-RO-EFF	8/17/2023	300	14797-65-0	Nitrite as N	ND	mg/L
AWPF-RO-EFF	8/24/2023	300	14797-65-0	Nitrite as N	ND	mg/L
AWPF-RO-EFF	6/22/2023	351.2		Nitrogen, Kjeldahl	0.21	mg/L
AWPF-RO-EFF	6/29/2023	351.2		Nitrogen, Kjeldahl	ND	mg/L
AWPF-RO-EFF	7/7/2023	351.2		Nitrogen, Kjeldahl	0.19	mg/L
AWPF-RO-EFF	7/20/2023	351.2		Nitrogen, Kjeldahl	ND	mg/L
AWPF-RO-EFF	7/27/2023	351.2		Nitrogen, Kjeldahl	ND	mg/L
AWPF-RO-EFF	8/3/2023	351.2		Nitrogen, Kjeldahl	0.13	mg/L
AWPF-RO-EFF	8/10/2023	351.2		Nitrogen, Kjeldahl	ND	mg/L
AWPF-RO-EFF	8/17/2023	351.2		Nitrogen, Kjeldahl	0.089	mg/L
AWPF-RO-EFF	8/24/2023	351.2		Nitrogen, Kjeldahl	0.22	mg/L
AWPF-RO-EFF	6/22/2023	Total Nitrogen		Nitrogen, Total	0.47	mg/L
AWPF-RO-EFF	6/29/2023	Total Nitrogen		Nitrogen, Total	0.053	mg/L
AWPF-RO-EFF	7/7/2023	Total Nitrogen		Nitrogen, Total	0.26	mg/L
AWPF-RO-EFF	7/20/2023	Total Nitrogen		Nitrogen, Total	ND	mg/L
AWPF-RO-EFF	7/27/2023	Total Nitrogen		Nitrogen, Total	ND	mg/L
AWPF-RO-EFF	8/10/2023	Total Nitrogen		Nitrogen, Total	0.084	mg/L
AWPF-RO-EFF	8/17/2023	Total Nitrogen		Nitrogen, Total	0.13	mg/L
AWPF-RO-EFF	8/24/2023	Total Nitrogen		Nitrogen, Total	0.22	mg/L
AWPF-RO-EFF	6/22/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	6/29/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	7/7/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	7/20/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	7/27/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	8/3/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	8/10/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	8/17/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	8/24/2023	SM 4500 P E		Orthophosphate as P	ND	mg/L
AWPF-RO-EFF	6/22/2023	SM 4500 P E		Orthophosphate as P, Dissolved	ND	mg/L
AWPF-RO-EFF	6/29/2023	SM 4500 P E		Orthophosphate as P, Dissolved	ND	mg/L
AWPF-RO-EFF	6/22/2023	SM 4500 P E	7723-14-0	Phosphorus, Total	ND	mg/L
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	2023695	Potassium	0.58	mg/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	2023695	Potassium	0.7	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	2023695	Potassium	0.5	mg/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	2023695	Potassium	0.6	mg/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	2023695	Potassium	1	mg/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	2023695	Potassium	0.51	mg/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	2023695	Potassium	0.67	mg/L
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	7631-86-9	Silica	0.35	mg/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	7631-86-9	Silica	0.32	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7631-86-9	Silica	0.41	mg/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	7631-86-9	Silica	0.42	mg/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	7631-86-9	Silica	0.54	mg/L
AWPF-RO-EFF	8/10/2023	200.7 Rev 4.4	7631-86-9	Silica	0.45	mg/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	7631-86-9	Silica	0.47	mg/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	7631-86-9	Silica	0.44	mg/L
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	7440-23-5	Sodium	3.7	mg/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	7440-23-5	Sodium	3.8	mg/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7440-23-5	Sodium	3.7	mg/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	7440-23-5	Sodium	4.2	mg/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	7440-23-5	Sodium	27	mg/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	7440-23-5	Sodium	26	mg/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	7440-23-5	Sodium	33	mg/L

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	6/22/2023	SM 2510B		Specific Conductance	23	umhos/cm
AWPF-RO-EFF	6/29/2023	SM 2510B		Specific Conductance	24	umhos/cm
AWPF-RO-EFF	7/7/2023	SM 2510B		Specific Conductance	24	umhos/cm
AWPF-RO-EFF	7/20/2023	SM 2510B		Specific Conductance	23	umhos/cm
AWPF-RO-EFF	7/27/2023	SM 2510B		Specific Conductance	27	umhos/cm
AWPF-RO-EFF	8/3/2023	SM 2510B		Specific Conductance	140	umhos/cm
AWPF-RO-EFF	8/10/2023	SM 2510B		Specific Conductance	45	umhos/cm
AWPF-RO-EFF	8/17/2023	SM 2510B		Specific Conductance	120	umhos/cm
AWPF-RO-EFF	8/24/2023	SM 2510B		Specific Conductance	160	umhos/cm
AWPF-RO-EFF	6/22/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	6/29/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	7/7/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	7/20/2023	200.7 Rev 4.4	7440-24-6	Strontium	3.4	ug/L
AWPF-RO-EFF	7/27/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	8/3/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	8/10/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	8/17/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	8/24/2023	200.7 Rev 4.4	7440-24-6	Strontium	ND	ug/L
AWPF-RO-EFF	6/22/2023	300	14808-79-8	Sulfate	ND	mg/L
AWPF-RO-EFF	6/29/2023	300	14808-79-8	Sulfate	ND	mg/L
AWPF-RO-EFF	7/7/2023	300	14808-79-8	Sulfate	0.032	mg/L
AWPF-RO-EFF	7/20/2023	300	14808-79-8	Sulfate	ND	mg/L
AWPF-RO-EFF	7/27/2023	300	14808-79-8	Sulfate	1	mg/L
AWPF-RO-EFF	8/3/2023	300	14808-79-8	Sulfate	0.11	mg/L
AWPF-RO-EFF	8/10/2023	300	14808-79-8	Sulfate	0.032	mg/L
AWPF-RO-EFF	8/17/2023	300	14808-79-8	Sulfate	0.062	mg/L
AWPF-RO-EFF	8/24/2023	300	14808-79-8	Sulfate	0.07	mg/L
AWPF-RO-EFF	6/22/2023	SM 2540C		Total Dissolved Solids	15	mg/L
AWPF-RO-EFF	6/29/2023	SM 2540C		Total Dissolved Solids	19	mg/L
AWPF-RO-EFF	7/7/2023	SM 2540C		Total Dissolved Solids	14	mg/L
AWPF-RO-EFF	7/20/2023	SM 2540C		Total Dissolved Solids	19	mg/L
AWPF-RO-EFF	7/27/2023	SM 2540C		Total Dissolved Solids	19	mg/L
AWPF-RO-EFF	8/3/2023	SM 2540C		Total Dissolved Solids	70	mg/L

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	8/10/2023	SM 2540C		Total Dissolved Solids	31	mg/L
AWPF-RO-EFF	8/17/2023	SM 2540C		Total Dissolved Solids	78	mg/L
AWPF-RO-EFF	8/24/2023	SM 2540C		Total Dissolved Solids	110	mg/L
AWPF-RO-EFF	6/22/2023	Inorganic N		Total Inorganic Nitrogen	0.45	mg/L
AWPF-RO-EFF	6/29/2023	Inorganic N		Total Inorganic Nitrogen	0.17	mg/L
AWPF-RO-EFF	7/7/2023	Inorganic N		Total Inorganic Nitrogen	0.24	mg/L
AWPF-RO-EFF	7/20/2023	Inorganic N		Total Inorganic Nitrogen	0.13	mg/L
AWPF-RO-EFF	7/27/2023	Inorganic N		Total Inorganic Nitrogen	0.17	mg/L
AWPF-RO-EFF	8/3/2023	Inorganic N		Total Inorganic Nitrogen	0.16	mg/L
AWPF-RO-EFF	8/10/2023	Inorganic N		Total Inorganic Nitrogen	0.22	mg/L
AWPF-RO-EFF	8/17/2023	Inorganic N		Total Inorganic Nitrogen	0.11	mg/L
AWPF-RO-EFF	8/24/2023	Inorganic N		Total Inorganic Nitrogen	0.24	mg/L
AWPF-RO-EFF	6/22/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.24	mg/L
AWPF-RO-EFF	6/29/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.73	mg/L
AWPF-RO-EFF	7/7/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.25	mg/L
AWPF-RO-EFF	7/20/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.3	mg/L
AWPF-RO-EFF	7/27/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.42	mg/L
AWPF-RO-EFF	8/3/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.25	mg/L
AWPF-RO-EFF	8/10/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.34	mg/L
AWPF-RO-EFF	8/17/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.42	mg/L
AWPF-RO-EFF	8/24/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.5	mg/L
AWPF-RO-EFF	6/29/2023	365.1	7723-14-0	Total Phosphorus as P	0.011	mg/L
AWPF-RO-EFF	6/29/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	7/7/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	7/20/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	7/27/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	8/3/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	8/10/2023	365.1	7723-14-0	Total Phosphorus as P	0.012	mg/L
AWPF-RO-EFF	8/17/2023	365.1	7723-14-0	Total Phosphorus as P	0.014	mg/L
AWPF-RO-EFF	8/24/2023	365.1	7723-14-0	Total Phosphorus as P	ND	mg/L
AWPF-RO-EFF	6/22/2023	180.1		Turbidity	0.1	NTU
AWPF-RO-EFF	6/29/2023	180.1		Turbidity	0.05	NTU
AWPF-RO-EFF	7/7/2023	180.1		Turbidity	0.05	NTU

Appendix A: Pilot Study RO Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-RO-EFF	7/20/2023	180.1		Turbidity	0.05	NTU
AWPF-RO-EFF	7/27/2023	180.1		Turbidity	0.05	NTU
AWPF-RO-EFF	8/3/2023	180.1		Turbidity	0.35	NTU
AWPF-RO-EFF	8/10/2023	180.1		Turbidity	0.15	NTU
AWPF-RO-EFF	8/17/2023	180.1		Turbidity	0.2	NTU
AWPF-RO-EFF	8/24/2023	180.1		Turbidity	0.25	NTU

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	524.2	79-00-5	1,1,2-Trichloroethane	0.08	ug/L
AWPF-UVAOP-EFF	7/20/2023	SRL 524M	96-18-4	1,2,3-Trichloropropane	0.0037	ug/L
AWPF-UVAOP-EFF	7/20/2023	1613B	76523-40-5	13C-2,3,7,8-TCDD	1400	pg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2320B		Alkalinity as CaCO3	8	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2320B		Alkalinity as CaCO3	7.4	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Alkalinity as CaCO3	6.46	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Alkalinity as CaCO3	6.4	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2320B		Alkalinity as CaCO3	6	mg/L
AWPF-UVAOP-EFF	7/27/2023	SM 2320B		Alkalinity as CaCO3	2.7	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	8	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	7.4	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	6.46	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	6.4	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	6	mg/L
AWPF-UVAOP-EFF	7/27/2023	SM 2320B		Bicarbonate Alkalinity as CaCO3	2.7	mg/L
AWPF-UVAOP-EFF	7/20/2023	200.7 Rev 4.4	7440-42-8	Boron	0.12	mg/L
AWPF-UVAOP-EFF	7/20/2023	525.2	103-23-1	Di(2-ethylhexyl)adipate	0.082	ug/L
AWPF-UVAOP-EFF	7/20/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.57	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.35	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.28	mg/L
AWPF-UVAOP-EFF	7/27/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.24	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.24	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 5310C	7440-44-0	Dissolved Organic Carbon	0.24	mg/L
AWPF-UVAOP-EFF	7/20/2023	SM 4500 F C	16984-48-8	Fluoride	0.023	mg/L
AWPF-UVAOP-EFF	7/20/2023	556	50-00-0	Formaldehyde	19	ug/L
AWPF-UVAOP-EFF	7/20/2023	PPCP NEG	25812-30-0	Gemfibrozil	0.00063	ug/L
AWPF-UVAOP-EFF	7/20/2023	900	12587-46-1	Gross Alpha	-0.0307	pCi/L
AWPF-UVAOP-EFF	7/20/2023	900	12587-47-2	Gross Beta	1.07	pCi/L
AWPF-UVAOP-EFF	7/20/2023	218.6	18540-29-9	Hexavalent Chromium (CrVI)	0.16	ug/L
AWPF-UVAOP-EFF	7/20/2023	1631E	7439-97-6	Mercury	0.85	ng/L
AWPF-UVAOP-EFF	8/17/2023	521.1	59-89-2	N-Nitrosomorpholine (NMOR)	1.61	ng/L
AWPF-UVAOP-EFF	8/17/2023	521.1	59-89-2	N-Nitrosomorpholine (NMOR)	1.3	ng/L
AWPF-UVAOP-EFF	7/20/2023	903	13982-63-3	Radium-226	0.0486	pCi/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	904	15262-20-1	Radium-228	0.369	pCi/L
AWPF-UVAOP-EFF	7/20/2023	200.7 Rev 4.4	7440-23-5	Sodium	3.9	mg/L
AWPF-UVAOP-EFF	7/27/2023	SM 2510B		Specific Conductance	32	umhos/cm
AWPF-UVAOP-EFF	7/20/2023	905	10098-97-2	Strontium-90	-0.295	pCi/L
AWPF-UVAOP-EFF	8/3/2023	SM 2540C		Total Dissolved Solids	53	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2540C		Total Dissolved Solids	27	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2540C		Total Dissolved Solids	17	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2540C		Total Dissolved Solids	10	mg/L
AWPF-UVAOP-EFF	7/27/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.5	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.36	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.19	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.18	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 5310C	7440-44-0	Total Organic Carbon	0.17	mg/L
AWPF-UVAOP-EFF	7/20/2023	6251B	76-03-9	Trichloroacetic acid	0.44	ug/L
AWPF-UVAOP-EFF	7/20/2023	906	10028-17-8	Tritium	-31.5	pCi/L
AWPF-UVAOP-EFF	7/20/2023	524.2	630-20-6	1,1,1,2-Tetrachloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	71-55-6	1,1,1-Trichloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	79-34-5	1,1,2,2-Tetrachloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-35-4	1,1-Dichlorethylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-34-3	1,1-Dichloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	563-58-6	1,1-Dichloropropene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	87-61-6	1,2,3-Trichlorobenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	96-18-4	1,2,3-Trichloropropane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	120-82-1	1,2,4-Trichlorobenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	95-63-6	1,2,4-Trimethylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	504.1	96-12-8	1,2-Dibromo-3-Chloropropane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	504.1	106-93-4	1,2-Dibromoethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	107-06-2	1,2-Dichloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	78-87-5	1,2-Dichloropropane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	108-67-8	1,3,5-Trimethylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	142-28-9	1,3-Dichloropropane	ND	ug/L
AWPF-UVAOP-EFF	7/27/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-UVAOP-EFF	8/3/2023	522	123-91-1	1,4-Dioxane	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	8/10/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-UVAOP-EFF	8/17/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-UVAOP-EFF	8/24/2023	522	123-91-1	1,4-Dioxane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	594-20-7	2,2-Dichloropropane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	1613B	1746-01-6	2,3,7,8-TCDD	ND	pg/L
AWPF-UVAOP-EFF	7/20/2023	515.4	93-76-5	2,4,5-T	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	93-72-1	2,4,5-TP (Silvex)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	94-75-7	2,4-D	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	94-82-6	2,4-DB	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	121-14-2	2,4-Dinitrotoluene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	78-93-3	2-Butanone (MEK)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	624.1	110-75-8	2-Chloroethyl vinyl ether	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	591-78-6	2-Hexanone	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	51-36-5	3,5-Dichlorobenzoic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	16655-82-6	3-Hydroxycarbofuran	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	208-96-8	Acenaphthylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	50594-66-6	Acifluorfen	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	624.1	107-02-8	Acrolein	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	15972-60-8	Alachlor (Alanex)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	15972-60-8	Alachlor (Alanex)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	116-06-3	Aldicarb	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	1646-88-4	Aldicarb sulfone	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	1646-87-3	Aldicarb sulfoxide	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	309-00-2	Aldrin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	5103-71-9	alpha-Chlordane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7429-90-5	Aluminum	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	120-12-7	Anthracene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-36-0	Antimony	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-38-2	Arsenic	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	1912-24-9	Atrazine	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-39-3	Barium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	114-26-1	Baygon	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	25057-89-0	Bentazon	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	525.2	56-55-3	Benz(a)anthracene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	71-43-2	Benzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	50-32-8	Benzo[a]pyrene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	205-99-2	Benzo[b]fluoranthene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	191-24-2	Benzo[g,h,i]perylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	207-08-9	Benzo[k]fluoranthene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-41-7	Beryllium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	117-81-7	Bis(2-ethylhexyl) phthalate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	314-40-9	Bromacil	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	300.1	15541-45-4	Bromate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	108-86-1	Bromobenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	6251B	5589-96-8	Bromochloroacetic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	74-97-5	Bromochloromethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-27-4	Bromodichloromethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	74-96-4	Bromoethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-25-2	Bromoform	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	74-83-9	Bromomethane (Methyl Bromide)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	23184-66-9	Butachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	85-68-7	Butylbenzylphthalate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-43-9	Cadmium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	58-08-2	Caffeine	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	63-25-2	Carbaryl	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	1563-66-2	Carbofuran	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-15-0	Carbon disulfide	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	56-23-5	Carbon tetrachloride	ND	ug/L
AWPF-UVAOP-EFF	7/27/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2320B		Carbonate Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	300.1	14866-68-3	Chlorate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	57-74-9	Chlordane	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	300	14998-27-7	Chlorite	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	108-90-7	Chlorobenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-00-3	Chloroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	67-66-3	Chloroform (Trichloromethane)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	74-87-3	Chloromethane (methyl chloride)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-47-3	Chromium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	218-01-9	Chrysene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	156-59-2	cis-1,2-Dichloroethylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	10061-01-5	cis-1,3-Dichloropropene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	9223B		Coliform, Total	ND	MPN/100mL
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-50-8	Copper	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	218.6 CR3	16065-83-1	Cr (III)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	335.4	57-12-5	Cyanide, Total	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	515.4	75-99-0	Dalapon	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	333-41-5	Diazinon (Qualitative)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	53-70-3	Dibenz(a,h)anthracene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	6251B	631-64-1	Dibromoacetic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	124-48-1	Dibromochloromethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	74-95-3	Dibromomethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	1918-00-9	Dicamba	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	6251B	79-43-6	Dichloroacetic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-71-8	Dichlorodifluoromethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-09-2	Dichloromethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	120-36-5	Dichlorprop	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	60-57-1	Dieldrin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	60-57-1	Dieldrin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	84-66-2	Diethylphthalate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	108-20-3	Diisopropyl ether	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	60-51-5	Dimethoate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	131-11-3	Dimethylphthalate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	84-74-2	Di-n-butyl phthalate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	515.4	88-85-7	Dinoseb	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	549.2	2764-72-9	Diquat	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	548.1	145-73-3	Endothall	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	72-20-8	Endrin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	72-20-8	Endrin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	9223B	68583-22-2	Escherichia coli	ND	MPN/100mL
AWPF-UVAOP-EFF	7/20/2023	524.2	100-41-4	Ethylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	8015C	107-21-1	Ethylene glycol	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	525.2	206-44-0	Fluoranthene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	86-73-7	Fluorene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	5103-74-2	gamma-Chlordane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	547	1071-83-6	Glyphosate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	76-44-8	Heptachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	76-44-8	Heptachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	1024-57-3	Heptachlor epoxide (isomer B)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	1024-57-3	Heptachlor epoxide (isomer B)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	118-74-1	Hexachlorobenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	87-68-3	Hexachlorobutadiene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	77-47-4	Hexachlorocyclopentadiene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	8321B	2691-41-0	HMX	ND	ug/L
AWPF-UVAOP-EFF	7/27/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2320B		Hydroxide Alkalinity as CaCO3	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	525.2	193-39-5	Indeno[1,2,3-cd]pyrene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	PPCP NEG	66108-95-0	Iohexol	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.7 Rev 4.4	7439-89-6	Iron	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	525.2	78-59-1	Isophorone	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	98-82-8	Isopropylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7439-92-1	Lead	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	58-89-9	Lindane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	58-89-9	Lindane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	179601-23-1	m,p-Xylenes	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	200.8	7439-96-5	Manganese	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	541-73-1	m-Dichlorobenzene (1,3-DCB)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	2032-65-7	Methiocarb	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	16752-77-5	Methomyl	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	72-43-5	Methoxychlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	72-43-5	Methoxychlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	SM 5540C		Methylene Blue Active Substances	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	524.2	1634-04-4	Methyl-tert-butyl Ether (MTBE)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	51218-45-2	Metolachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	21087-64-9	Metribuzin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	2212-67-1	Molinate	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	6251B	79-08-3	Monobromoacetic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	6251B	79-11-8	Monochloroacetic acid	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	91-20-3	Naphthalene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	104-51-8	n-Butylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-02-0	Nickel	ND	ug/L
AWPF-UVAOP-EFF	8/17/2023	521.1	62-75-9	N-Nitrosodimethylamine (NDMA)	ND	ng/L
AWPF-UVAOP-EFF	8/17/2023	521.1	62-75-9	N-Nitrosodimethylamine (NDMA)	ND	ng/L
AWPF-UVAOP-EFF	7/20/2023	524.2	103-65-1	N-Propylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	95-49-8	o-Chlorotoluene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	95-50-1	o-Dichlorobenzene (1,2-DCB)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	531.2	23135-22-0	Oxamyl	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	95-47-6	o-Xylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	549.2	4685-14-7	Paraquat	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	12674-11-2	PCB-1016	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	11104-28-2	PCB-1221	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	11141-16-5	PCB-1232	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	53469-21-9	PCB-1242	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	12672-29-6	PCB-1248	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	11097-69-1	PCB-1254	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	11096-82-5	PCB-1260	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	106-43-4	p-Chlorotoluene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	106-46-7	p-Dichlorobenzene (1,4-DCB)	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	515.4	87-86-5	Pentachlorophenol	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	314	14797-73-0	Perchlorate	ND	ug/L
AWPF-UVAOP-EFF	8/17/2023	533	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	ND	ng/L
AWPF-UVAOP-EFF	8/17/2023	533	335-67-1	Perfluorooctanoic acid (PFOA)	ND	ng/L
AWPF-UVAOP-EFF	7/20/2023	525.2	85-01-8	Phenanthrene	ND	ug/L
AWPF-UVAOP-EFF	7/27/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	8/3/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	8/10/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	8/17/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	8/24/2023	SM 2320B		Phenolphthalein Alkalinity	ND	mg/L
AWPF-UVAOP-EFF	7/20/2023	515.4	2/1/1918	Picloram	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	99-87-6	p-Isopropyltoluene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	1336-36-3	Polychlorinated biphenyls, Total	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	1918-16-7	Propachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	129-00-0	Pyrene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	8321B	121-82-4	RDX	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	135-98-8	sec-Butylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7782-49-2	Selenium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-22-4	Silver	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	122-34-9	Simazine	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	100-42-5	Styrene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	994-05-8	Tert-amyl methyl ether	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	637-92-3	Tert-butyl ethyl ether	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	98-06-6	tert-Butylbenzene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	127-18-4	Tetrachloroethene (PCE)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-28-0	Thallium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	28249-77-6	Thiobencarb	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	8321B	118-96-7	TNT	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	108-88-3	Toluene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	505	8001-35-2	Toxaphene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	156-60-5	trans-1,2-Dichloroethylene	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	10061-02-6	trans-1,3-Dichloropropene	ND	ug/L

Appendix B: UV/AOP Effluent

Client Sample ID	Collection Date	Analysis Method	CAS	Analyte	Result	Unit
AWPF-UVAOP-EFF	7/20/2023	525.2	39765-80-5	trans-Nonachlor	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	79-01-6	Trichloroethylene (TCE)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-69-4	Trichlorofluoromethane (Freon 11)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	76-13-1	Trichlorotrifluoroethane	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	525.2	1582-09-8	Trifluralin	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-61-1	Uranium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-61-1	Uranium	ND	pCi/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-62-2	Vanadium	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	524.2	75-01-4	Vinyl Chloride (VC)	ND	ug/L
AWPF-UVAOP-EFF	7/20/2023	200.8	7440-66-6	Zinc	ND	ug/L

Bear Valley Water Sustainability Study

• December 2016•

WSC
WATER SYSTEMS CONSULTING, INC.

Recycled Water Facilities Planning Study

for the

Bear Valley Water Sustainability Project

Prepared for

Big Bear Area Regional Wastewater Agency

Big Bear City Community Services District

Big Bear Lake Department of Water and Power

Big Bear Municipal Water District

Prepared Under the Responsible Charge of:

Laine Carlson

12/21/2016

WSC

WATER SYSTEMS CONSULTING, INC.

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- David Caretto, Chairman representing the City of Big Bear Lake
- John Green, Vice Chairman representing Big Bear Area Community Services District
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LIST OF ACRONYMS AND ABBREVIATIONS

The abbreviations included in this report are spelled out in the text the first time they are used an are subsequently identified by abbreviation only. A summary of the abbreviations used in this report is provided in this section.

Note: References are noted throughout the text of this report with the reference number in parentheses, i.e. (2). See Chapter 10 for the corresponding reference information.

Abbreviation	Definition
2015 UWMPs	2015 BBCCSD UWMP and 2015 BBLDWP UWMP
AFY	Acre-feet per Year
AOP	Advanced Oxidation Process
Basin	Big Bear Valley Groundwater Management Zone
Basin Plan	Santa Ana Region Basin Plan
BBARWA	Big Bear Area Regional Wastewater Agency
BBCCSD	Big Bear City Community Services District
BBLDWP	Big Bear Lake Department of Water and Power
BBMWD	Big Bear Municipal Water District
Bear Valley Mutual	Bear Valley Mutual Water District
bgs	Below ground surface
BMPTF	Basin Monitoring Program Task Force
BOD	Biochemical Oxygen Demand
CCF	Hundred Cubic Feet
CCR	California Code of Regulations
CDM	Camp Dresser & McKee, Inc.
CDPH	California Department of Public Health
CEC	California Energy Commission
CEC	Constituent of Emerging Concern
CEQA	California Environmental Quality Act
COD	Chemical Oxygen Demand
COE	U.S Army Corps of Engineers
Colorado WDR	Colorado River Basin RWQCB WDR Order No. R7-2016-0026
CSA 53	County of San Bernardino Service Area 53B
DAC	Disadvantaged Communities
DDW	Division of Drinking Water
DPR	Direct Potable Reuse
DWR	Department of Water Resources
EA	Environmental Assessment
EDU	Equivalent Dwelling Unit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAT	Full Advanced Treatment
ft	Feet
FTE	Full time equivalent
FY	Fiscal Year

Abbreviation	Definition
gpm	Gallons per minute
GRRP	Groundwater Replenishment Reuse Project
HGL	Hydraulic Grade Line
I/I	Infiltration and Inflow
in	Inches
IPR	Indirect Potable Reuse
IRWM	Integrated Regional Water Management
IS	Initial Study
Lake	Big Bear Lake
LV Site	Lucerne Valley
MBR	Membrane Bioreactor
MDD	Maximum Day Demand
MG	Million gallons
MGD	Million gallons per day
mL	milliliters
MMBTU	Million British Thermal Units
MPN	Most Probable Number
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPR	Non-Potable Reuse
O&M	Operation and Maintenance
ORP	Oxidation-reduction Potential
PEIR	Program Environmental Impact Report
PFD	Process Flow Diagram
PHD	Peak Hour Demand
PPCP	Pharmaceuticals and Personal Care Products
Prop 1	2014 California Water Bond
RO	Reverse Osmosis
RW	Recycled Water
RWC	Recycled Water Concentration
RWMP	BBARWA's 2006 Recycled Water Master Plan
RW Policy	SWRCB Recycled Water Policy
RWQCB	Regional Water Quality Control Board
Santa Ana WDR	Santa Ana RWQCB WDR Order No. R-8-2005-0044
SAWPA	Santa Ana Watershed Project Authority
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SMP	BBARWA's 2010 Sewer Master Plan
SNMP	Salt and Nutrient Management Plan
Study	Recycled Water Facilities Planning Study
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TIN	Total Inorganic Nitrogen
Title 22	California Code of Regulations, Title 22, Division 4, Chapter 3, Section 60301
TM	Technical Memorandum

Abbreviation	Definition
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UF	Ultrafiltration
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	Ultraviolet
UV/AOP	Ultraviolet-Advanced Oxidation Process
UWMP	Urban Water Management Plan
Valley	Big Bear Valley
VSEP	Vibratory Shear-Enhanced Process
WDR	Waste Discharge and Produce/Use Water Recycling Requirements
WQO	Water Quality Objectives
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

INTRODUCTION

Local groundwater provides the sole drinking water supply for the Big Bear Valley (Valley), located in the San Bernardino Mountains of San Bernardino County, California. Drought conditions and a long-term decline in precipitation trends have led local water and wastewater management agencies to investigate opportunities for supplemental supplies, which are extremely limited due to the high elevation and isolated location of the Valley. Currently, wastewater generated within the Valley is treated to secondary standards and discharged outside of the watershed to irrigate crops in the Lucerne Valley.

This Recycled Water Facilities Planning Study (Study) evaluates alternatives to develop a Bear Valley Water Sustainability Project with the goal to retain highly treated wastewater within the Valley for beneficial use. The Project Team for this Study is comprised of the Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), and Big Bear Municipal Water District (BBMWD). The Project Team recognizes that retaining recycled water in the watershed for beneficial use would significantly increase the sustainability of local water supplies and has partnered to jointly fund and prepare this Study. This Study was funded in part by a grant from the California State Water Resources Control Board (SWRCB) Water Recycling Funding Program.

GOALS AND OBJECTIVES

The Project Team established the following goals and objectives to guide the development of the Bear Valley Water Sustainability Project.

- Create a new and sustainable water supply
- Educate the community about water cycle, recycled water treatment process and water quality to gain public support
- Create a project that benefits all agencies involved
- Develop a cost-effective project to offset potable water demands
- Take advantage of current outside funding opportunities
- Explore viability of developing a fish hatchery to provide community benefits and potentially offset project costs
- Identify the costs of project components and the beneficiaries they will be allocated to

ALTERNATIVES ANALYSIS

This Study leverages prior recycled water planning efforts in the region and evaluates opportunities in the context of current and prospective future regulations. The following three recycled water project alternatives were developed for evaluation in this Study:

- Alternative 1: Provides disinfected tertiary recycled water for landscape irrigation and construction water use. Requires tertiary upgrades to the BBARWA Wastewater Treatment Plant (WWTP).

- Alternative 2: Provides advanced purified water for groundwater recharge at the Greenspot Recharge Site. Requires tertiary and advanced treatment upgrades to the BBARWA WWTP.
- Alternative 3: Provides advanced purified water for groundwater recharge at Sand Canyon Recharge Site. Assumes construction of a satellite treatment plant that provides tertiary and advanced treatment. Due to the unknown volume of dilution water available at this location, a range of treatment requirements were evaluated to identify bookend costs for this alternative.
- Alternative 4: Provides advanced purified water for a groundwater recharge at the Greenspot and Sand Canyon Sites to utilize all of the available recycled water in the Big Bear Valley. Requires tertiary and advanced treatment upgrades to the BBARWA WWTP.

Table ES-1 summarizes the costs and yield of the four alternatives.

Table ES-1. Cost and Yield Comparison for Alternatives Evaluated

Alternative	Alternative 1 Irrigation	Alternative 2 Greenspot	Alternative 3 Sand Canyon (Low Range)	Alternative 3 Sand Canyon (High Range)	Alternative 4 Greenspot and Sand Canyon
Total Capital Cost	$3,257,000	$44,533,000	$23,255,000	$24,315,000	$69,700,000
Annual O&M Cost	$65,000	$1,539,000	$1,174,000	$1,259,000	$2,726,000
Recycled Water Yield (AFY)	54	1,000	520	500	1,750
Unit Cost ($/AF)	$3,960	$3,580	$4,310	$4,750	$3,390
NPV	$5,087,000	$88,172,000	$56,759,000	$60,247,000	$147,270,000

For comparison to the recycled water alternatives, the Study updated a prior analysis that estimated the cost for a non-recycled water alternative to convey imported State Water Project water to the Big Bear Valley from the Morongo Basin pipeline. The estimated unit cost for this imported water concept is $5,630/AF. However, the Big Bear Agencies do not currently have supply contracts with a State Water Contractor and State Water Project water deliveries have declined in recent years and are subject to further reductions based on environmental and hydrologic factors. An imported water supply, if available, would be costlier than recycled water supplies and would not provide a sustainable or drought proof supply for the Valley.

RECOMMENDED ALTERNATIVES

The alternatives analysis concluded that opportunities for non-potable reuse for landscape irrigation in the Valley are limited and not cost effective due to relatively low demands and the extensive distribution system required to reach the customers.

Groundwater recharge was determined to be the most favorable alternative and the Sand Canyon and Greenspot Recharge Sites are both favorable for artificial recharge. Alternative 4 retains all of the available recycled water in the Valley and has the lowest unit cost among all the alternatives considered.

A further discussion of the recommended project is included in Chapter 6.

FUNDING AND FINANCING

The cost estimate for the recommended Alternative 4 is summarized in Table ES-2.

Table ES-2. Cost Summary for Alternative 4

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF
Alternative 4: Greenspot & Sand Canyon Recharge	$69,700,000	$2,726,000	1,750	$3,390

The project could be funded through a combination of grants and low interest loans. The SWRCB Water Recycling Funding Program received funding from the 2014 California Water Bond (Prop 1) and is currently offering grant funding for water recycling projects. This grant program, which is described in more detail in Section 8.2.1, is offering 35% grants, with a maximum grant amount of $15,000,000. To illustrate the benefits of this grant program, Table ES-3 summarizes the local portion of the project costs if a 35% grant is received to reduce the local capital contribution.

Table ES-3. Cost Summary with 35% Grant for Alternative 4

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF
Alternative 4: Greenspot & Sand Canyon Recharge	$45,305,000	$2,726,000	1,750	$2,750

There may be opportunities to leverage other grant funding programs, such as the United States Department of Agriculture (USDA) Rural Development Water and Environment Program, to further reduce the portion of project costs that must be funded locally.

CONCLUSIONS

The implementation of a Bear Valley Water Sustainability Project that retains highly treated water in the Valley for beneficial use would provide a sustainable and drought proof source of supply that would support current and future residents and businesses long into the future. However, even with taking advantage of current funding programs, such a project would represent a significant investment for the community. The costs and long term benefits to the community should be carefully considered when determining the timing for implementation of the Bear Valley Water Sustainability Project.

1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Big Bear Valley (Valley) is located in the San Bernardino Mountains of San Bernardino County, California. The area includes approximately 135 square miles within a 12-mile long valley surrounded by mountain ridges and rugged slopes. Land surface elevations range from 6,000 to 9,900 ft and the area is entirely surrounded by the San Bernardino National Forest. Big Bear Lake lies within the Valley and has a surface area of approximately 10 square miles and 23 miles of shoreline.

Local groundwater provides the sole drinking water supply for the Valley. Drought conditions and a long-term decline in precipitation trends have led the local water agencies to investigate opportunities for supplemental supplies, which are extremely limited due to its isolated location at the top of the watershed.

Currently, wastewater generated within the Valley undergoes preliminary and secondary treatment and is discharged outside of the watershed to irrigate alfalfa fields in the Lucerne Valley located approximately 20 miles north of the Valley. This Study evaluates alternatives to develop a Bear Valley Water Sustainability Project with the goal to retain highly treated wastewater within the Valley for beneficial use. By doing so, this will provide a supplemental and drought proof source of water for current and future Valley residents and businesses. This Study leverages prior recycled water planning efforts in the region and evaluates opportunities in the context of current and prospective future regulations. This Study was funded in part by a grant from the California State Water Resources Control Board (SWRCB) Water Recycling Funding Program.

1.2 PROJECT TEAM

The Project Team is comprised of the Big Bear Area Regional Wastewater Agency (BBARWA), Big Bear City Community Services District (BBCCSD), Big Bear Lake Department of Water and Power (BBLDWP), and Big Bear Municipal Water District (BBMWD). The Project Team recognizes that retaining recycled water in the watershed for beneficial use would significantly increase the sustainability of local water supplies and has partnered to jointly fund and prepare this Study. The following sections provide a brief introduction to each agency.

1.2.1 BBARWA

BBARWA was formed in March 1974 to conduct a study to develop a plan for wastewater management within the greater Valley region. A subsequent 1975 Wastewater Facilities Plan was prepared which identified the need to provide centralized, environmentally friendly wastewater conveyance, treatment and disposal for the BBARWA service area.

The BBARWA service area includes the entire Big Bear Valley (79,000 acres) and is served by three separate collection systems: the City of Big Bear Lake, representing approximately 47% of the connections, and the BBCCSD, representing approximately 48% of the connections, and the County of San Bernardino Service Area 53B (CSA 53), representing approximately 5% of the connections. Each of these member agencies maintains and operates its own wastewater collection system, and delivers wastewater to BBARWA's interceptor system for transport to the BBARWA Regional Wastewater Treatment Plant (WWTP).

1.2.2 BBCCSD

BBCCSD was created in 1966 by a formation and consolidation election and initially provided solid waste collection, fire protection and street lighting services. In 1967, the former Big Bear Mutual Service Company voted to relinquish ownership and operation of their water system to BBCCSD. Currently BBBCSD's services include water, wastewater collection, fire protection & emergency medical services, solid waste collection, and street lighting services. BBCCSD's water service area includes Big Bear City and portions of San Bernardino County. BBCCSD's wastewater collection area includes Big Bear City and portions unincorporated communities such as Sugarloaf, Erwin Lake, Whispering Forest, and Moonridge.

1.2.3 BBLDWP

BBLDWP was formed in 1989 with the purchase of the retail water system from Southern California Water Company and currently provides water service to the City of Big Bear Lake, located along the south side of Big Bear Lake, as well as the unincorporated communities of Fawnskin, which lies to the north of the lake, and Sugarloaf, Erwin Lake and Lake William areas, which lie on the east side of the Valley.

The City of Big Bear Lake provides wastewater collection services within the city, while BBCCSD and CSA 53B provide wastewater collection services within BBLDWP's water service area that lies outside the city limits.

1.2.4 BBMWD

BBMWD, formed in 1964, is an independent special district that is responsible for the overall management of Big Bear Lake. The primary responsibilities of BBMWD are:

- Stabilization of the level of Big Bear Lake by managing the amount of water released to Bear Valley Mutual
- Watershed/water quality management
- Recreation management
- Wildlife habitat preservation and enhancement
- Bear Valley Dam and Reservoir maintenance

The Big Bear Dam was originally constructed to provide water storage for Bear Valley Mutual Water Company (Bear Valley Mutual), which was formed in 1903 by the citrus growers of the Redlands/Highland area to ensure water supply for irrigation needs. The historic operation of the Big Bear Lake (Lake) as an irrigation reservoir resulted in drastic fluctuations in lake levels, which conflicted with the goals of BBMWD and the community of Big Bear Valley. A legal conflict over the water rights and management of the lake was ultimately settled out of court through the 1977 Judgement. Under the terms of this judgement, BBMWD purchased the lake bottom, Bear Valley Dam, and the right to utilize and manage the surface of Big Bear Lake from Bear Valley Mutual. Bear Valley Mutual retained a storage right and ownership of all water inflow into Lake (1).

The 1977 Judgment allows BBMWD to maintain a higher water level in the lake by delivering water to Bear Valley Mutual from an alternate source of water. This alternate source of water, referred to as in-lieu water, comes mainly from the State Water Project through a contract with San Bernardino Valley Municipal Water District, a State Water Contractor. If BBMWD does not wish to purchase in-lieu water, it must deliver water from the Lake to Bear Valley Mutual to meet their water demands.

BBMWD currently has a contract with the Big Bear Mountain Resorts, allowing the withdrawal of an allocated amount of water from the Lake to use for snow making purposes. Currently, Big Bear Mountain Resort is authorized to withdraw a maximum of 11,000 acre-feet (AF) of water from the Lake over a 10-year rolling period, not exceeding 1,300 AF in any single year. It is calculated that half of the water withdrawn from the lake is returned as runoff (1). Note that Mammoth Resorts recently purchased the Big Bear Mountain Resorts and potential future changes in their operations may affect water needs and wastewater generation from the resorts.

1.3 GOALS AND OBJECTIVES OF BEAR VALLEY WATER SUSTAINABILITY PROJECT

Members of the Project Team identified goals and objectives for the Bear Valley Water Sustainability Project through discussions with potential stakeholders, insight gained from prior recycled water planning efforts, and feedback from their respective boards. Based on the information gathered through this collaborative process, the Project Team established the following goals and objectives to guide the development of the Bear Valley Water Sustainability Project.

- Create a new and sustainable water supply
- Educate the community about the hydrologic cycle, recycled water treatment processes, and water quality objectives to gain public support for the project
- Create a project that benefits all agencies involved
- Develop a cost-effective project to offset potable water demands
- Take advantage of current outside funding opportunities
- Explore viability of developing a fish hatchery to provide community benefits and potentially offset project costs
- Identify the costs of project components and the beneficiaries they will be allocated to

1.4 STUDY AREA CHARACTERISTICS

1.4.1 Location

The study area for this Study includes the entire Big Bear Valley, spanning the collective service areas of the Project Team. The water service areas in the study area are shown in Figure 1-1 and the sewer collection service areas are shown in Figure 1-2.

1.4.2 Population

The 2015 population for the Big Bear Valley was estimated to be approximately 23,000 based on the BBCCSD 2015 Urban Water Management Plan (UWMP) and BBLDWP 2015 UWMP (collectively the 2015 UWMPs). The area is primarily residential with some commercial, and experiences an influx of part-time population and vacationers enjoying the summer and winter recreational facilities within the valley. Due to the recreational nature of the Big Bear City and the City of Big Bear Lake economies, occupancy within the valley fluctuates seasonally, typically peaking in July and at the lowest level during the winter. Population and recreation fluctuations are anticipated to remain constant relative to previous years. The City of Big Bear Lake's growth rate is estimated to be 0.7% and Big Bear City's growth rate is 0.9%. Table 1-1 presents the historic and projected full-time resident population for the Big Bear Valley.

Table 1-1. Historic and Projected Population for the Big Bear Valley

Water Service Area	2010	2015	2020	2025	2030	2035
BBLDWP	9,404	11,382	11,786	12,204	12,637	13,086
BBCCSD	11,503	11,528	11,667	12,244	12,849	13,485
Total	**20,907**	**22,910**	**23,453**	**24,448**	**25,486**	**26,571**

Notes:
1. Values were obtained from the 2015 BBLDWP UWMP and the 2015 BBCCSD UWMP.
2. Values are representative of full-time residents.
3. CSA 53B represents approximately 5% of BBARWA's sewer connections. (2) It is assumed that BBARWA's CSA 53B customers (in Fawnskin) are included in the BBLDWP Water Service Area population estimate.

1.4.3 Environmental Resources

In 2005, BBARWA prepared a Program Environmental Impact Report (EIR) for the Recycled Water Master Plan. (3) The EIR describes the environmental resources in the area, which are summarized in the following subsections.

1.4.3.1 *Geography*

The Valley is located in the San Bernardino Mountains in San Bernardino County, California. The Valley includes approximately 135 square lies of unincorporated area surrounding Big Bear Lake and is entirely surrounded by the San Bernardino National Forest. The valley's land surfaces range from 7,000 to 9,900 ft and is surrounded by mountain ridges and rugged slopes. Big Bear Lake, at an elevation of 6,740 ft, has a surface area of 10 square limes and 23 miles of shoreline.

1.4.3.2 *Water Resources and Wetlands*

Groundwater is the current water resource in the Valley. The Big Bear Valley Groundwater Basin contains 16 subunits as shown in Figure 2-1. The study area contains a variety of wetlands and aquatic habitats, a number of streams with riparian habitat and typical wetlands along the lake.

1.4.3.3 *Agricultural*

The Valley does not contain any commercial agricultural operation. The San Bernardino County General Plan (1996) discourages agricultural land use in mountain regions.

1.4.3.4 *Cultural and Historical Properties*

Within the Valley there are several designated California Historical Landmarks and County Points of Historic Interest including the Old Big Bear Dam and Baldwin Lake. The area was occupied by the Serrano Native Americans until 1861. Smaller villages were located near water sources like small creeks with larger villages situated at Pan Hot Springs and in the Baldwin Lake area. No recorded Native American sites have been identified in the area.

1.4.3.5 *Biological Resources*

There are many biological resources within the Valley including forest, streams, lakes, meadows, unique animals, and plants that are protected by numerous federal and state agencies and regulations. Some of the major protected animals include the Bald Eagle, Southern Rubber Boa, Southwestern Willow Flycatcher, Unarmored Threespine Stickleback, and the San Bernardino Flying Squirrel. A more detailed list of the protected animals and plants is included in the EIR.

1.4.3.6 *Air Quality*

The Valley lies just within the South Coast Air Basin, which is one of the major air management basins in California. Since the Valley is not located near the Cajon Pass and Banning Pass, which transport pollution out of the basin, the Valley is believed to have better air quality than elsewhere in the basin, during winter and summer. (3)

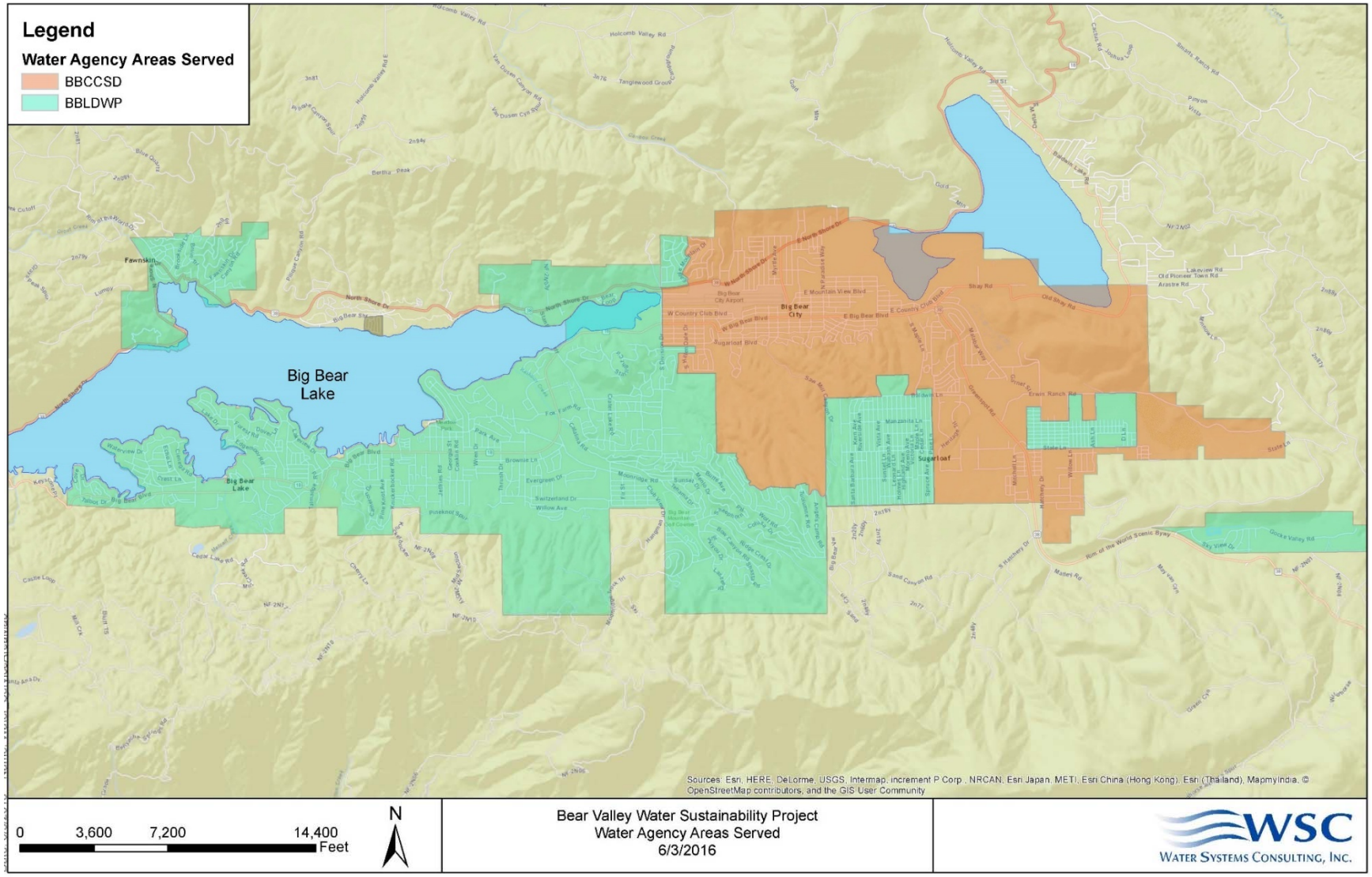

Figure 1-1. Water Agency Service Area

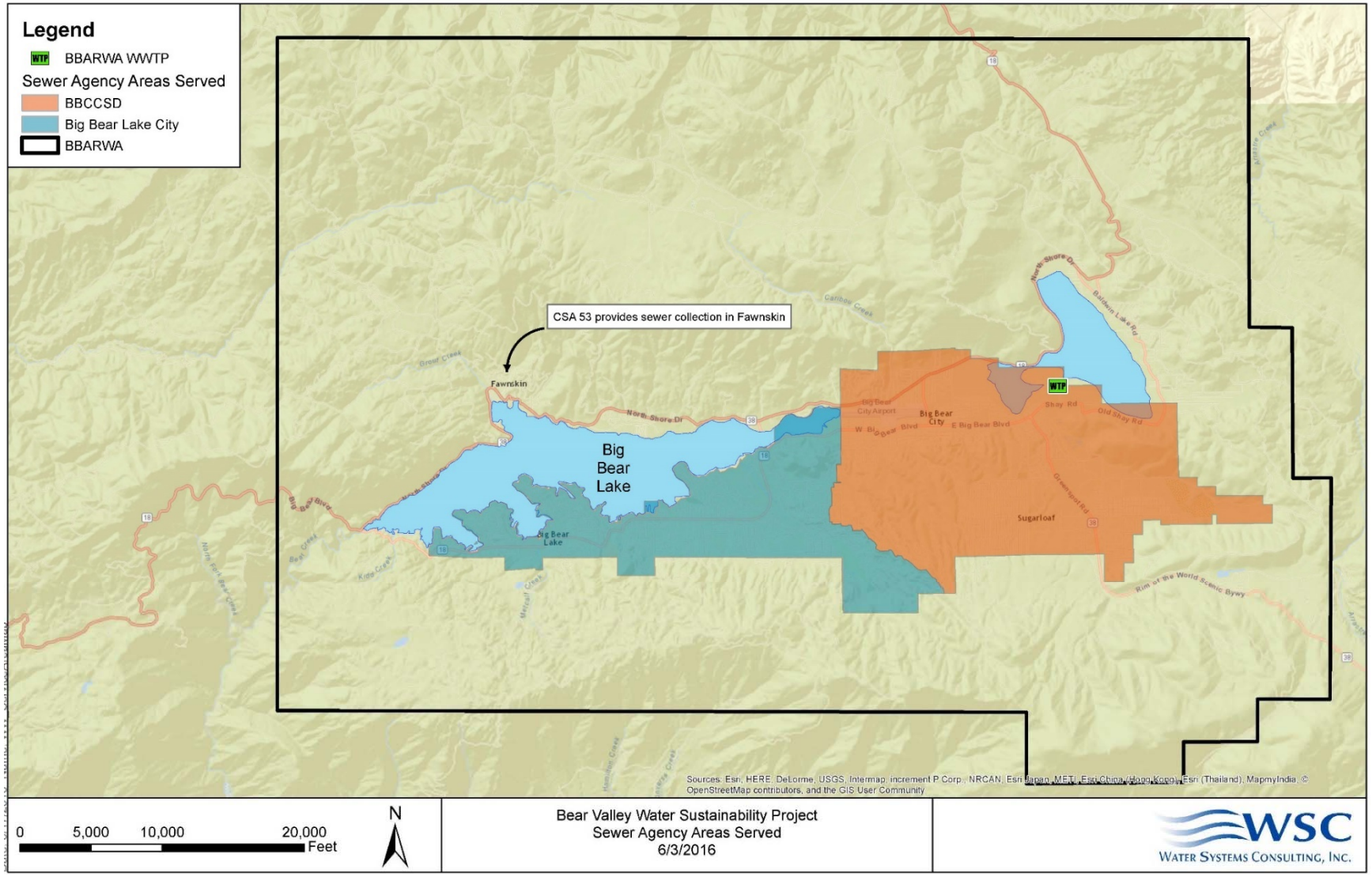

Figure 1-2. Sewer Collection Agency Service Area

1.4.4 Climate

The Valley climate is a semi-arid, Mediterranean environment with cold winters, warm summers, and moderate rainfall. The average monthly temperature ranges from about 32 to 62 degrees Fahrenheit (°F), with an average annual temperature of 47°F. Most of the precipitation typically occurs from November through April. Records show that the average monthly precipitation ranges from about 0.1 in to 7.10 in. The historical precipitation and temperatures are presented in Figure 1-3 and Figure 1-4.

As shown, precipitation trends are declining and temperature trends are increasing. These long term trends can have an impact on the sustainability of local water supplies in the Valley. The potential impacts include (4):

- Reduction of snowpack, which is a significant source of water in the Valley
- Increase in intensity and frequency of extreme weather events
- Effects on groundwater recharge during droughts
- General decline in ecosystem health and function
- Changes to demand level and patterns due to increasing temperatures

These factors reinforce the importance of securing additional sustainable water supplies for the region.

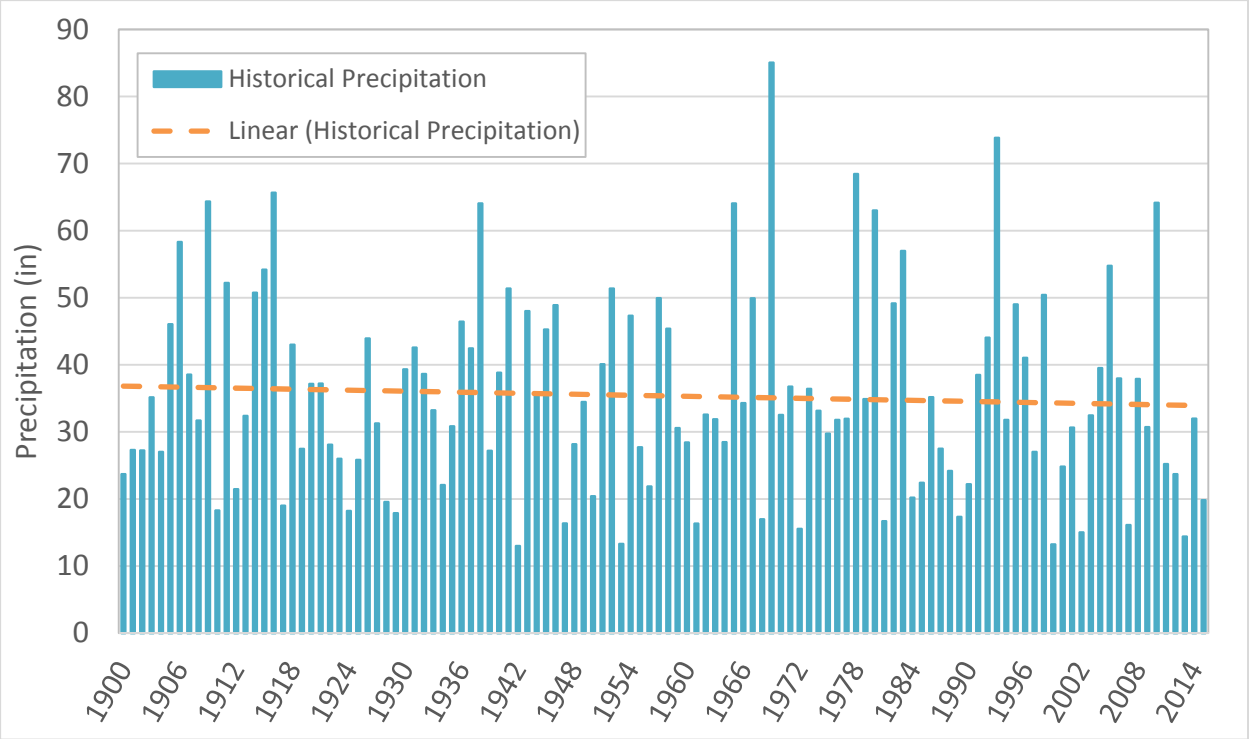

Figure 1-3. Historical Precipitation in the Big Bear Valley (5)

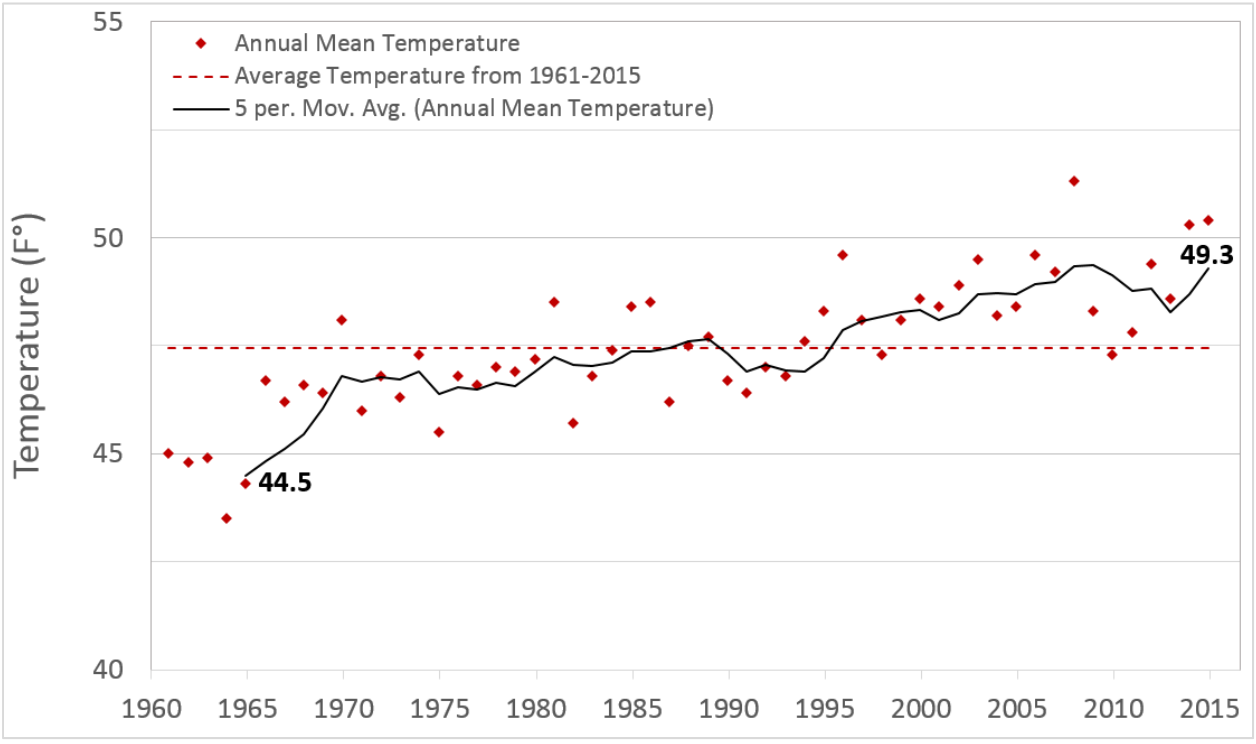

Figure 1-4. Historical Average Annual Temperatures in the Big Bear Valley (6)

2 WATER SUPPLIES AND CHARACTERISTICS

This section provides a brief overview of current water supplies in the Big Bear Valley to provide context for the development of recycled water supplies. Currently, the sole source of water supply in the Valley is groundwater from the Big Bear Valley Groundwater Management Zone (Basin). Surface water and imported water are currently not used by the water agencies. Additional information about water supplies can be found in the 2015 UWMPs.

2.1 BIG BEAR VALLEY GROUNDWATER MANAGEMENT ZONE

The Basin lies in the northeastern portion of the Santa Ana River Watershed and is currently not adjudicated. The Basin is roughly 14 miles long from east to west and 7 miles wide from north to south. Big Bear Lake and Baldwin Lake are located in the middle of the Basin. Surface drainage within the Basin flows to one of the two lakes, mostly Big Bear Lake. Big Bear Lake empties on the west into Bear Creek, which is a tributary to the Santa Ana River. The Basin is primarily composed of unconsolidated alluvium and is divided into upper, middle and lower aquifers; where the upper and middle aquifers are the primary producers. Based on the drainage system, the Basin is divided into 16 hydrologic subunits with the main tributaries including Grout Creek, Van Dusen Canyon, Sawmill Canyon, Sand Canyon, Knickerbocker Creek, Metcalf Creek, and North Creek. The Basin and subunits are presented in Figure 2-1.

The Basin is recharged from percolation of precipitation, runoff and underflow from fracture rock formations; with groundwater levels that generally correlate with annual fluctuations of precipitation. Storage capacity of the Basin is estimated by DWR at 42,000 AFY with the maximum perennial yield estimated at 4,800 AFY (7). In addition to the municipal water purveyors, there are numerous private wells throughout the Basin serving properties that are not connected to a public water system.

BBLDWP and BBCCSD manage and monitor the Basin. Through the Groundwater Monitoring and Management Plan, BBLDWP manages the Basin by conducting monthly monitoring of 18 non-pumping monitoring wells and approximately 40 production wells, bi-annual Technical Review Team meetings, and has established conservation levels based on groundwater levels and trends in key wells. BBCCSD also manages the groundwater level and water quality by conducting monthly monitoring in 11 non-pumping monitoring wells and 13 production wells, monthly monitoring of surface flow in Van Dusen Creek, Shay Creek and Green Canyon Creek, and has established action criteria for average groundwater levels across the BBCCSD service area that are tied to conservation stages and measures. Conservation efforts have helped to keep annual groundwater production less than the perennial yield of the Basin. The Basin is not currently identified by DWR to be in overdraft condition. (4) (8)

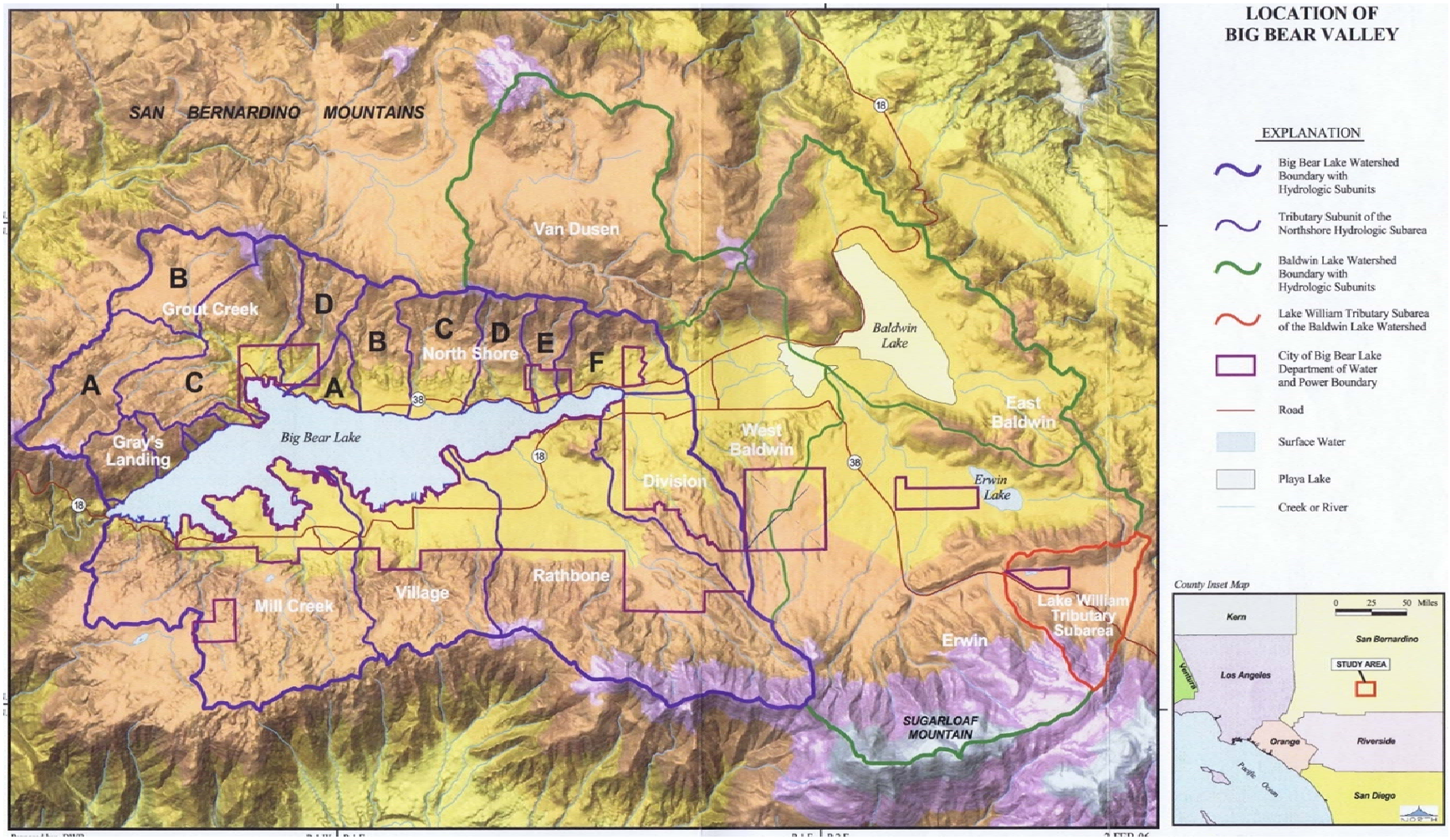

Figure 2-1. Big Bear Valley Groundwater Basin and Subunits (9)

2.2 WATER DEMAND AND USE TRENDS

The BBLDWP service area is primarily residential with commercial accounts making up 5% and industrial making up less than 1% of the total accounts. BBCCSD serves only residential accounts. The projected water demands for BBLDWP and BBCCSD area are presented in Table 2-1. The historical and projected water demands for each water agency along with the total demands for the agencies are presented in Figure 2-2. These estimates do not include water used from private wells, which was estimated to be approximately 169 AFY in the BBLWDP 2006 Water Master Plan (7).

Table 2-1. Water Demand Projections for Bear Valley Water Agencies (AFY)

Water Agency	2015	2020	2025	2030	2035
BBLDWP[1]	2,095	2,169	2,246	2,326	2,408
BBCCSD[2]	940	1,163	1,220	1,281	1,344
Total	3,035	3,332	3,466	3,607	3,752

Note:
1. BBLDWP 2015 UWMP
2. BBCCSD 2015 UWMP

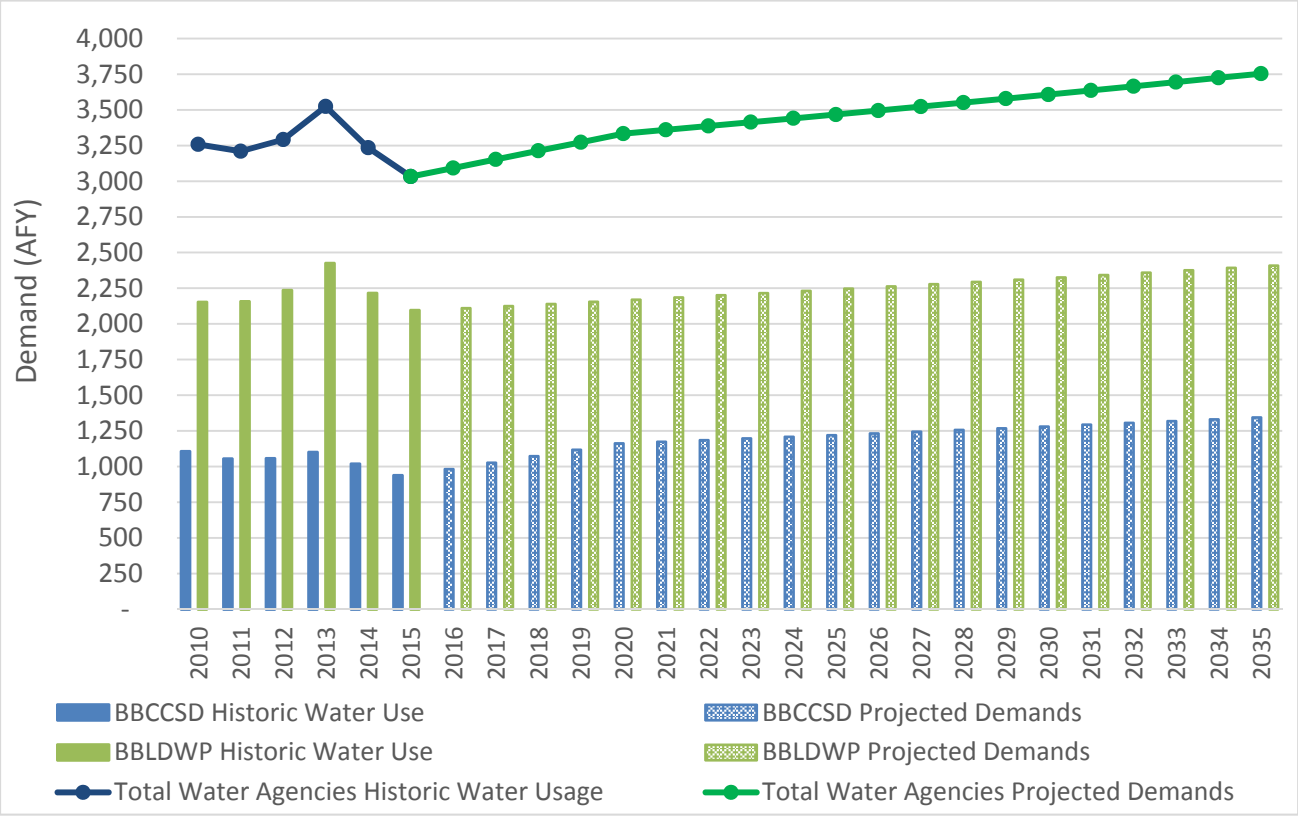

Figure 2-2. Historic and Projected Water Demands

2.3 WATER QUALITY

As stated in the 2015 UWMPs, the Basin generally contains high water quality. The BBLDWP 2015 UWMP states that the eastern portion of the Basin does contain elevated fluoride levels and there are other problem constituents including manganese, uranium, and arsenic. Water treatment plants, occasional blending projects and wells being shut down address these problems; however, these potential water quality issues are not anticipated to disrupt groundwater supply.

Total dissolved solids (TDS) concentrations in the Big Bear Valley groundwater supplies range from 140 to 450 mg/l with an average of 250 mg/l in the Big Bear Valley (10) (11). For recycled water projects, the concentration of TDS (or salts) in the water are of importance because high TDS RW can impact beneficial uses as well as treatment costs. For groundwater recharge applications, elevated TDS levels may be prohibited in order to protect the groundwater quality. In this case, excess salts would need to be removed, resulting in higher costs for FAT process construction and operation, as well as the brine management system. In RW irrigation applications, elevated TDS levels in the RW can be harmful to landscape plants or turf due to salt buildup in the root zone. Salt buildup in landscape applications can often be managed and is not likely to require additional treatment.

2.4 WATER PRICING

BBLDWP and BBCCSD have similar water rate structures comprised of 2 components: rates per hundred cubic foot (CCF) to account for variable costs and water service charges to account for fixed costs. Both BBLDWP and BBCCSD's billing cycles are bi-monthly. The current rate structures are shown in Table 2-2 and Table 2-3 for BBLDWP and Table 2-4 and Table 2-5 for BBCCSD.

Table 2-2. BBLDWP Fixed Rates

Fixed Rates	Residential Service	Commercial Service
Bimonthly service charge, 5/8" meters	$87.66	$51.92
Bimonthly service charge, 1" meters	$156.92	$86.55
Service charge base rate	0-8 ccf	0-4 ccf
Note: 1. Rates as of May 2016 available at http://www.bbldwp.com/		

Table 2-3. BBLDWP Tier Rates

Level	Water Amount (ccf)	Rate ($/ccf)
Residential Service Rates		
Tier 1	9-24	$2.64
Tier 2	25-40	$3.67
Tier 3	41-60	$5.47
Tier 4	61-100	$9.31
Tier 5	101+	$12.53
Commercial Service Rates		
Tier 1	5+	$3.79
Note: 1. Rates as of May 2016 available at http://www.bbldwp.com/		

Table 2-4. BBCCSD Base Rates

Meter Size	Base Rate
5/8", 3/4", 1"	$63.43
1 1/2"	$126.85
2"	$202.96
3"	$380.56
4"	$634.26
6"	$1268.52
Note: 1. Rates as of May 2016 available at http://www.bbccsd.org/	

Table 2-5. BBCCSD Tier Rates

Meter Size	Tier 1 (hcf)	Tier 2 (hcf)	Tier 3 (hcf)
5/8", 3/4", 1"	0-12	13-38	Over 38
1 1/2"	0-24	25-48	Over 48
2"	0-38	39-77	Over 77
3"	0-72	73-144	Over 144
4"	0-120	121-240	Over 240
6"	0-240	241-480	Over 480
Tier Cost ($/hcf)	$1.63	$1.75	$2.43
Note: 1. Rates as of May 2016 available at http://www.bbccsd.org/			

3 WASTEWATER CHARACTERISTICS AND FACILITIES

BBARWA owns and operates a 4.9 million gallons per day (MGD) capacity WWTP located just south of Baldwin Lake on the east side of the Valley. The WWTP currently treats approximately 1.76 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake and the CSA 53 in the community of Fawnskin.

3.1 EXISTING AND PROJECTED WASTEWATER FLOWS

The influent flows to BBARWA's WWTP are comprised of three components:

- Flow from full-time residential homes
- Flows due to tourism, commercial activities and part-time residential homes
- Flows from Infiltration and Inflow (I/I) due to precipitation

These components create a seasonal variation in the wastewater flows treated at the plant. Figure 3-1 illustrates the monthly variation of the flows due to each wastewater flow components. The monthly base flows correspond to flows from full-time residents; while the monthly other flows are comprised of flows from seasonal residents or tourism. Based on full-time residency rates from BBCCSD and BBLDWP and the number of full-time dwelling units reported by Bear Valley Electric, BBARWA's 2010 Sewer Master Plan (2010 SMP) estimated that the full-time residential rate is 38% (2).

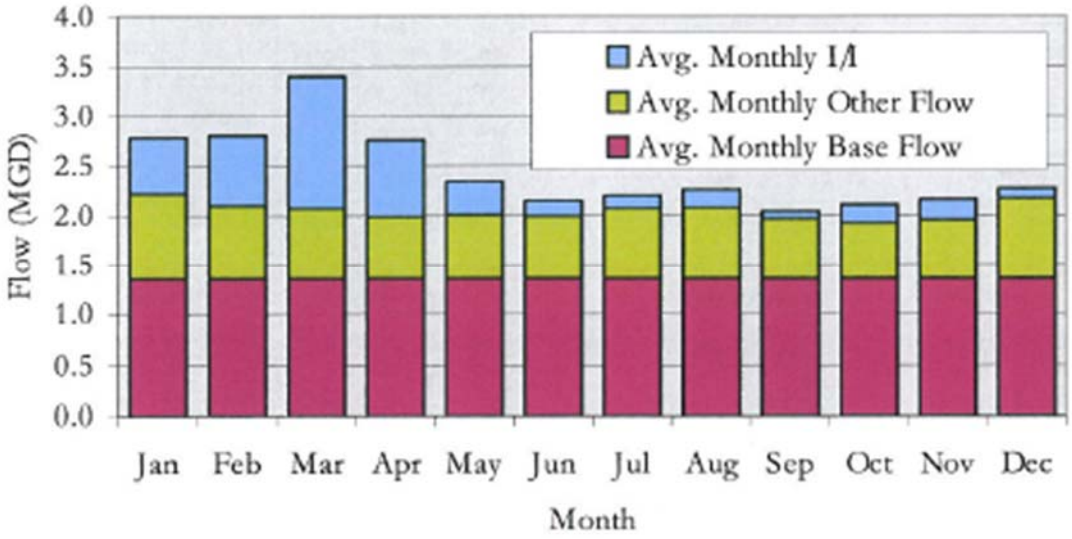

Figure 3-1. Seasonal Variation of BBARWA's Wastewater Flows (2)

The tourism season is largely concentrated in the months of December through April due the local ski resorts. The months of June and July also see a slight rise in tourism due to Lake recreation activities. Average daily flows and the seasonal variation from 2011 to 2015 are shown in Figure 3-2. The average daily flow for this time period is approximately 2.1 MGD and the maximum month flow is 5.5 MGD. In 2015, the annual average effluent flow was 1.76 MGD and the maximum month flow was 2.32 MGD in January 2015. The highest daily influent flow of 3.30 MGD occurred on January 2, 2015.

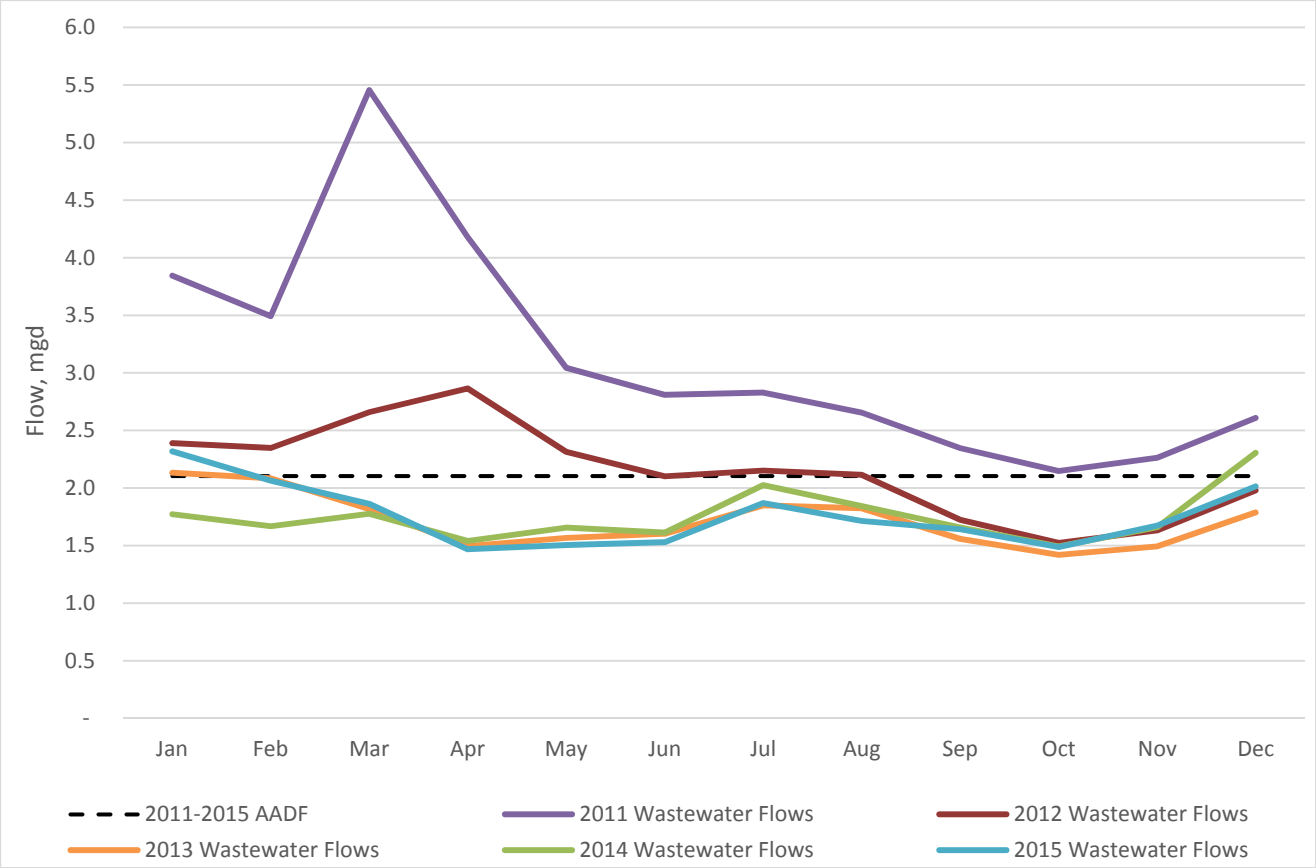

Figure 3-2. Average Daily Flows by Month (2011-2015)

The 2010 SMP estimated the future sewer flows based on future population and equivalent dwelling unit (EDU) projections utilizing the constant sewer load index of 172 gallons per day for full time residential EDUs. For the purposes of this Study, an EDU is defined as the amount of wastewater flow generated by one single-family residence. The 2010 SMP assumes the full-time EDUs will increase at an annual rate of 0.8% over a 20-year period based on a long-term average.

Assuming the full-time residence rate remains at 38% and that I/I will be consistent with the previous average, the 2010 SMP projects that the average annual sewer flows will increase from 2.1 MGD to 2.73 MGD by 2030. If the full-time resident sewer component factor grows to 100 %, the plant could see flows up to 5.27 MGD in 2030.

3.2 EXISTING FACILITIES AND DISCHARGE REQUIREMENTS

BBARWA's WWTP is located on a 93.5-acre lot. The WWTP process components occupy 11.2 acres and the remaining 82.3 acres include storage ponds and evaporation ponds. Influent flows are conveyed through three BBARWA operated sewer mains and lift stations to the plant.

- Lake Interceptor Line: Serves the City of Big Bear Lake's sewer system and uses the Lake Pump Station to convey flows to the WWTP
- North Shore Interceptor: Serves SBC 53B sewer system and conveys flows to the BBARWA Trunk Line
- BBARWA Trunk Line: Serves BBCCSD's sewer system and conveys flows from the North Shore Interceptor. Pump Station #1, Pump Station #2 and Pump Station #3 are used to pump flows to the WWTP.

The WWTP currently provides preliminary and secondary treatment. Table 3-1 summarizes the WWTP's treatment processes and the process flow diagram is depicted in Figure 3-3.

Table 3-1. BBARWA's WWTP Treatment Process

Treatment Process[1]	Description
Preliminary Treatment	Consists of bar screens, grit removal and disposal of solids
Secondary Biological Treatment	Consists of oxidation ditches which uses mechanical aeration to achieve organic material stabilization, nutrient removal and pathogen reduction. Solids production is minimized by the Cannibal® Solids Reduction System, through use of a side-stream interchange bioreactor with aeration controlled by the ORP level.
Secondary Sedimentation Treatment	Consists of clarifiers to settle solids. Waste activated sludge (WAS) is pumped to a dissolved air floatation (DAF) system
WAS Thickening	Consists of a DAF system that skims sludge for sludge dewatering. Filtrate is returned to oxidation ditches.
Sludge Dewatering[2]	Sludge is dewatered using a belt press and a heated drying facility. The drying facility consists of a covered building where floors are heated by the WWTP's generator exhaust. This allows for sludge to be dewatered throughout the year instead of summer only. The dry solids are hauled to a composting facility in Redlands.

Notes:
1. Descriptions obtained from the 2005 BBARWA Recycled Water Master Plan unless otherwise noted.
2. Obtained from BBARWA's website - http://bbarwa.org

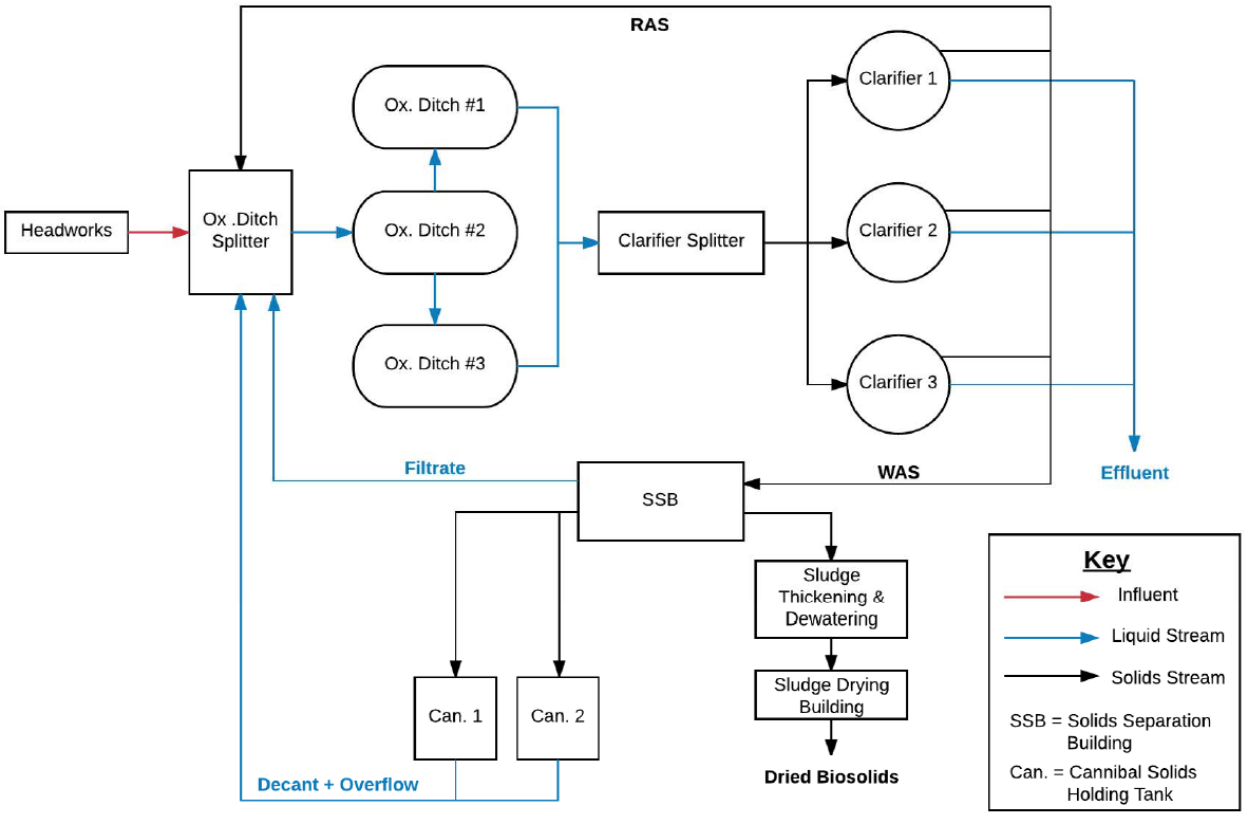

Figure 3-3. BBARWA WWTP Process Flow Diagram

BBARWA recently completed several upgrades to the sludge dewatering process. Heat exchangers were installed on the existing generator to capture waste heat; hot water from the heat exchangers is used to heat the floor of the lined drying bed. A metal building was also constructed to cover the lined drying bed that measures 315-ft in length and 60-ft in width so that the dewatering process could operate year round.

BBARWA's WWTP generates its own electricity using three natural gas generators that can be run in parallel: two 250 KW Cummins generators and one Waukesha generator with a rating of 600 kilowatts for a total generating capacity of 1100 kilowatts. BBARWA only generates the energy needed to operate the WWTP and Administration Building and typical generation is in the range of 225,000 - 350,000 kilowatt-hours (kW-hr) per month. In 2015, total energy generation was 3,100,216 kW-hr. Natural gas consumption was 43,544 million British Thermal Units (MMBTU) or 435,440 therms. BBARWA also has a connection to the Bear Valley Electric utility system that is used to run its pumping stations and can serve as an emergency backup power supply for the WWTP.

3.2.1 Existing Discharge Requirements

The wastewater stream that is treated by the WWTP consists of sewage generated from urban land uses. There are no significant sources of major industrial waste or processing water treated by the facility (2). The WWTP discharge is currently regulated by the Santa Ana Regional Water Quality Control Board (RWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR) issued on June 24, 2005. There are three permitted discharge locations, summarized in Table 3-2. Discharge Point 001 for irrigation in Lucerne Valley, is located within the Colorado River Basin Region and is regulated by Colorado River Basin RWQCB WDR Order No. R7-2016-0026 (Colorado WDR), issued on June 30, 2016.

Treated secondary effluent is discharged to a 480-acre site in Lucerne Valley (LV Site) for irrigation of fodder and fiber crops that are used as feed for livestock. Use of recycled water for crop irrigation at the LV Site began in 1980 and 100% of the WWTP effluent is currently discharged to the LV Site. Figure 3-4 depicts the location of BBARWA's existing recycled water distribution facilities and the LV Site, approximately 20 miles north of the Valley.

Table 3-2. WDR Order No. R8-2016-0044 Discharge Points

Discharge Point	Effluent Description	Receiving Water/Disposal Site	Recycling Reuse
001[1]	Secondary effluent w/o disinfection	Storage Ponds in Lucerne Valley	Irrigation in Lucerne Valley
002	Secondary effluent with disinfection	State surface water (Storage pond in Baldwin Lake) and Big Bear Valley Groundwater Management Zone	Construction and wildlife habitat
003	Tertiary effluent with disinfection	Big Bear Valley Groundwater Management Zone	Irrigation

Notes:
1. The Colorado River Basin Regional Water Quality Control Board (Region 7) regulated the use of the recycled water in the Lucerne Valley (WDR Order No. R7-2016-0026).

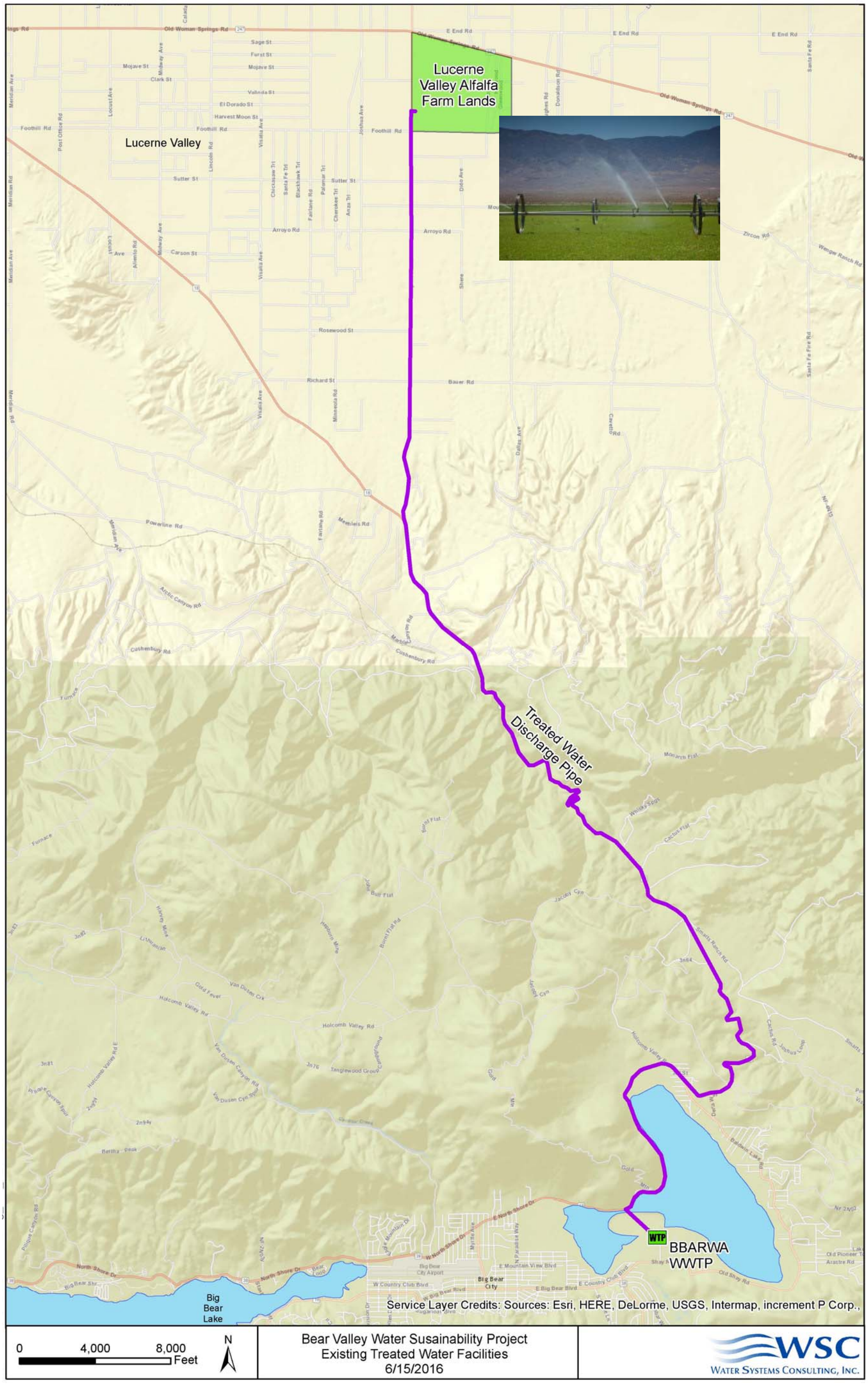

Figure 3-4. Existing Recycled Water Facilities

The effluent requirements for conventional pollutants for recycled water discharged to the LV Site contained within the Colorado WDR are presented in Table 3-3 and a summary of the actual effluent quality in 2015 is presented in Table 3-4.

The previous Colorado WDR that regulated this discharge (Board Order 01-156) included a TDS limit of a maximum of 400 mg/L above the domestic source water. The WWTP discharge was always well within compliance with this requirement. The recently updated WDR requires BBARWA to provide a technical report in the form of a study that analyzes the impacts to groundwater in the vicinity of the LV Site by the discharge and an evaluation of water quality trends. The results of the study will be used to establish an appropriate effluent limitation for TDS. BBARWA has begun the preparation of this report, which is required to be submitted by December 30, 2017 (18 months of the adoption of the Colorado WDR). Based on the background water quality in the vicinity of the LV Site and discussions with the Colorado River Basin RWQCB, it is not anticipated that the results of this study will lead to the establishment of a TDS limit lower than the current effluent TDS level. Therefore, additional treatment upgrades are not anticipated to be required to comply with this provision.

A copy of the two WDR permits are attached in Appendix A.

Table 3-3. Discharge Limits for LV Site and Actual 2015 Effluent Quality

Parameter	Units	30-Day Mean	7-Day Mean	Maximum Daily
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	-
Total Suspended Solids (TSS)	mg/L	30	45	-
Chloride	mg/L	60	-	80
Sulfate	mg/L	60	-	80
Boron	mg/L	-	-	0.75
Total Nitrogen	mg/L	10	-	-
pH	pH units	Between 6.0 - 9.0 at all times		

Table 3-4. 2015 BBARWA WWTP Effluent Quality – Annual Average

Parameter	Value	Units
TDS	453	mg/L
BOD_5	6	mg/L
TSS	13	mg/L
Chloride	56	mg/L
Sulfate	43	mg/L
Phosphorus	2.3	mg/L
Total Inorganic Nitrogen (TIN)	4.6	mg/L
pH	7.12 – 8.09	pH units

3.2.2 BBARWA Operating Budget

BBARWA's operating budget for Fiscal Year (FY) 2017 is shown in Table 3-5.

Table 3-5. BBARWA FY 2017 Operating Budget (12)

Expense Category	Budget FY 2017
Salaries and Benefits	$ 1,933,443
Power	$ 531,528
Sludge Removal	$ 258,910
Chemicals	$ 43,816
Materials and Supplies	$ 139,421
Repairs and Replacements	$ 141,680
Equipment Rental	$ 770
Utilities Expense	$ 6,337
Communications Expense	$ 42,084
Contractual Services - Other	$ 100,340
Contractual Services - Prof	$ 211,272
Permits and fees	$ 149,100
Property Tax Expense	$ 3,705
Insurance	$ 90,931
Other Operating Expense	$ 58,578
Depreciation Expense	$ 841,470
Total Operating Expense	**$ 4,553,385**

3.2.3 Current Rate Schedule

BBARWA's current rate schedule is shown in Table 3-6.

Table 3-6 BBARWA Rate Schedule (12)

Member Agency	Charge per EDU
City of Big Bear Lake	$206.37
Big Bear City CSD	$197.35
CSA 53B	$192.48
Connection Fee[1]	$3,670

Notes:

1. Effective July 1, 2016

3.2.4 Capital Improvement Plan

BBARWA's 5-year Capital Improvement Plan for Fiscal Years 2017-2021 is shown in Table 3-7.

Table 3-7 BBARWA 5-year Capital Improvement Plan (12)

Primary Account	Budget FY 2017	Forecast FY 2018	Forecast FY 2019	Forecast FY 2020	Forecast FY 2021	5-Year FY 2017-2021
Administration Building	$5,000	$0	$0	$0	$0	$5,000
Flow Measuring Devices	$19,271	$26,497	$0	$48,031	$0	$93,799
Interceptor System	$0	$0	$411,334	$579,637	$0	$990,971
Other Equipment	$26,408	$33,623	$34,343	$138,175	$6,708	$239,257
Other Capital Assets	$0	$0	$14,578	$0	$0	$14,578
Other Tangible Plant	$0	$0	$0	$106,319	$0	$106,319
Power Generating Equipment	$0	$109,273	$0	$0	$309,976	$419,249
Transportation Equipment	$77,800	$0	$0	$93,903	$64,706	$236,409
Treatment Plant	$114,126	$292,272	$1,751,791	$1,644,175	$257,105	$4,059,469
Total	**$242,605**	**$461,665**	**$2,212,046**	**$2,610,240**	**$638,495**	**$6,165,051**

3.3 TREATMENT REQUIREMENTS

In order to recharge the groundwater basin or discharge recycled water to the Lake, the recycled water must meet the water quality objectives set by the Basin Plan. The Basin Plan establishes beneficial uses and water quality standards for the ground and surface waters of the region and includes an implementation plan describing the actions by the RWQCB and others that are necessary to achieve and protect the water quality standards. The Basin Plan provides a general narrative regarding the water quality objectives for each water body type and specific numeric objectives for total dissolved solids (TDS), hardness, sodium, chloride, total inorganic nitrogen (TIN), sulfate, and chemical oxygen demand (COD). Additional information about the Basin plan is provided in Appendix B. The water quality objectives for the Big Bear Valley are summarized in Table 3-8.

Table 3-8. Basin Plan Water Quality Objectives

Water Body	TDS	Hardness	Sodium	Chloride	TIN	Sulfate	COD
Inland Surface Streams							
Rathbone Creek	300	-	-	-	-	-	-
Lakes and Reservoirs							
Big Bear Lake	175	125	20	10	0.15	10	-
Wetlands (Inland)							
Stanfield Marsh (Narrative Objectives)	-	-	-	-	-	-	-
Groundwater Management Zones							
Big Bear Valley	300	225	20	10	5	20	-

3.3.1 Recycled Water Treatment Level for Groundwater Recharge

A key consideration in the development of any recycled water project is the required quality and treatment level of the recycled water as established by State Regulations. There are several factors that can drive that determination for each project. For groundwater recharge projects, the primary factors influencing level of treatment are: (1) availability of high quality dilution water in the vicinity of the recharge area; and (2) whether additional treatment is required to meet the Basin Plan Objectives for TDS for the proposed beneficial use location. Either factor can be the driver for the required treatment level, depending on the specifics of a particular project. These considerations for treatment level decisions are depicted in Figure 3-5.

The groundwater replenishment regulations in Title 22 require that the initial concentration of filtered and disinfected tertiary recycled water (Recycled Water Concentration or RWC) not exceed 20% of the total recharge water, which requires 80% of the total recharge water to come from other high quality water sources for blending. Blend water can be a combination of imported SWP water, captured stormwater, or natural underflow. If sufficient dilution water is not available from these sources, advanced purified recycled water using reverse osmosis (RO) and advanced oxidation can serve as a dilution source.

According to the Basin Plan, if the current quality of a management zone is the same as or poorer than the specified water quality objectives, then that management zone does not have assimilative capacity. If the current quality is better than the specified water quality objectives, then that management zone has assimilative capacity. If there is assimilative capacity in the receiving waters for TDS, nitrogen or other constituents, a recycled water discharge may be of poorer quality than the objectives for those constituents, as long as the discharge does not cause violation of the objectives and provided that antidegradation requirements are met. However, if there is no assimilative capacity in the receiving waters, the recycled water quality cannot be poorer than the receiving water objectives and may require additional treatment. Alternatively, the Basin Plan can be amended to specify "maximum benefit" water quality objectives, which create assimilative capacity, subject to approval by the Santa Ana RWQCB and the implementation of certain projects and actions by the responsible agencies. The assimilative capacity of the Big Bear Valley Groundwater Management Zone has not yet been evaluated. Assimilative capacity can be evaluated on a project specific basis or for the basin as whole through the Santa Ana Watershed Project Authority Basin Monitoring Program Task Force (BMPTF).

Advanced treatment that uses a RO process can be used to achieve both dilution requirements and TDS removal. Additional information on the regulations related to these considerations is provided in Appendix B.

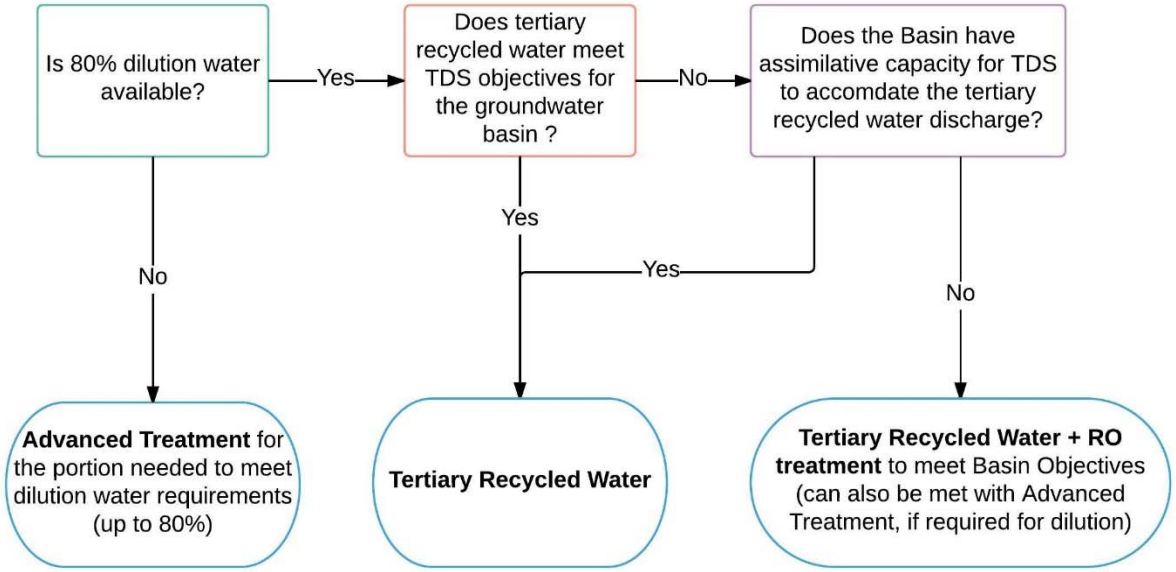

Figure 3-5. Treatment Level Considerations

At the planning level, there is some uncertainty in the treatment requirements because the available dilution water has often not been fully quantified and the ability to use assimilative capacity, if available, has not been determined. Project proponents have an opportunity to perform additional analysis to demonstrate to the RWQCB and DDW that tertiary treatment and dilution water will meet the Title 22 and Basin Plan requirements. The RWQCB and DDW will make the final decisions on the required treatment levels after review and evaluation of technical information presented by the project proponent during the permitting process.

4 RECYCLED WATER MARKET AND OPPORTUNITIES

4.1 PRIOR MARKET ANALYSIS

There is a long legacy of exploring water reuse opportunities in the Big Bear Valley for a variety of beneficial uses including wildlife habitat, landscape irrigation, surface water discharge, and groundwater recharge. Water reuse opportunities in the Valley were first investigated in 1964 and evaluations have continued intermittently since BBARWA was formed in 1974.

Appendix C includes a timeline summarizing the evolution of wastewater management in the Valley from 1935 to 2003 as well as a partial list of documents related to water reuse in the Valley, as of April 2005.

The most recent effort to develop a recycled water program in the Valley culminated with the development of the BBARWA Recycled Water Master Plan (RWMP), which was completed in 2006, and the Program Environmental Impact Report (PEIR), which examined the alternatives, put forth in the RWMP.

The 2006 RWMP evaluated several recycled water opportunities:

- Non-potable reuse for irrigation, industrial, commercial, and construction use;
- Environmental uses; and
- Groundwater recharge through surface recharge basins.

The RWMP recommended a phased implementation of a recycled water program that included both non-potable reuse and groundwater recharge at the Greenspot Recharge Site in the Erwin Lake area. Phase 1 included only groundwater recharge at the Greenspot Recharge Site. A recycled water distribution system to non-potable users was recommended for subsequent phases once assurances were obtained from potential recycled water users who would be connected.

Ultimately, the BBARWA Board certified the PEIR in 2006 and received and filed the RWMP, but decided not to approve the implementation of a recycled water project at that time.

4.2 MARKET ANALYSIS UPDATE

This Study updated the market analysis performed in the 2006 RWMP and evaluated opportunities for additional types of reuse. The types of reuse considered in this Study include:

- Landscape Irrigation
- Fish Hatchery Supply
- Surface Water Discharge
- Groundwater Recharge – Inland injection and/or surface spreading
- Direct Potable Reuse, pending future regulations

4.2.1 Landscape Irrigation

An initial list of 55 potential recycled water users in the Big Bear Valley was compiled from the users listed in the 2006 RWMP, as well as additional users identified by the Project Team. At the Alternatives Development Workshop for this Study, the Project Team reviewed this list and eliminated some potential users that: are no longer in existence or did not develop as expected; are anticipated to be closed in the near future; have low water demands; or are expected to be unwilling to convert to recycled water.

The final list of 25 potential recycled water users considered in the Study. For each user, consumption records from 2011-2014 were obtained from that user's water supplier, either BBLDWP or BBCCSD. The average of the annual consumption between 2011 and 2014 was used as the estimated recycled water demand. Where consumption records were not available, estimated demands from other studies were used. The list of potential recycled water users is shown in Table 4-1 and on Figure 4-1. Appendix D includes the sources of data used to estimate demands for each user, as well as estimates of maximum day demand and peak hour demand for each.

Table 4-1. Potential Recycled Water Users and Demands

User ID	Potential Recycled Water User	Total Annual Demand (AFY)
1	North Shore Elementary School	8.6
2	Rotary Pine Knot Park	2.6
3	Veterans Park	2.3
4	Meadow Park	0.9
5	Big Bear Middle School	12.6
6	Big Bear Elementary School	5.1
7	Big Bear Snow Play	0.1
8	City of Big Bear Lake City Hall and Village Streetscape	0.6
9	World Mark (Timeshare Resort)	20.6
10	Big Bear High School	22.2
11	Stickleback	37.8
14	Big Bear Airport District (Landscaping Meter)	0.6
15	Church of Jesus Christ Latter Day Saints	1.8
16	Erwin Lake Park	1.6
17	Gold Mountain Memorial Park (Cemetery)	0.0
22	Sonny's Place Equestrian Center	0.0
23	Whispering Pines	8.3
25	Chautauqua High School B	2.1
27	Paradise Park (Proposed)	3.0
28	Big Bear Golf Course	120.0
30	The Ranch	1.6
31	Alpine Zoo	1.5
33	Baldwin Lake Elementary	7.7
34	Sugarloaf Park	22.0
35	Otto Lawrence (Inn Der Bach)	0.5
	Total	284.3

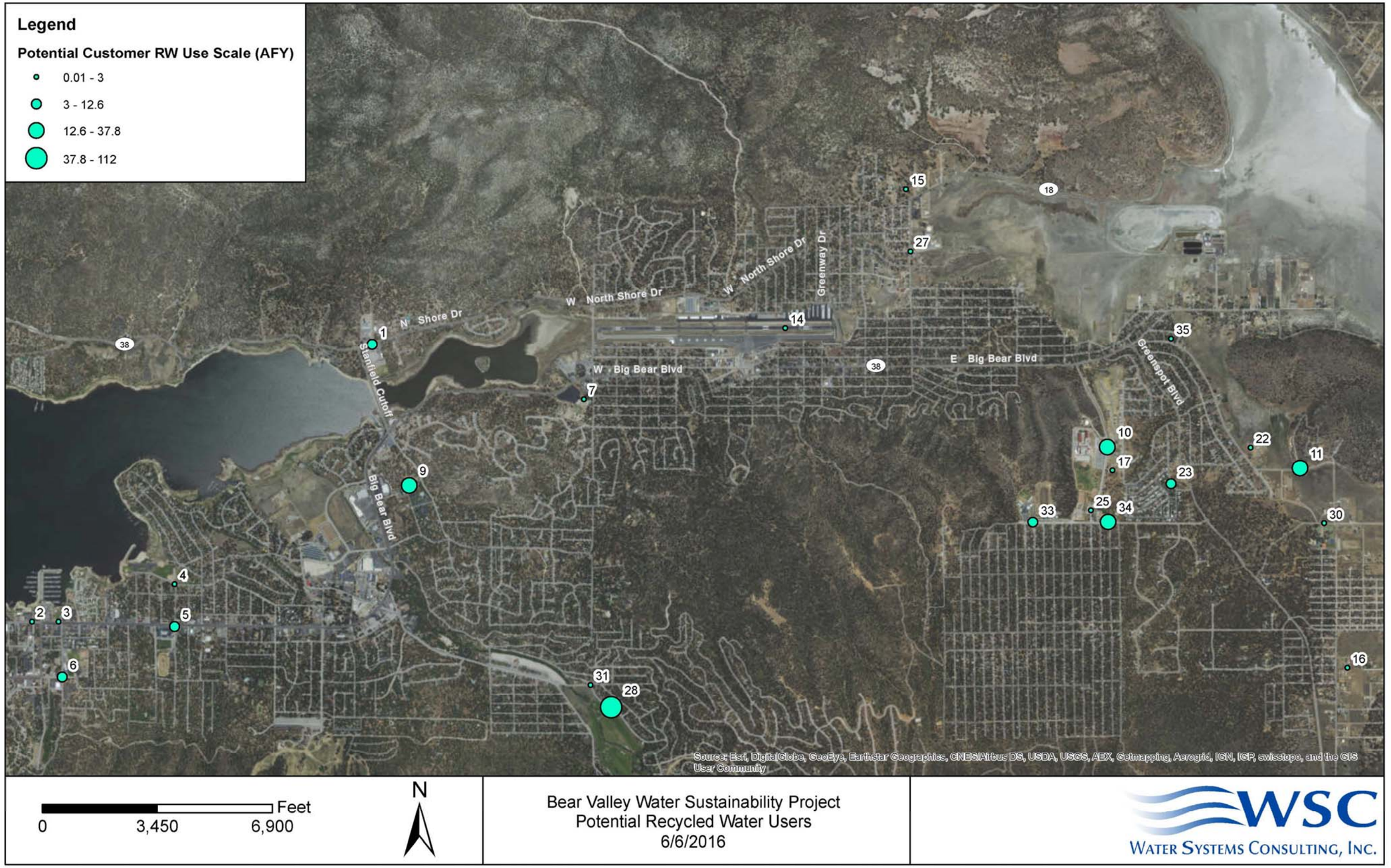

Figure 4-1. Potential Recycled Water Users

4.2.2 Fish Hatchery

One of the goals of this Study was to explore the viability of developing a fish hatchery to provide community benefits and potentially offset the costs of a project that provides a new and sustainable source of water to the Valley.

A Technical Memorandum (TM) describing a conceptual recirculating hatchery at the BBARWA WWTP site is included in Appendix I. This TM summarizes the research compiled, sources gathered, and calculations conducted regarding the fish hatchery and treatment wetlands concepts. The TM assumed the hatchery would be sized to produce 150,000 pounds of trout per year to meet the local demand for stocking the Lake. The effluent from the hatchery is assumed to be treated using a constructed wetlands system to reduce ammonia concentrations and total suspended solids and recycled water from the BBARWA plant would be provided as makeup water. A conceptual process flow diagram for the hatchery and wetlands treatment concept is shown in Figure 4-2. Additional details are provided in Appendix I.

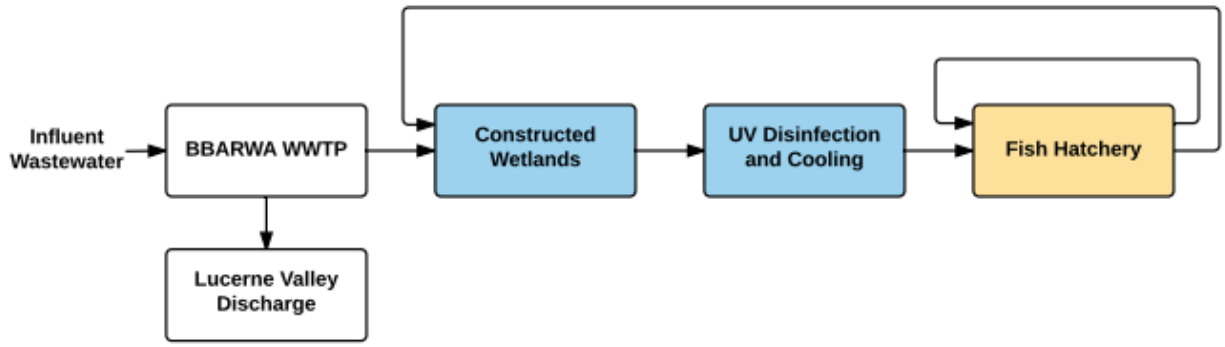

Figure 4-2. Conceptual Hatchery Process Flow Diagram

A concept level opinion of preliminary cost was developed to provide an order of magnitude estimate for the hatchery and wetlands treatment concept to help guide decisions on next steps for this concept. The preliminary estimate of annual unit cost is in the range of $8 - $12 per pound of fish, which is higher than BBMWD typically pays for fish from other sources, although supply from these sources is often limited.

Although impoundments at fish hatcheries are identified as an acceptable use of recycled water in Title 22, no examples of hatcheries using recycled water as a supply were identified. There are several potential environmental and regulatory hurdles to implementing a fish hatchery with a recycled water supply.

The Project Team has decided not to pursue implementation of a fish hatchery at the BBARWA WWTP site using a recycled water supply at this time. However, the alternatives analysis in Chapter 5 identifies potential opportunities to integrate a hatchery with the water supply alternatives.

4.2.3 Groundwater Recharge – Surface Spreading

The potential to supplement supply in the Big Bear Valley with recycled water using surface recharge facilities was previously evaluated by GEOSCIENCE Support Services, Inc. (GEOSCIENCE) in a 2004 Recharge Evaluation (13), as well as in prior studies. In the 2004 Recharge Evaluation, four sites were initially identified for investigation of artificial recharge potential:

- The area north of Green Spot Spring (Erwin Subunit; Eastern Baldwin Lake Watershed),
- Van Dusen Canyon (West Baldwin Subunit; Western Baldwin Lake Watershed),
- Shay Meadow Area (Erwin Subunit; central Baldwin Lake Watershed), and
- Sand Canyon (Rathbone Subunit; Eastern Big Bear Lake Watershed).

Figure 4-3 shows the potential recharge locations that were evaluated. After a preliminary evaluation of site access and environmental issues, preliminary investigations and borehole drilling, regulatory requirements, and pilot testing, the Shay Meadow and Sand Canyon sites were removed from consideration before any additional field investigations were conducted. The Green Spot Spring and Van Dusen Canyon sites were the subjects of further drilling and testing. Although not fully evaluated in the 2004 GEOSCIENCE study, the Sand Canyon recharge is included in this Study and is discussed in Section 4.2.3.4.

4.2.3.1 *Greenspot Recharge Site*

Analysis of the drilling and pilot recharge testing at the Greenspot site resulted in the following conclusions (13):

- The Greenspot site is located on recent alluvial deposits of permeable sand and gravel and no soil layers were observed beneath the site that would inhibit the downward percolation of recharge water to the ground water table.
- Groundwater levels start at approximately 100 ft below ground surface (bgs), which allows adequate space for mounding and storage of recharge water.
- A one-month pilot recharge test resulted in recharge rates of 3.1 to 3.7 ft/day. For planning purposes, the recharge rate is assumed to be one half of the observed rate to be conservative.
- At the seepage velocities estimated from the artificial recharge test data, ground water recharged at the Green Spot Site would reach the nearest production wells (BBLDWP's Lakewood well field) in 8.5 to 17.5 months.
- No fatal flaws were identified during the pilot recharge test.
- The property necessary to support a full-scale program at this site should include more than five acres of area for surface water spreading, plus the necessary additional land for berms and maintenance access.

In a subsequent study by GEOSCIENCE in 2005 titled *Analysis of Ground Water Flow Model Simulations for the Proposed Green Spot Artificial Recharge Site*, a calibrated groundwater flow model was used to simulate and evaluate a full-scale artificial recharge spreading basin facility at this site. The study evaluated potential changes in groundwater levels that would result from the artificial recharge of 500, 1,000, 1,500 or 2,000 AFY of water, with and without additional groundwater pumping. The study concluded that:

- An additional extraction well field downgradient of the recharge site would be needed to effectively intercept the water that is artificially recharged at the Greenspot Recharge Site. The study assumed 6 extraction wells at a rate of 100 gallons per minute (gpm) each.
- Groundwater levels can be maintained below approximately 30 ft bgs with as much as 1,000 AFY of artificial recharge during periods of below normal precipitation, provided that an equivalent amount of water is extracted at the down gradient well field.
- During wet periods, further pumping from the extraction well field and Lakewood Wells is required to artificially lower the ground water levels to maintain storage space within the aquifer in order to continue artificial recharge.
- DWR records suggest that some existing private wells are located in the vicinity of the proposed recharge basins and would be within 6-months travel time from the proposed basins. However, the exact locations of these wells will have to be verified.

4.2.3.2 *Van Dusen Site*

Analysis of the drilling and pilot recharge testing at the Van Dusen site resulted in the following conclusions (13):

- The Van Dusen site is located on recent alluvial deposits of permeable sand and gravel. Some soil layers were observed beneath the site that may inhibit the downward percolation of recharge water to the groundwater table.
- Groundwater levels start at approximately 100 ft bgs, which allows adequate space for mounding and storage of recharge water.
- A one-month pilot recharge test resulted in recharge rates of 1.1 to 1.6 ft/day. For planning purposes, the recharge rate is assumed to be one half of the observed rate to be conservative.
- At the seepage velocities estimated from the artificial recharge test data, ground water recharged at the Van Dusen Canyon site would reach the nearest production well (BBCCSD Well No. 1) in approximately 106 to 160 months.
- No fatal flaws were identified during the pilot recharge test.

Given the lower recharge rates and limited availability of property, this site is not as favorable as the Green Spot Site (13). The Van Dusen Site was not considered in this Study.

4.2.3.3 *Shay Meadow Area*

The Shay Meadow site was not considered viable due to shallow ground water and environmental concerns (13) and was not considered in this Study.

4.2.3.4 *Sand Canyon Site*

From a geohydrologic perspective, the Sand Canyon area is very promising for artificial recharge. Sediments above the ground water consist primarily of permeable sand and the ground water surface is greater than 100 ft bgs. However, Sand Canyon was removed from consideration prior to further testing due to its distance from BBARWA, site access constraints, and regulatory issues (13). Although coordination with the flood control agency increases the complexity of project implementation, the Sand Canyon Site was included in this Study due to the significant recharge potential and proximity to BBLDWP's primary production facilities. A conceptual satellite treatment facility was evaluated as an alternative to produce a recycled water supply closer to this site.

A report prepared for BBLDWP in 1991 estimated that the long term percolation rate for the Sand Canyon stream channel is between 1.5 and 4.5 ft/day, but recommended using the minimum value of 1.5 ft/day to be conservative (14). The report estimated that approximately 750 AFY of recycled water could be recharged at Sand Canyon while meeting the minimum travel time requirement before extraction at downstream wells. Travel time and blending requirements were the limiting criteria for this analysis and the actual recharge potential may be greater. The study assumes that a series of small berms 4 ft in height would be constructed along the Sand Canyon streambed above Teton Drive with a total area of approximately 2.5 acres. As this is a flood control channel, the berms would need to be designed to allow the conveyance of flood flows through the channel and may need to be designed to wash out during large flood events.

An alternative approach later identified by BBLDWP is to modify the stream channel to slow down the flow of water to allow maximum percolation but not interfere with flood flows. This concept could include widening the stream to the extent possible to create a meandering stream with small natural ponds to slow the water down and enhance percolation. Either concept would need to be coordinated with the flood control agency to ensure that the capacity of the flood control channel remains sufficient to meet the primary purpose of providing flood protection. If these improvements resulted in a decrease in surface flow entering the Lake, the impact to surface water rights under the 1977 Judgment would need to be evaluated.

4.2.3.5 *Stanfield Marsh*

In addition to the sites identified in the 2004 Recharge Evaluation, the Project Team considered the concept of discharging recycled water to a drainage channel that parallels the south side of the Big Bear Airport and discharges into the Stanfield Marsh, which is tributary to the Lake. However, according to the 1998 BBARWA Engineer's Report, the Stanfield Marsh has a significant clay later on the bottom of the marsh that prevents percolation into the surrounding groundwater basin (15). The report states that BBLDWP has wells that are less than 1000 ft from the marsh high water level and studies by BBLDWP have shown that the wells do not receive replenishment groundwater from the marsh. The report does not include the details on the underlying geology and the referenced studies were not found for review; however, this indicates that recharge at Stanfield Marsh is not a viable site for replenishment of the groundwater supply.

Additionally, since the Stanfield Marsh is hydraulically connected to the Lake, discharges to the Stanfield Marsh would likely be required to meet water quality objectives of the Lake. The TDS objective for the Lake is 175 mg/L, which would require a significant portion of the discharge to receive RO treatment to reduce TDS. Due to the apparent absence of a water supply benefit, the Stanfield Marsh was not considered for recharge as part of this Study. However, further evaluation could be conducted to assess whether recharge in the bottom of the drainage channel along the south side of the airport would recharge the shallow aquifer and provide a water supply benefit.

The Stanfield Marsh and the Lake are designated as Municipal Supply in the Basin Plan. While the water in the Lake is not used locally for municipal supply, discharges from the Lake enter Bear Creek and are collected downstream at the confluence with the Santa Ana River and are ultimately delivered to two drinking water filtration plants that provide municipal supply in the San Bernardino Valley. The 1998 BBARWA Engineer's Report states that retention time for recycled water discharged to the Lake would be in excess of 20 years. Once released from the Lake, water traveling through Bear Creek provides an additional environmental buffer. Due to the magnitude of the environmental buffer, discussions with DDW indicated that discharge of recycled water to the Lake would not be regulated as surface water augmentation.

Although DDW has indicated that discharging of recycled water to the Lake would not be regulated by that agency, a National Pollutant Discharge Elimination System (NPDES) permit issued by the Santa Ana RWQCB would be required for any discharges to waters of the United States (i.e. rivers, lakes, wetlands, and oceans). An NPDES permit may be issued in conjunction with a WDR Order. The NPDES permit will establish numerical limitations on the concentrations of pollutants that can be in the discharge water. The limitations are based on treatment technology capabilities and surface water uses. The water quality objectives for the Lake in the Basin Plan would apply and would therefore require salt removal before discharge into the Lake, and may require treatment for other criteria that apply to the Lake. Since recycled water discharge to the Lake was not tied to a direct water supply benefit, this alternative was not evaluated in this Study.

The 2004 Recharge Evaluation noted that other sites that have not been previously considered for artificial recharge applications may exist in the Valley, but would require further studies to identify and test.

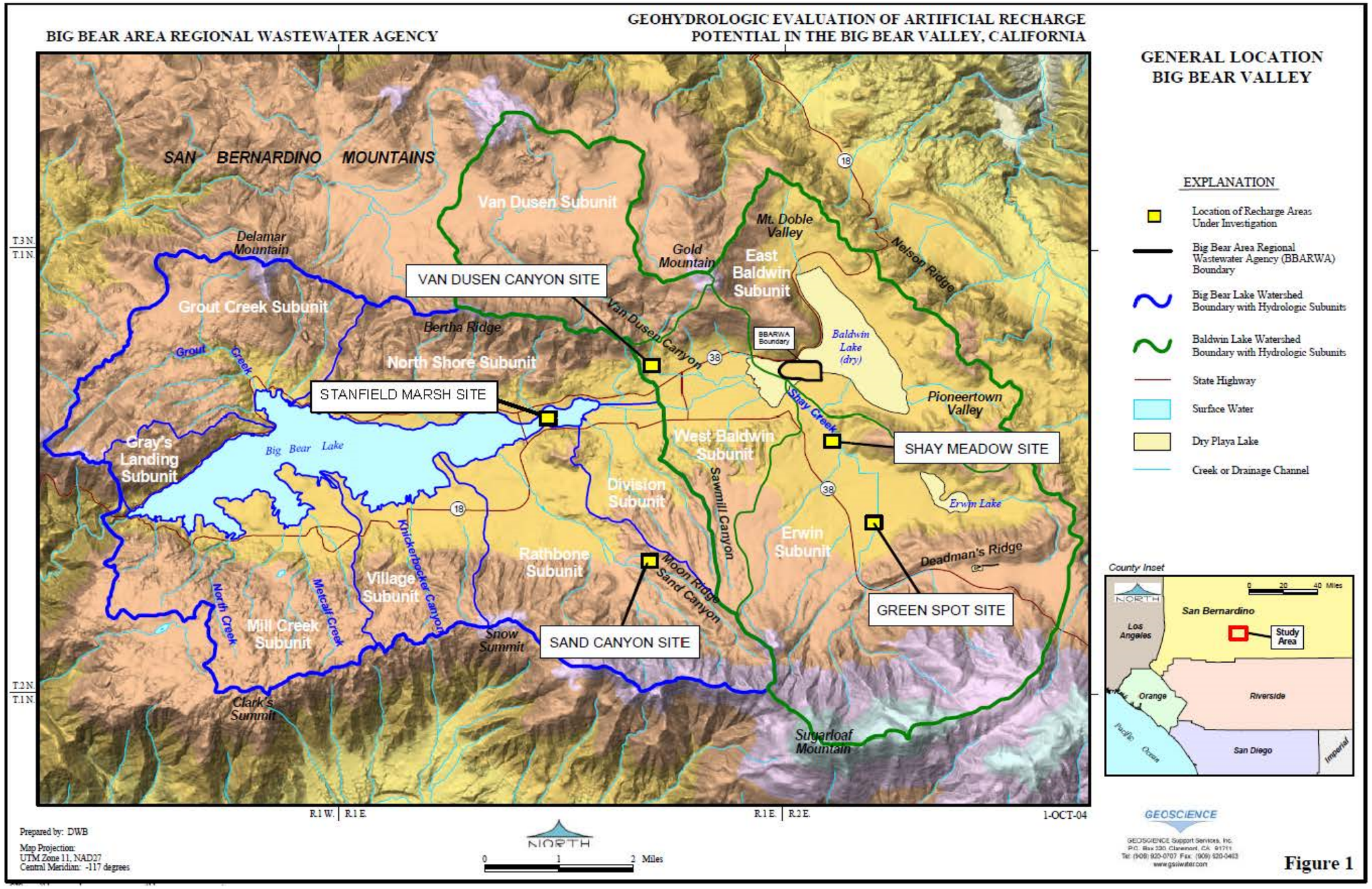

Figure 4-3. Potential Recharge Areas Evaluated (13)

4.2.4 Groundwater Recharge – Subsurface

The Groundwater Recharge Regulations also regulate subsurface recharge via injection wells. Due to the existence of viable surface recharge sites in the Valley and the operational and maintenance requirements of injection wells, the Project Team chose not to evaluate subsurface groundwater recharge in this Study.

4.2.5 Direct Potable Reuse

Direct Potable Reuse involves the use of advanced treatment technologies to purify wastewater for use as municipal drinking water. Recycled water may be introduced into the raw water supply directly upstream of a drinking water treatment facility, or an advanced water treatment facility may be permitted as a drinking water treatment facility and water is the introduced directly into the public water system. Either alternative may require an engineered storage buffer as part of the purification process.

Water agencies in California have begun evaluating the possibility of implementing DPR as a source of local water supply; however, there are currently no regulations for direct potable reuse. Senate Bill (SB) 918 approved on September 30th, 2010 and subsequent SB 322 approved on October 8th, 2014 directed the California Department of Public Health (CDPH), to investigate the feasibility of developing uniform water recycling criteria for DPR (CDPH's responsibilities have since been transferred to the SWRCB's DDW). Additionally, the bills required SWRCB to convene an expert panel for technical and scientific issues, and an advisory group to advise the expert panel and the SWRCB on the development of the feasibility report. The SWRCB will consolidate the information from the expert panel report and provide the findings in a Report to Legislature. A draft Report to Legislature providing recommendations related to the feasibility of developing regulatory criteria for DPR was released for public comment on September 1, 2016, and the final Report to Legislature is due by December 31st, 2016. The expert panel's feasibility report is available as an attachment to the Report to Legislature.

Since there is no surface water treatment plant in the Valley, a potential future DPR project in the Valley may be designed to introduce advanced purified water directly into the potable water system after retention in an engineered water storage buffer. As noted above, DPR is not currently regulated in California but it is recommended that the Bear Valley Agencies continue to track the evolution of recycled water regulations and consider exploring a DPR concept as a long term strategy to increase recycled water use within the Valley.

5 PROJECT ALTERNATIVES ANALYSIS

This section describes the development of the alternatives and the alternatives analysis process used to select the preferred alternative. Appendix E includes a summary of the technical criteria and financial assumptions used for this analysis. Section 6 provides discussion of the following:

- Details of each alternative and the no-project alternative
- Water conservation and reduction analysis
- Alternatives analysis considerations

5.1 ALTERNATIVES EVALUATED

At the Alternatives Development Workshop, the following three recycled water project alternatives were selected for further development and evaluation in this Study:

- Alternative 1: Disinfection Tertiary Landscape Irrigation
- Alternative 2: Groundwater Recharge at Greenspot
- Alternative 3: Groundwater Recharge at Sand Canyon
- Alternative 4: Groundwater Recharge at Greenspot & Sand Canyon

The following subsections provide details of potential use of the recycled water, infrastructure requirements, recycled water unit cost, location, advantages, and disadvantages for each alternative.

5.1.1 Alternative 1: Disinfected Tertiary Landscape Irrigation

Alternative 1 includes upgrading BBARWA's existing WWTP to tertiary treatment for production of Title 22 disinfected tertiary water for landscape irrigation throughout the Valley. Beneficial use of recycled water for disinfected tertiary landscape irrigation is permitted in unrestricted access areas such as school yards, parks and golf courses.

5.1.1.1 *Treatment Upgrades*

To implement Alternative 1, the BBARWA WWTP would need to upgrade to a tertiary treatment process to produce Title 22 disinfected tertiary recycled water (RW). BBARWA's existing secondary treatment and clarification facilities are assumed to be sufficient for adequate BOD and TSS removal prior to tertiary treatment. The new treatment processes required at the BBARWA WWTP to produce disinfected tertiary recycled water include:

- Tertiary filtration. Cloth media filters are assumed as the tertiary filtration process because the technology is offered by multiple vendors, easy to operate and low cost.
- Disinfection. Chlorination is assumed as the disinfection process because the BBARWA staff is familiar with chlorine dosing systems, and chlorination provides adequate disinfection to reliably produce disinfected tertiary RW.

A process flow diagram (PFD) for Alternative 1 is shown in Figure 5-1. The new facilities required for this alternative are outlined in blue. Additional detail on each of the treatment systems is provided in Appendix F.

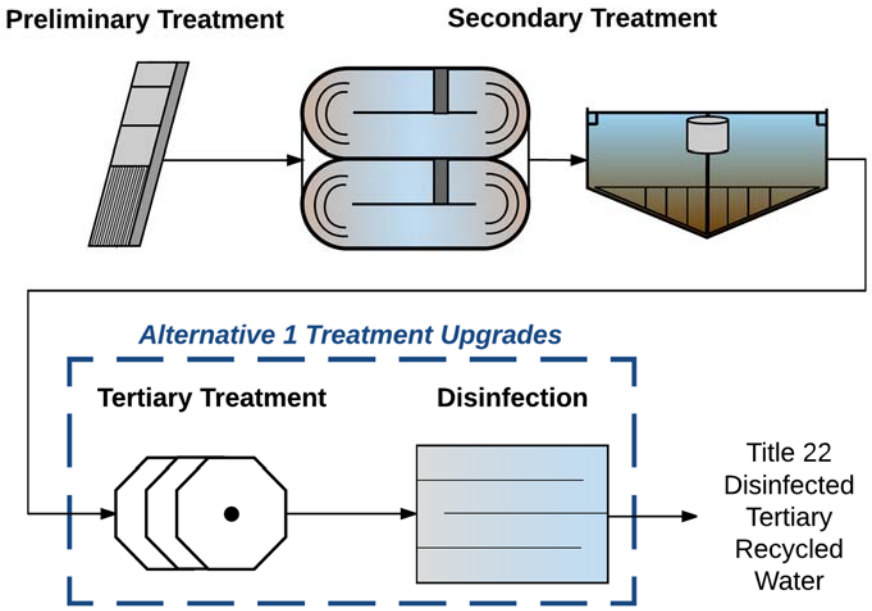

Figure 5-1. Treatment Process Flow Diagram for Alternative 1

5.1.1.2 *Potential Landscape Irrigation in Big Bear Valley*

As described in Section 4.2.1, 25 potential recycled water users were identified. These users can be served with disinfected tertiary recycled water for landscape irrigation. Conceptual pipeline alignments were developed to deliver recycled water to the largest users throughout the valley, while serving other, smaller RW users along the way. Potential users which were not in proximity to the pipeline alignments were assumed not to be served with recycled water. The potential users with the largest estimated annual demand include the WorldMark (20.6 AFY), Sugarloaf Park (22 AFY), Big Bear Middle School (12.6 AFY), Big Bear High School (22.2 AFY) and Big Bear Golf Course (120 AFY). Big Bear Golf Course currently pumps from private wells and may be unwilling to convert to recycled water due to the cost of recycled water conversion and service. Additionally, the Big Bear Valley agencies have indicated the WorldMark timeshare resort is removing turf and their future RW demand may be significantly lower than currently estimated.

Alternative 1 is broken down into seven incremental segments numbered 1.1 to 1.6. Segment 1.1 represents a complete and independent portion of the recycled water system, extending south of the WWTP to serve potential customers in the community of Sugarloaf. The remaining segments 1.2 to 1.6 extend west from the WWTP as shown in Figure 5-2.

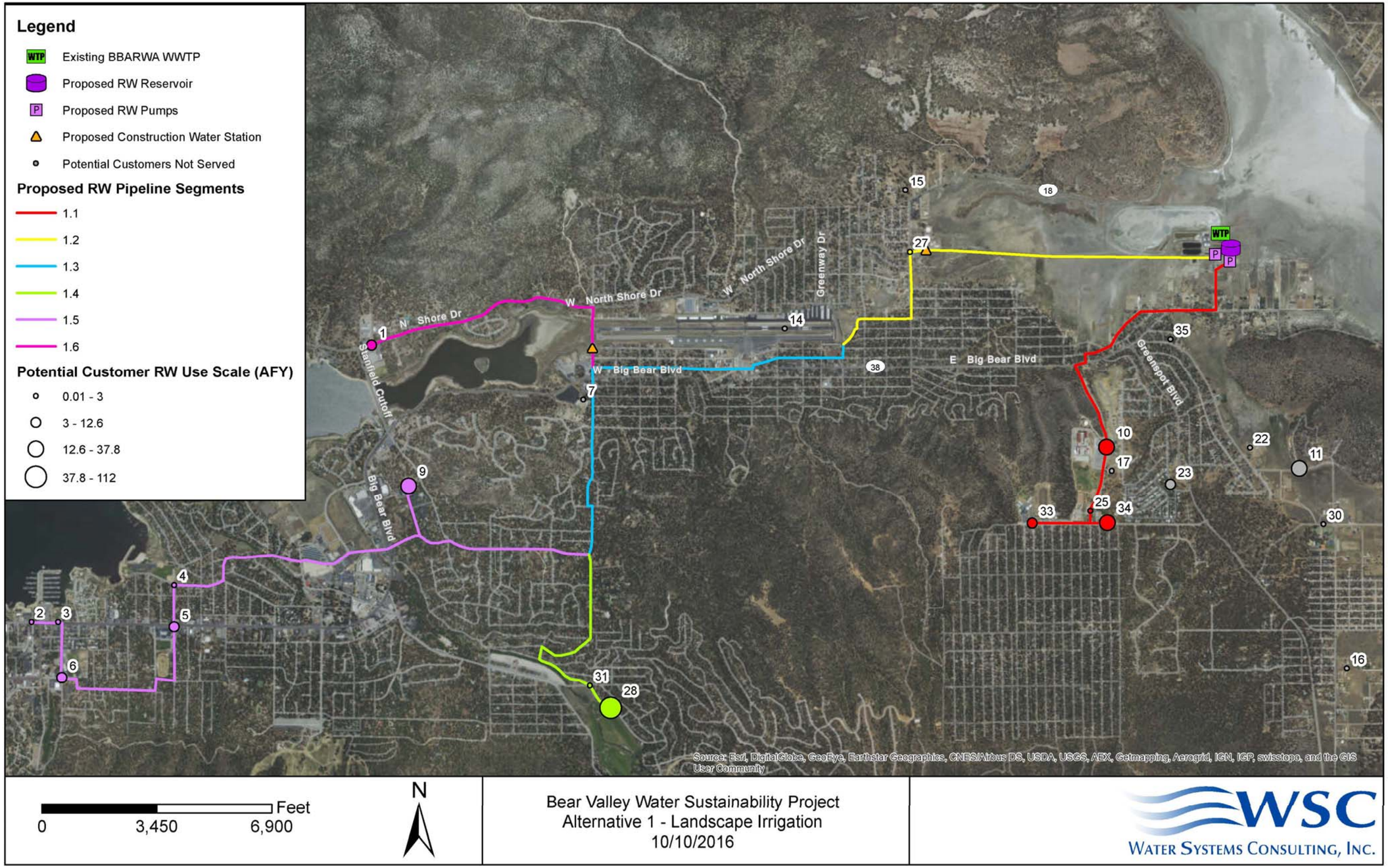

Figure 5-2. Alternative 1 Overview

The infrastructure analysis and cost estimates are presented incrementally and cumulatively by segment to illustrate how unit costs and infrastructure requirements vary as additional segments are implemented. This approach allows the Project Team to make cost versus benefit based decisions to incrementally expand the system as determined feasible.

Depending on which RW distribution system segments are constructed, the beneficial use yield ranges from 54 – 231 AFY, or approximately 3 - 12% of the total treated effluent from BBARWA in 2015. If the demand from the Big Bear Golf Course is excluded, the maximum yield would be 111 AFY, or 6% of the total treated effluent in 2015. Potable water demands could potentially be offset further through use of recycled water for construction uses, although it is not expected to be a significant or consistent future use. Table 5-1 provides a summary of the annual average demand in AFY of each segment.

Table 5-1. Customers and Annual Average Demand by Segment

Segment	Number of Customers Per Segment	Segment Annual Average Demand (AFY)	Cumulative Demand (AFY)
1.1	**4**	**54**	**54**
	10 - Big Bear High School	22.2	
	25 - Chautauqua High School B	2.1	
	33 - Baldwin Lake Elementary	7.7	
	34 - Sugarloaf Park	22.0	
1.2	**1**	**3**	**57**
	27 - Paradise Park	3.0	
1.3	**0**	**0**	**57**
1.4	**2**	**121**	**178**
	28 - Big Bear Golf Course	120	
	31 - Alpine Zoo	1.5	
1.5	**6**	**44**	**222**
	2 - Rotary Pine Knot Park	2.6	
	3 - Veterans Park	2.3	
	4 - Meadow Park	0.9	
	5 -Big Bear Middle School	12.6	
	6 - Big Bear Elementary School	5.1	
	9 - World Mark	20.6	
1.6	**1**	**9**	**231**
	1 - North Shore Elementary School	8.6	

5.1.1.3 *Storage, Pumping & Distribution System*

Implementation of Alternative 1 would require the construction of a storage tank and two RW booster pump stations at the BBARWA WWTP. To distribute the disinfected tertiary RW, 2.29 to 13.0 miles of recycled water mains would need to be installed, depending on the segments implemented. The onsite storage tank would range from 120,000 to 600,000 gallons in cumulative capacity, and function as a suction reservoir for the RW booster pump stations. The Project Team recently became aware of a 500,000-gallon modular precast concrete storage tank which was available from the U.S Army Corps of Engineers (COE). A cost analysis was performed to compare the value of transporting and erecting the precast tank with construction of a traditional cast-in-place concrete tank. It was determined the potential cost savings in purchasing the precast tank from the COE was outweighed by the risk of tank degradation or damage during storage and transport, therefore, the cost estimates in this Study are based on construction of a new storage tank. Appendix J includes the cost estimate and memorandum detailing the results of the cost analysis.

Segment 1.1 is independent of the others and would require a 248 gpm booster station which operates at a hydraulic grade line (HGL) of 7,200-ft. The remaining segments would require a cumulative booster pump station capacity for ranging from 17 - 990 gpm, and would operate at an HGL of 7,010-ft. System HGLs are selected to maintain the RW HGL 10 ft below the corresponding potable water system HGL for a given customer. By maintaining a lower pressure in the RW system reduces the risk of contamination of the potable water system in the event of a cross-connection between the two systems. Because segments 1.2-1.6 serve customers located in different potable pressure zones, some connections may require a pressure regulator to maintain an HGL that is lower than the potable HGL. The storage, pumping and distribution facilities are summarized in Table 5-2 and Table 5-3.

Table 5-2. Alternative 1 Facilities Summary

Segment #	Segment Annual Average Demand (AFY)	Cumulative Demand (AFY)	Segment Storage[1] (MG)	Cumulative Storage (MG)	Segment Booster Pump Capacity[2] (gpm)	Cumulative Booster Pump Capacity[2] (gpm)
1.1	54	54	0.13	0.13	248	272
1.2	3	57	0.08	0.21	17	17
1.3	0	57	-	0.21	-	17
1.4	121	178	0.35	0.56	720	737
1.5	44	223	0.10	0.66	205	942
1.6	9	231	0.02	0.68	49	991

Notes:
1. RW Storage sized for one maximum day demand (MDD)
2. Equal to peak hour demand (PHD). Segment 1.1 has a separate booster pump sized for 7200' HGL. Booster pump capacity for Segments 1.2-1.6 is cumulative, sized for 7010' HGL.

Table 5-3. Alternative 1 Pipeline Summary

Segment	Pipelines (miles)	Cumulative Pipeline Length (miles)	Pipe Size (in)[1]
1.1	2.29	2.29	4, 6, 8
1.2	2.15	4.44	12
1.3	2.17	6.61	12
1.4	1.15	7.76	10
1.5	3.79	11.6	4, 6
1.6	1.44	13.0	4

Notes:
1. Pipe sizing is based on all segments being constructed to serve all customers. Some sizes can be reduced if subsequent segments are not constructed.

5.1.1.4 *Operational Requirements*

It is estimated that the operation and maintenance of the treatment and distribution upgrades will required an additional 0.5 full time equivalent (FTE). The labor costs associated with the operations are included in the Annual Operation and Maintenance (O&M) costs presented in Section 5.1.1.5.

5.1.1.5 *Unit Cost*

The unit cost for Alternative 1 is broken down by each segment considered for the RW distribution system, as shown in Table 5-4. Itemized cost estimates for each segment are included in Appendix G.

Table 5-4. Unit Cost for Alternative 1

Segment #	Total Capital Cost	Annual O&M	Segment Unit Cost	Cumulative Unit Cost
1.1	$3.26 M	$65,000	$3,950	$3,950
1.2, 1.3 & 1.4	$11.4 M	$101,000	--	$5,010
1.5	$4.06 M	$30,000	$4,880	$4,980
1.6	$1.31 M	$11,000	$8,250	$5,140

5.1.1.6 *Advantages and Disadvantages*

Compared to the groundwater recharge alternatives, the disinfected tertiary alternative is the easiest to implement in terms of regulatory approval and treatment upgrades. Regulations for disinfected tertiary RW production for landscape irrigation are established and well understood, so minimal regulatory barriers are anticipated for implementation of Alternative 1. BBARWA's Santa Ana WDR already includes the use of tertiary treated disinfected effluent for irrigation in the Big Bear Valley Groundwater Management Zone. Various proprietary cloth media filters are approved by the CDPH as a Title 22 filtration process, therefore effluent water quality is expected to be reliable. BBARWA staff also maintain some familiarity with chlorine dosing systems from prior RW practices.

The BBARWA WWTP is distant from a majority of the potential RW users, requiring 13 miles of pipelines and booster station energy to distribute the RW throughout the Valley. Segment 1.1 provides the lowest unit cost but results in only 54 AFY of recycled water yield, or 3% of the total available treated effluent. The remaining segments have a significantly higher unit cost and are based on the assumption that all potential RW users convert to RW, although the Big Bear Valley agencies have expressed uncertainty in the willingness for some customers to convert. Specifically, the WorldMark Resort has been removing turf and their future irrigation water use is expected to decline, and the golf course currently owns private wells that produce water at a much lower cost than the Alternative 1 unit cost. Without these types of significant users, the unit cost of the RW in Alternative 1 increases considerably.

The maximum potential benefit of Alternative 1 is keeping 231 AFY of water in the valley, or roughly 13% of what was exported in 2015. With the added uncertainty of customer conversion to RW that would increase unit cost and reduce beneficial use yield, Alternative 1 does not adequately address the Bear Valley agencies' goal of developing a cost effective, drought proof and sustainable water source.

5.1.1.7 *Potential Refinements*

Alternative 1 does not beneficially use all of the treated effluent in the Valley but could potentially co-exist with a fish hatchery at the BBARWA WWTP site that uses excess treated effluent to provide makeup water to a recirculating fish hatchery treatment system. If a wetlands system is used as part of a fish hatchery treatment system, that process could potentially be used to produce tertiary treated disinfected recycled water for landscape irrigation customers. A conceptual PFD for this concept is depicted in Figure 5-3.

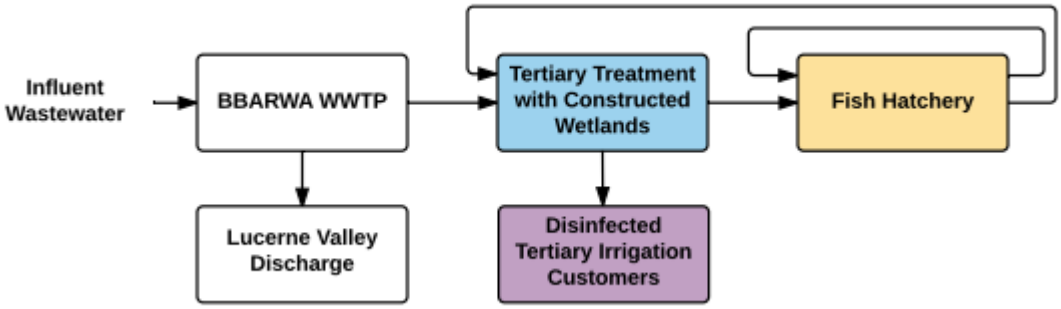

Figure 5-3. Alternative 1 Potential Refinement Process Flow Diagram

5.1.2 Alternative 2: Groundwater Recharge at Greenspot

Alternative 2 includes upgrading BBARWA's existing WWTP to include tertiary and advanced treatment for production of both disinfected tertiary water and advanced purified water for groundwater recharge at the Greenspot Recharge Site. As discussed in Section 4.2.3.1, the anticipated recharge capacity at the Greenspot site is 1,000 AFY, subject to sufficient pumping from the nearby extraction well field to maintain storage volume in the basin.

5.1.2.1 *Treatment Upgrades*

For Alternative 2, BBARWA's existing secondary treatment and clarification facilities are assumed to be sufficient for adequate BOD and TSS removal prior to tertiary treatment. The secondary effluent from the existing WWTP would be fed to the advanced treatment process train consisting of:

1. Microfiltration/ultrafiltration (MF/UF)
2. Reverse Osmosis (RO)
3. Ultraviolet Advanced Oxidation (UV/AOP)
4. Brine Disposal

The combination of MF, RO and UV/AOP is considered the conventional indirect potable reuse treatment train. This treatment train meets the criteria in the DDW Regulations Related to Recycled Water (Title 22, Article 5.2).

One of the issues with the RO process is that the TDS removed from the feed water is concentrated into a brine stream that needs to be disposed of. Based on the results of previous investigations and pilot testing of brine treatment and disposal alternatives for the BBARWA WWTP, the recommended method of brine disposal was effluent mixing coupled with brine reduction and evaporation ponds (16). Under this scenario, a portion of the brine would be mixed with the secondary effluent that is discharged to the LV Site for irrigation. The portion of brine that is mixed would be limited to ensure that the effluent meets the discharge requirements of the Colorado WDR permit for the LV Site. For the remaining brine, Vibratory Shear-Enhanced Processing (VSEP) would be used to reduce the volume of concentrate. The reduced concentrate would then be conveyed to new, lined evaporation ponds on the LV Site. A smaller brine pipeline would be installed inside the existing discharge pipeline to the LV Site. Note that this brine management scheme is dependent on BBARWA's WDR TDS effluent limits for discharge to the LV Site; as stated in Section 3.2.1, the TDS limit will be revised following a site specific study scheduled for completion in December 2017. The brine disposal costs for this alternative are based on this scenario and costs were estimated by escalating the costs estimates in the prior report to the cost basis used in this Study.

A PFD for Alternative 2 is shown in Figure 5-4. The new facilities required for this alternative are outlined in blue. Additional detail on each of the treatment systems is provided in Appendix F.

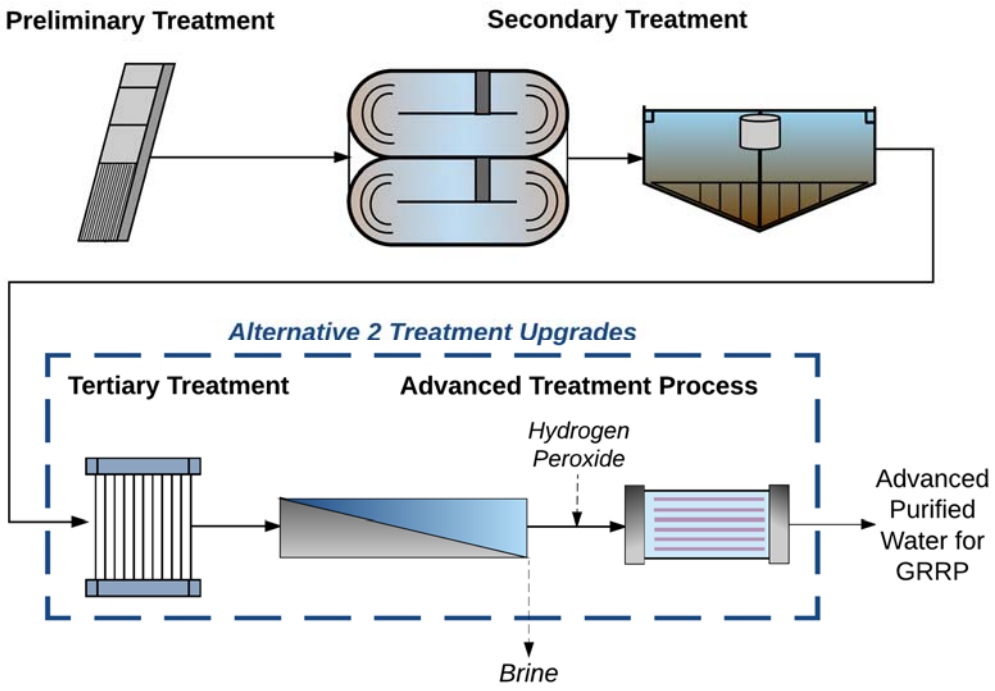

Figure 5-4. Treatment Process Flow Diagram for Alternative 2

5.1.2.1.1 Advanced Treatment Blending Considerations

As discussed in Section 3.3.1, there are two primary factors that influence the requirement for advanced treatment: the RWC and the water quality objectives for the beneficial use location.

Based on the prior Greenspot recharge analysis discussed in Section 4.2.3.1, total inflow to the Erwin Subunit is approximately 900 AFY. Dilution credit can be obtained for the portion of this flow in the uppermost portion of the aquifer in the vicinity of the recharge site. The prior studies did not provide this level of detail but, based on the proportional area of the approximate recharge area to the total model area, the underflow in the vicinity of the recharge basins may be on the order of 100 AFY. The sum of underflow and advanced purified water must be 80% of the total water in the recharge area, such that tertiary RW is equal to 20% of the total water to meet the RWC requirement. Assuming an underflow credit of 100 AFY, advanced treatment of 78% of the recharge water would be required to meet the initial RWC requirement of 20%, as shown in Table 5-5.

Table 5-5 Water Sources for Alternative 2 Groundwater Recharge

Water Source	Contribution, AFY	Contribution, % of Total
Tertiary RW	220	20%
Advanced Purified Water	780	71%
Underflow	100	9%
Total	**1,100**	**100%**

The assimilative capacity for TDS in the Big Bear Valley Groundwater Management Zone has not been determined so a range of potential assimilative capacities was considered for this analysis. Recent water quality samples taken at BBLDWP's nearby Lakewood Wells showed an average TDS concentration of 230 mg/L. As the groundwater objective is 300 mg/L, it is assumed that the increment of 70 mg/L would be the maximum assimilative capacity available. Other locations in the basin have current TDS levels in excess of the TDS Objective, so it is likely that there may be no assimilative capacity for TDS, depending on the methodology applied. Based on the range of assimilative capacity for TDS from 0 to 70 mg/L, 30-45% of the flows would need to be treated with MF and RO to comply with the Basin Plan.

The RWC requirement of 78% advanced treatment controls. For Alternative 2, it is assumed that 22% of the recharge water will receive tertiary treatment and 78% will receive advanced treatment to meet groundwater recharge blending requirements and the Basin Plan objective for TDS. The treatment process will be sized to produce 1,000 AFY of blended water for recharge and the remaining flows treated at the existing BBARWA WWTP will continue to be discharged to the LV Site.

A simplified PFD representing this blending scenario is shown in Figure 5-5.

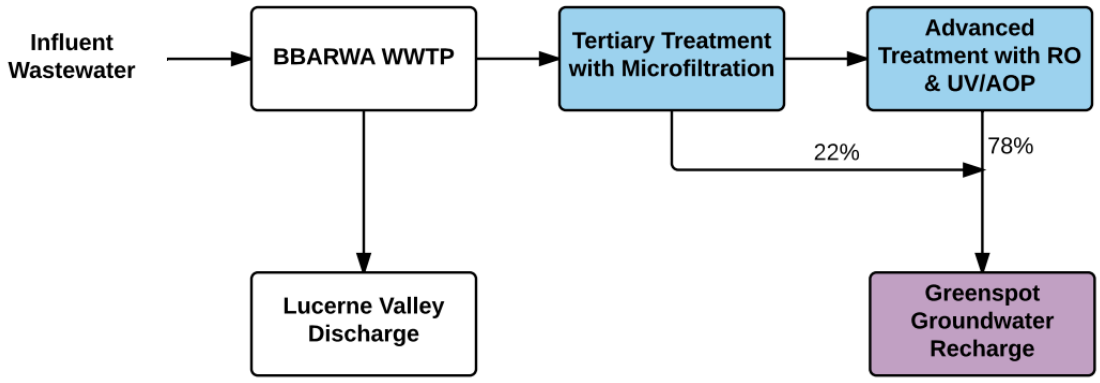

Figure 5-5. 22% Tertiary/78% Advanced Treatment Process Flow Diagram for Alternative 2

5.1.2.2 *Distribution System & Recharge Facilities*

Approximately 16,200 ft of 12-in pipeline is required to convey the RW to the Greenspot Recharge Site. A new 0.9 MG storage tank and approximately 620 gpm pump station would also be constructed on the BBARWA WWTP site for storage and conveyance to the recharge ponds.

The Greenspot Recharge Site is assumed to be a 7-acre site to allow more than five acres of area for surface water spreading, plus the necessary additional land for berms and maintenance access.

This alternative includes the addition of 6 extraction wells downgradient of the recharge site to effectively intercept the water that is artificially recharged at the Greenspot Recharge Site. The Greenspot recharge facilities also include 2 monitoring wells for sampling and monitoring the groundwater water quality in accordance with the Groundwater Recharge Regulations. These wells are assumed to have a pumping capacity of 100 gpm each.

The location of the facilities required for Alternative 2 are shown in Figure 5-6.

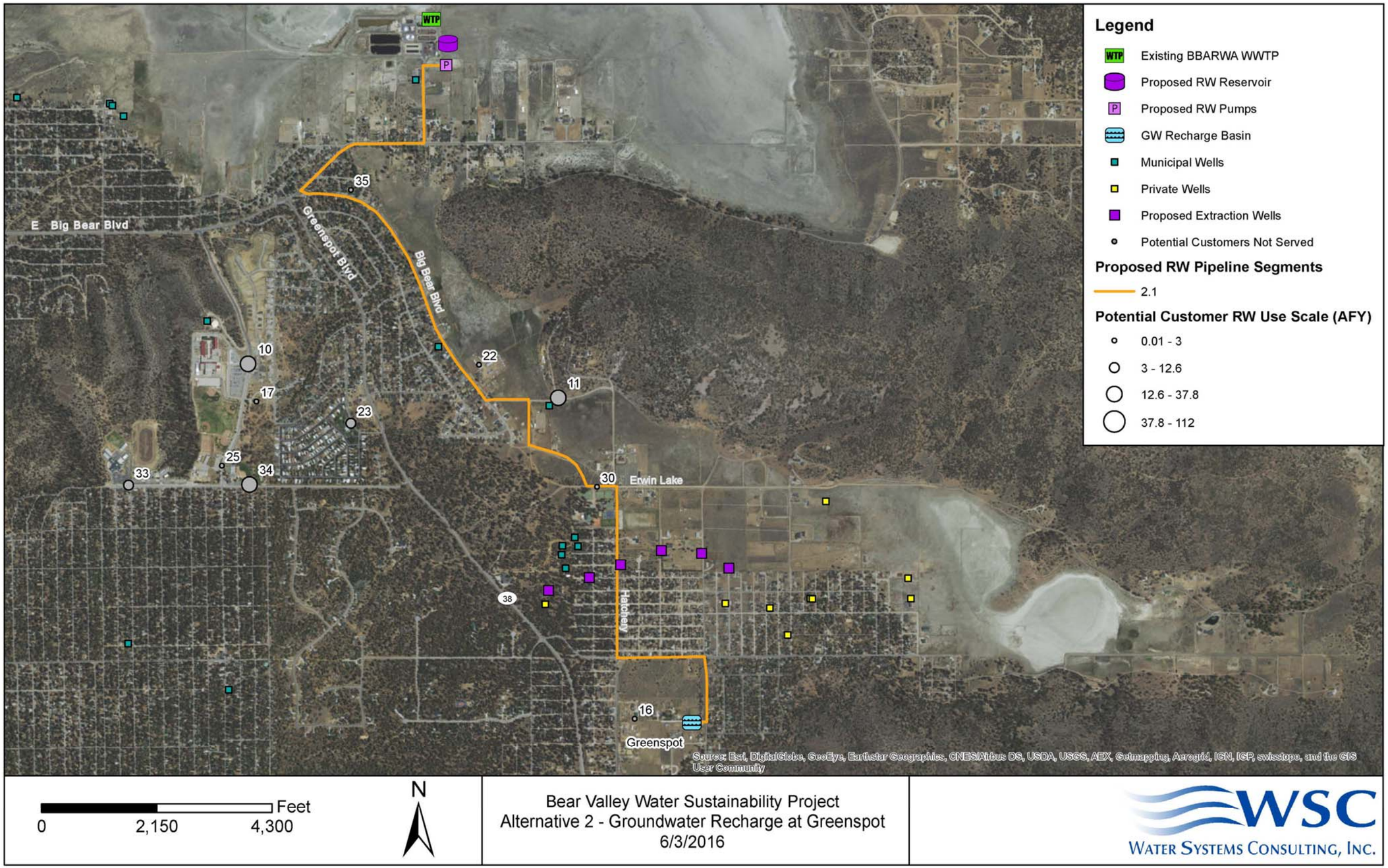

Figure 5-6. Alternative 2 Overview

5.1.2.3 *Operational Requirements*

It is estimated that the operation and maintenance of the treatment and distribution upgrades for Alternative 2 will require an additional 1.5 FTE. The labor costs associated with the operations are included in the Annual O&M costs presented in Section 5.1.2.4.

5.1.2.4 *Unit Cost*

The unit cost for Alternative 2 is shown in Table 5-6. Itemized costs estimates are included in Appendix G.

Table 5-6. Unit Cost for Alternative 2

Total Capital Cost	Annual O&M	Unit Cost ($/AF)
$44,533,000	$1,539,000	$3,580

5.1.2.5 *Advantages and Disadvantages*

Alternative 2 provides the highest recycled water yield and retains 50% of the available treated effluent in the Valley.

Recharge at the Greenspot site has been evaluated extensively in the past through groundwater modeling and pilot recharge testing. Therefore, there are relatively few uncertainties regarding the implementation, operation, and effectiveness of this alternative. Determination of the underflow credit using the existing groundwater model will be needed to confirm the advanced treatment volume required to meet RWC blending requirements.

The available groundwater storage in the Erwin subunit is relatively small so recharge and extraction operations will need to be closely coordinated to avoid excessive increase or decrease of water level in the vicinity of the recharge site. BBLDWP and BBCCSD would need to shift a significant portion of their production to the new or existing wells located downstream of the recharge site.

BBLDWP's existing Lakewood and Maple wells in this area are already underutilized and shifting production to their Erwin Lake system is not desirable for the operation of their water system. The Erwin Lake Zone is the lowest zone in their water system, has the fewest customer connections, and is remote from the rest of BBLDWP's water system.

Water recharged at the Green Spot Site would reach the nearest known production wells (BBLDWP's Lakewood well field) in 8.5 to 17.5 months, which meets the travel time and retention time requirements in the groundwater recharge regulations. However, DWR records suggest that some existing private wells are located in the vicinity of the proposed recharge basins and would be within 6-months travel time from the proposed basins. The exact locations of these wells will have to be verified and mitigation measures may need to be identified and implemented if there is not sufficient travel time from these wells.

Alternative 2 does not provide habitat or recreational benefits to the Lake or the community.

5.1.2.6 *Potential Refinements*

Another potential environmental use in this area is to provide recycled water for the Shay Creek unarmored threespine stickleback fish habitat. This particular stickleback fish is a state- and federally listed endangered species. Since 1985, the BBCCSD has provided potable water to the pond to maintain the wetland habitat that supports this federally listed endangered fish. The average volume of potable water provided to the stickleback habitat between 2011 and 2014 was 38 AFY. The pipeline to the Greenspot recharge site runs near the Shay Pond and could be connected to the Shay Pond by adding approximately 400 ft of pipe. This would provide an additional potable water offset of 38 AFY. However, due to the sensitivity of the species, coordination with several resource agencies would be required and there may be difficulty obtaining regulatory approval for this use.

Alternative 2 does not beneficially use all of the treated effluent in the Valley but could potentially co-exist with a fish hatchery at the BBARWA WWTP site that uses the excess treated effluent to provide makeup water to a recirculating fish hatchery treatment system. A conceptual PFD for this concept is depicted in Figure 5-7.

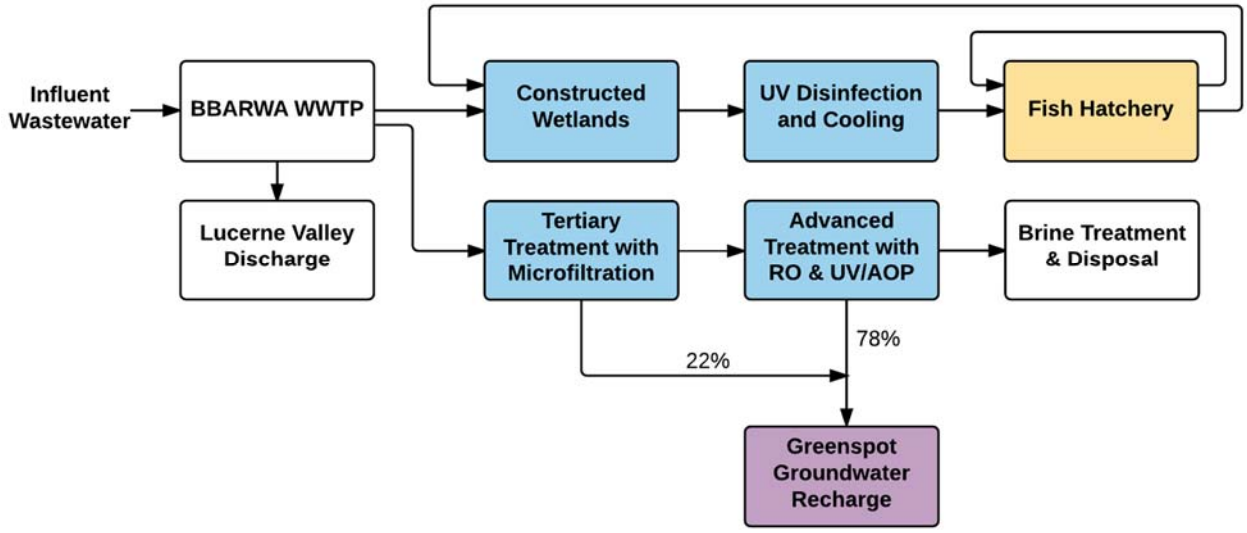

Figure 5-7. Alternative 2 Potential Refinement Process Flow Diagram

5.1.3 Alternative 3: Groundwater Recharge at Sand Canyon

Alternative 3 includes a new satellite advanced treatment facility located near BBARWA's existing Lake Pump Station, which is the sewer lift station that currently conveys waste water from the City of Big Bear Lake to the BBARWA WWTP. The satellite WWTP would produce both disinfected tertiary recycled water and advanced purified water for groundwater recharge at the Sand Canyon Recharge Site.

In 2014, the average annual flows to the Lake Pump Station were 0.84 MG and minimum daily flows of approximately 0.50 MGD are observed in the spring and fall months. The capacity of the satellite WWTP is assumed to be 0.5 MGD such that a baseline flow equal to annual minimum day flows is processed at the satellite facility. Sizing for annual minimum day flows reduces the amount of days per year that the process operates with excess capacity. It is assumed that solids and brine will be returned to the force main for treatment at BBARWA's existing WWTP along with any sewage flows in excess of 0.50 MGD. The collection system between the Lake Pump Station and the WWTP will need to be evaluated to assess whether the reduced flows would impact the ability to adequately convey solids to the WWTP. The volume of recycled water produced for beneficial use could range from 500 to 520 AFY, depend on the portion of the flows that receive advanced treatment, as discussed later in this section.

As discussed in Section 4.2.3.1, the anticipated recharge capacity of the Sand Canyon site is 750 AFY, so the limiting factor is the volume of recycled water that can be produced at the satellite WWTP.

5.1.3.1 *Treatment Upgrades*

For Alternative 3, a new satellite WWTP would be constructed near BBARWA's existing Lake Pump Station. The new treatment processes required for this alternative include:

1. Preliminary Treatment
2. Secondary and Tertiary Treatment. A Membrane Bioreactor (MBR) process is assumed.
3. Reverse Osmosis (RO)
4. Ultraviolet Advanced Oxidation (UV/AOP)
5. Brine Disposal

The combination of MBR, RO and UV/AOP is considered a conventional indirect potable reuse treatment train. This treatment train meets the criteria in the DDW Regulations Related to Recycled Water (Title 22, Article 5.2). One of the issues with the RO process is that the TDS removed from the feed water is concentrated into a brine stream that needs to be disposed of.

A PFD for Alternative 3 is shown in Figure 5-8. The new facilities required for this alternative are outlined in blue. Additional detail on each of the treatment systems is provided in Appendix F.

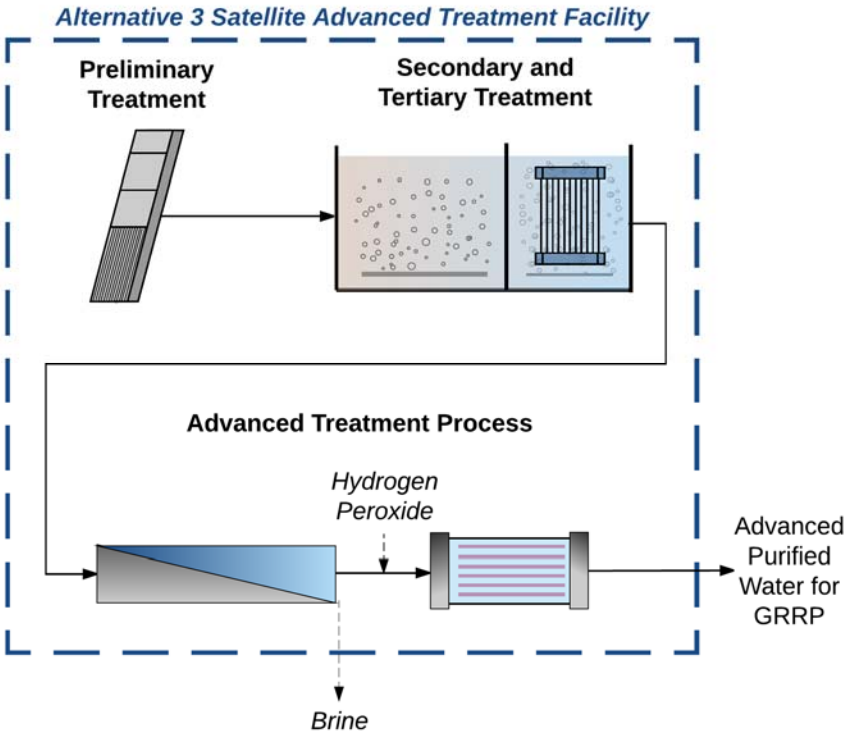

Figure 5-8. Treatment Process Flow Diagram for Alternative 3

5.1.3.1.1 Advanced Treatment Blending Considerations

As discussed in Section 3.3.1, there are two primary factors that influence the requirement for advanced treatment: the RWC and the water quality objectives for the beneficial use location.

The prior studies regarding evaluating recharge at the Sand Canyon Site did not address underflow at this location so a range of potential underflow values is considered for this alternative to provide a range of treatment costs. The 2012 United Stated Geological Survey (USGS) Geohydrology Report estimates the total recharge for the Rathbone subbasin to be 1,100 to 1,200 AFY (17). As a range of potential underflows, if 200 AFY is available for dilution credit, ~70% advanced treatment would be required; if 900 AFY is available for dilution credit, ~45% advanced treatment would be required to meet the 80% blend requirement and achieve an initial RWC requirement of 20%, as shown in Table 5-7. The 45% value was selected as a representative scenario to align with the RO treatment ratio required to meet the Basin Plan objective for TDS (discussed in the following paragraph) to provide a low range cost for this alternative.

Table 5-7 Water Sources for Alternative 3 Groundwater Recharge

	High Range Treatment Cost		Low Range Treatment Cost	
Water Source	Contribution, AFY	Contribution, % of Total	Contribution, AFY	Contribution, % of Total
Tertiary RW	140	20%	285	20%
Advanced Purified Water	360	51%	235	17%
Underflow	200	29%	900	63%
Total	**700**	**100%**	**1,420**	**100%**

The assimilative capacity for TDS in the Big Bear Valley Groundwater Management Zone has not been determined; however, recent water quality samples taken at BBLDWP's nearby wells showed an average TDS concentration greater than the Basin Plan objective for TDS of 300 mg/L. Therefore, it is assumed that there is no assimilative capacity for TDS. To meet the TDS objective of 300 mg/L, 45% of the flows would need to be treated with RO to comply with the Basin Plan.

For Alternative 3, a range of advanced treatment requirements was evaluated to provide bookends based for treatment costs based on a range of advanced treatment blends to meet dilution and TDS removal requirements. The high range cost for this alternative is based on 70% advanced treatment and 30% tertiary treatments. The low range cost for this alternative is based on 45% advanced treatment and 55% tertiary treatment. This is the minimum advanced treatment that could be required to achieve TDS removal and would require a significant underflow credit of 750 AFY. A simplified PFD representing this blending scenario is shown in Figure 5-9.

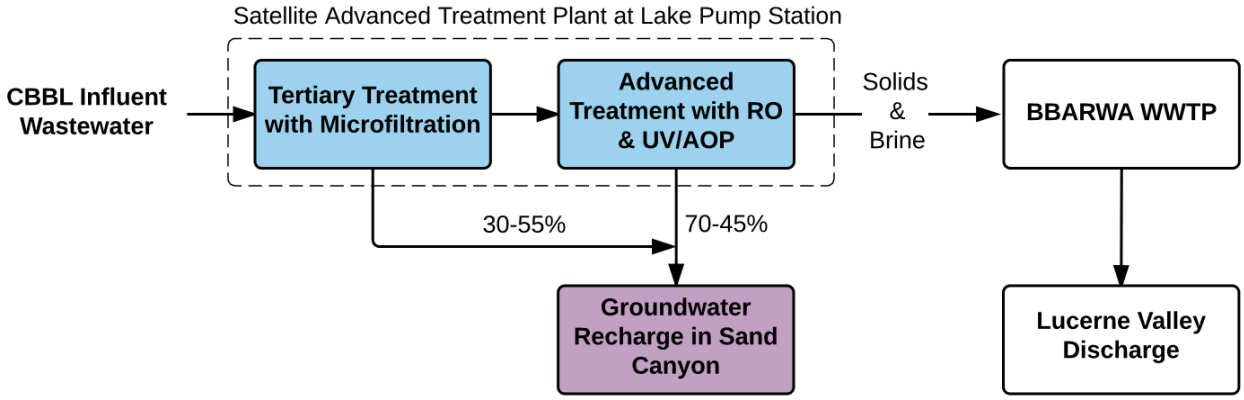

Figure 5-9. Treatment Process Flow Diagram Summarizing Blending Options for Alternative 3

5.1.3.2 *Distribution System & Recharge Facilities*

Approximately 17,400 ft of 8-in pipeline is required to convey the recycled water to the Sand Canyon Recharge Site, as well as a 310-320 gpm pump station at the new satellite WWTP.

The Sand Canyon Recharge Site is assumed to require 2.5 acres of recharge area based on the recommendation in the 1991 GEOSCIENCE evaluation (14).

Alternative 3 includes construction of 2 monitoring wells that will be used to collect groundwater samples to monitor water quality in the area. The water recharged in this alternatives is assumed to be produced by existing BBLDWP extraction wells downgradient of the recharge site.

The location of the facilities required for Alternative 3 are shown in Figure 5-10.

5.1.3.3 *Operational Requirements*

It is estimated that the operation and maintenance of the treatment and distribution upgrades for Alternative 3 will require an additional 2 FTE. The labor costs associated with the operations are included in the Annual O&M costs presented in Section 5.1.3.4.

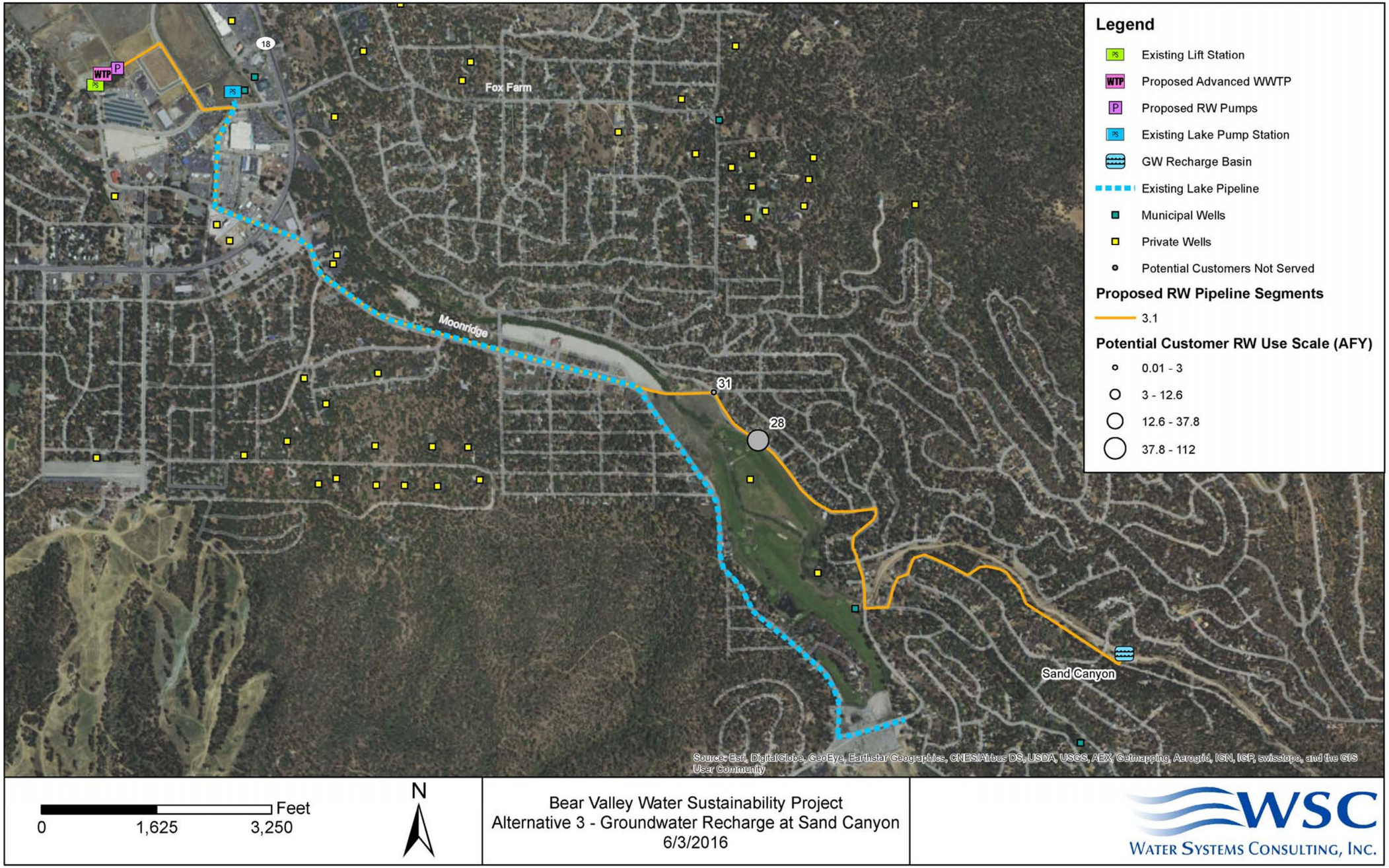

Figure 5-10. Alternative 3 Overview

5.1.3.4 *Unit Cost*

The range of unit costs for Alternative 3 is shown in Table 1-1, based on the range of advanced treatment requirements. Itemized costs estimates are included in Appendix G.

Table 5-8. Unit Cost for Alternative 3

Treatment Scenario	Total Capital Cost	Annual O&M	Unit Cost ($/AF)
70% Advanced 30% Tertiary	**$24,315,000**	1,259,000	$4,750
45% Advanced 55% Tertiary	**$23,255,000**	$1,174,000	$4,310

5.1.3.5 *Advantages and Disadvantages*

Alternative 3 provides 500-520 AFY of recycled water yield and retains approximately 25% of the available treated effluent in the Valley.

Alternative 3 includes the construction of a satellite WWTP at the Lake Pump Station and would require BBARWA to operate a second remote treatment facility.

Recharge at the Sand Canyon site has been evaluated in the past to confirm the feasibility of recharge at this site. Determination of the underflow credit using a groundwater model will be needed to confirm the advanced treatment volume required to meet RWC blending requirements.

The Sand Canyon channel serves as a flood control channel so all modifications and operations would need to be coordinated with and approved by the flood control agency. This adds some complexity to the implementation but is it expected to be technically feasible to use the channel for both artificial recharge and flood control.

BBLDWP's existing Sand Canyon and Lake Plant wells are downgradient of the Sand Canyon recharge site and can produce water for use in BBLDWP's Big Bear Lake and Moonridge systems, which are the two largest systems. BBLDWP can also provide water to BBCCSD through an existing interconnection.

Consistent recharge in the Sand Canyon stream would likely help stabilize Rathbun Creek underflows and may benefit the Lake by helping maintain more consistent flows in Rathbun Creek, which is tributary to the Lake.

5.1.3.6 *Potential Refinements*

There is an existing pipeline that runs from a pump station near the Lake to the Big Bear Mountain Resorts that provides Lake water for snowmaking and firefighting purposes. If this pipeline were used as a dual purpose to convey recycled water to the Sand Canyon site, the length of new pipeline required would be reduced by 9,700 ft. This would result in a cost savings of approximately $150/AF. However, the shared use of this pipeline may not be compatible with the operational requirements for both uses, and coordination with the Big Bear Mountain Resort would be required to assess the feasibility of this operation. Note that, Mammoth Resorts recently purchased the Big Bear Mountain Resorts and potential operational changes may affect water uses.

5.1.4 Alternative 4: Groundwater Recharge at Greenspot & Sand Canyon

Alternative 4 includes tertiary and advanced treatment upgrades to BBARWA's existing WWTP for production of both disinfected tertiary and advanced purified water for groundwater recharge at the Greenspot & Sand Canyon Recharge Sites. The anticipated recharge capacity is 1,750 AFY total, with 1,000 AFY at Greenspot and 750 AFY at Sand Canyon.

5.1.4.1 *Treatment Upgrades*

Alternative 4 requires tertiary and advanced treatment upgrades to BBARWA's WWTP. Based on historical effluent water quality data, it is assumed the existing primary and secondary treatment facilities at the BBARWA WWTP will produce secondary effluent suitable for tertiary filtration. The secondary effluent from the existing WWTP would be fed to the advanced treatment process train consisting of:

1. Microfiltration/ultrafiltration (MF/UF)
2. Reverse Osmosis (RO)
3. Ultraviolet Advanced Oxidation (UV/AOP)
4. Brine Disposal

As previously stated, this conventional IPR treatment train meets the criteria in the DDW Regulations Related to Recycled Water (Title 22, Article 5.2).

It is assumed the brine disposal management strategy for Alternative 4 will be identical to the brine disposal management strategy proposed for Alternative 2 described in Section 5.1.2.1. As previously noted, this brine disposal method must be re-evaluated following issuance of a WDR Order TDS limit for effluent discharge to the LV Site.

A PFD for Alternative 4 is shown in Figure 5-11. The new facilities required for this alternative are outlined in blue. Additional detail on each of the treatment systems is provided in Appendix F.

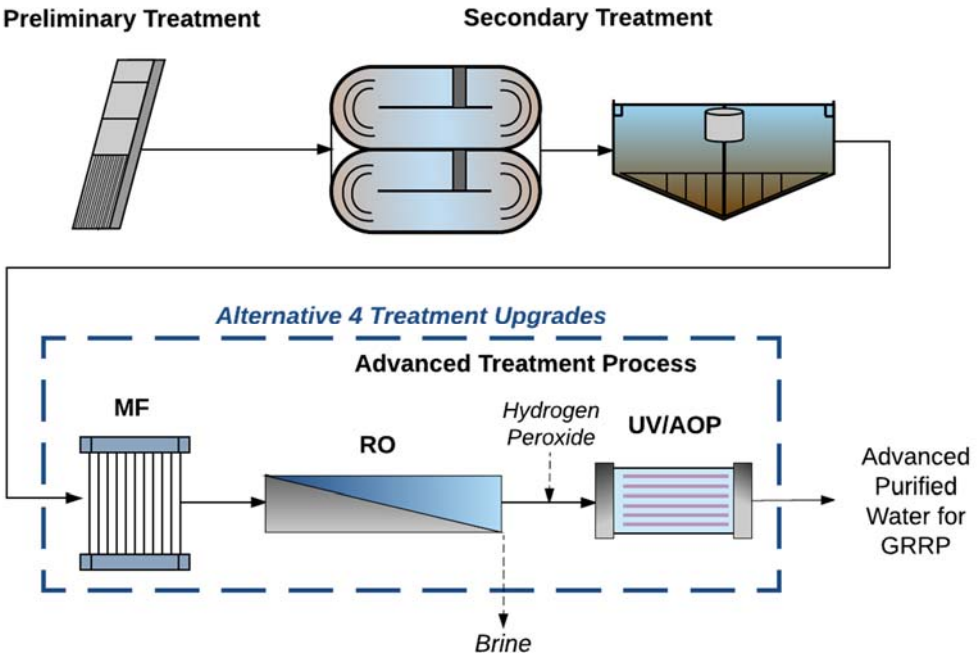

Figure 5-11 Treatment Process Flow Diagram for Alternative 4

5.1.4.1.1 Advanced Treatment Blending Considerations

Sections 5.1.2.1.1 and 5.1.3.1.1 provide an overview of the advanced treatment blending requirements for the Greenspot and Sand Canyon Sites based on results from prior studies and groundwater modeling analysis. For Alternative 4, it is assumed the underflow credit is 100 AFY at Greenspot and 200 AFY at Sand Canyon. The most stringent blending requirement of the two recharge sites governs the tertiary and advanced RW blending requirements and treatment capacities; this is done to avoid constructing duplicate facilities needed to store, pump and convey two different RW blends to each site. For the combined recharge project at Greenspot and Sand Canyon, the 22% Tertiary/78% Advanced blending requirement for Greenspot is required to meet the initial 20% RWC requirement at each recharge site. A simplified PFD representing this blending scenario is shown in Figure 5-12.

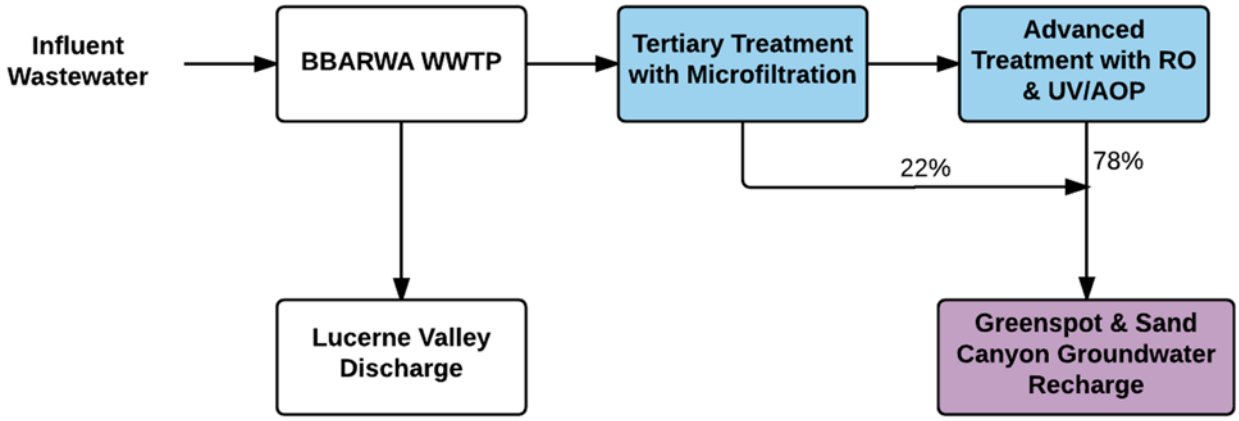

Figure 5-12 22% Tertiary/78% Advanced Treatment Process Flow Diagram for Alternative 4

5.1.4.2 *Distribution System & Recharge Facilities*

Approximately 50,200 ft of 12-in pipeline is required to convey the RW from the BBARWA WWTP to both recharge sites (approximately 16,200 ft to Greenspot and 34,000 ft to Sand Canyon). A new 1.6 MG storage tank and a pump station would also be constructed on the BBARWA WWTP site for storage and conveyance to the recharge ponds. The pump station would require pumps with capacities of approximately 615 gpm and 475 gpm to convey RW to Greenspot and Sand Canyon, respectively. The alignment and configuration of the distribution system can be optimized based on the final flow and head requirements of the distribution and recharge facilities.

The Greenspot Recharge Site is assumed to be a 7-acre site to allow more than five acres of area for surface water spreading, plus the necessary additional land for berms and maintenance access. The Sand Canyon Site is assumed to be a 2.5-acres based on the results from prior studies (14).

This alternative includes the addition of 6 extraction wells downgradient of the Greenspot recharge site to effectively intercept the water that is artificially recharged. These wells are assumed to have a pumping capacity of 100 gpm each. Water recharged at Sand Canyon is assumed to be produced by existing BBLDWP extraction wells downgradient of the recharge site. It is assumed 2 monitoring wells will be added at each recharge site for groundwater sample collection.

The location of the facilities required for Alterative 4 are shown in Figure 5-13.

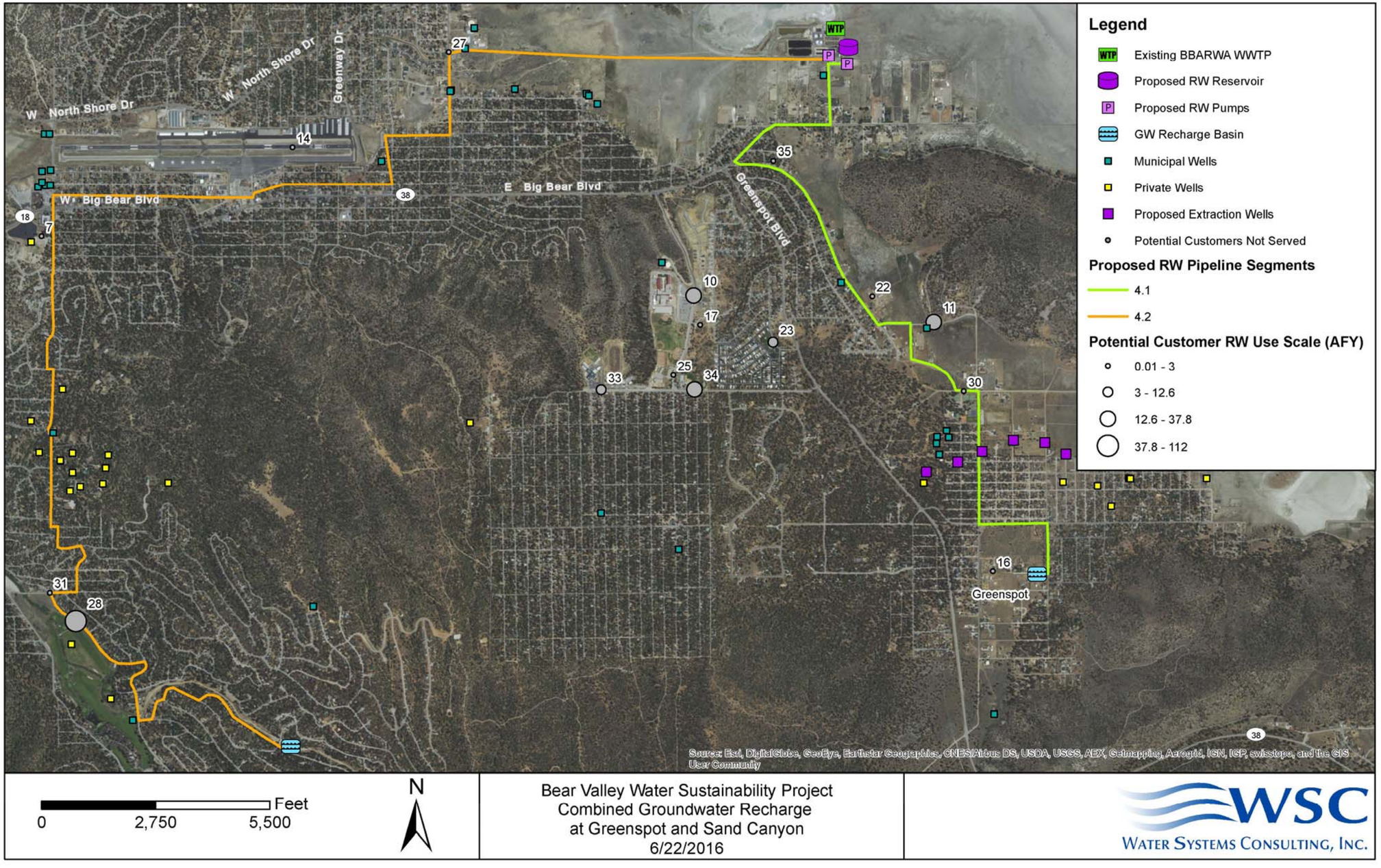

Figure 5-13 Alternative 4 Overview

5.1.4.3 *Operational Requirements*

It is estimated that the operation and maintenance of the treatment and distribution upgrades for Alternative 4 will require an additional 2 FTE. The labor costs associated with the operations are included in the Annual O&M costs presented in Section 5.1.2.4.

5.1.4.4 *Unit Cost*

The unit cost for Alternative 4 is shown in Table 5-9. Itemized costs estimates are included in Appendix G.

Table 5-9. Unit Cost for Alternative 4

Total Capital Cost	Annual O&M	Unit Cost ($/AF)
$69,700,000	$2,726,000	$3,390

5.1.4.5 *Advantages and Disadvantages*

Alternative 4 has the lowest unit cost of all the alternatives and it retains all the available RW in the Valley. The use of both recharge sites provides recharge in separate areas of the basin and provides some additional operational flexibility.

The key advantages to utilizing the Greenspot Recharge Site for an IPR application are discussed in Section 5.1.2.5. Most notably, the Greenspot site has been evaluated through extensive site-specific testing and it has been shown to have favorable recharge characteristics.

However, as stated in Section 5.1.2.5, the Greenspot Recharge Site would present some operational challenges for BBCCSD and BBLDWP. Both agencies would need to shift their production to the Erwin subunit to reclaim the recharge water and closely coordinate production well operations to ensure elevated groundwater levels do not hinder recharge potential at the site.

Prior studies have shown the Sand Canyon recharge site has soils ideal for recharge and percolation rates are sufficient to yield 750 AFY of recharge capacity. As described in Section 5.1.3.5, BBLDWP's existing Sand Canyon and Lake Plant wells are downgradient of the Sand Canyon recharge site and can produce water for use in BBLDWP's Big Bear Lake and Moonridge systems, which may be delivered to BBCCSD through an existing interconnection.

The main disadvantage to recharge at Sand Canyon is that it would have to serve as a flood control channel and a recharge basin, creating complexities in operational strategies and seasonal flood control management in the area.

Consistent recharge in the Sand Canyon stream would likely help stabilize Rathbun Creek underflows and may benefit the Lake by helping maintain more consistent flows in Rathbun Creek, which is tributary to the Lake.

5.1.4.6 *Potential Refinements*

Although Alternative 4 has the lowest unit cost of the alternatives considered, it also has the greatest capital cost. To potentially reduce the initial capital investment, a demonstration scale recharge project at Greenspot and a phased Alternative 4 project were considered as potential refinements to Alternative 4. These project refinements would reduce the technical, managerial and financial complexity of implementing Alternative 4 in one phase. The cost summaries for the potential refinement to Alternative 4 are included in Table 5-10 and the required facilities are described in the following subsections.

Table 5-10 Cost Summary for Potential Refinements to Alternative 4

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF	Net Present Value
Greenspot Phase 1	$26,058,000	$746,000	440	$4,410	$47,120,000
Greenspot Demonstration	$5,133,000	$590,000	50	$16,520	$22,254,000

Although the reduced scale of a demonstration scale or phased project provides an economic benefit of reduced capital expenditures, implementation of a phased construction project includes inherent risks. Phased expansion of WWTPs can result in the procurement of different products for the identical unit process which creates operational complexity. Similarly, changing personnel between phases can lead to alternative design approaches and result in differing operational requirements for identical unit processes. Careful consideration would have to be placed on maintaining consistent design practices, asset nomenclature and proposed operational procedures to minimize the design and construction risks associated with a phased project.

5.1.4.6.1 Greenspot Phase 1

The first potential refinement consists of phasing the construction of the project by implementing a recharge project at Greenspot to yield 25% of the total Alternative 4 beneficial use yield, or approximately 440 AFY. Of the two recharge sites, Greenspot is closer to the BBARWA WWTP and its hydrogeological conditions are well understood. The phased project assumes the same brine management strategy, RW blending requirements and underflow credits, as previously stated for Alternative 4.

For the phased approach to Alternative 4, 16,200-ft of 12-in. pipeline, a 275 gpm pump station and a 0.40 MG onsite RW storage tank are required to convey the RW to Greenspot. The 12-in. pipeline to Greenspot would have sufficient capacity to deliver the remainder of the Greenspot recharge capacity once additional phases of the project are implemented. Assuming the same blending requirements (22% tertiary/78% advanced) and 100 AFY of underflow credits, the tertiary and advanced treatment systems would be sized for 0.45 MGD and 0.36 MGD, respectively. To artificially recharge 440 AFY, only 3.5-acres of the Greenspot recharge site would need to be developed and it is assumed that 3 new production wells would be used to recover the water. It is assumed 2 monitoring wells would be sufficient for groundwater sampling.

The 25% capacity target for the first phase is intended to reduce capital costs while maintaining an appreciable beneficial use yield to provide a measurable water supply benefit (440 AFY is equivalent to roughly 10-15% of the Big Bear Valley's potable water demand). The 440 AFY capacity was also selected to allow for more manageable modular expansions of the tertiary and advanced treatment systems, which can be expanded upon with identically sized facilities at 25% increments until full capacity is reached.

It is estimated the operation and maintenance of the facilities associated with a phased Alternative 4 implementation would require 1.5 FTE.

This phased approach to implementation of Alternative 4 significantly reduces the capital cost required to initiate an artificial recharge project in the Valley. The unit cost of the RW would be high for the first phase of implementation; however, the facilities constructed in the first phase would remain in use during latter phases, which will reduce the unit cost as facility capacity is increased in the future.

5.1.4.6.2 Demonstration Recharge Project at Greenspot

Demonstration projects are common in the water-wastewater industry because they provide an opportunity for community education, establish proof of concept and promote local buy-in of the project. The Greenspot recharge site is close to schools in the Big Bear Valley, offering great educational opportunities for teaching students the value of water and the science behind artificial groundwater recharge. The small scale also gives operators the opportunity to learn about IPR processes and monitoring requirements with smaller facilities, which are more easily managed than full-scale systems.

The demonstration project includes purchasing a skid-mounted tertiary and advanced treatment system and delivering RW to the demonstration Greenspot recharge site using water tanker trucks. Deferring the construction of a 12-in pipeline to the Greenspot site would save approximately $5 million in capital costs and $32,000 in annual O&M of the pipeline. It is assumed the low volume of the brine stream from the advanced treatment system would not require volume reduction through brine treatment processes, saving another $17 million in capital costs.

The treatment system would be sized to provide a RW yield of 50 AFY. Assuming two operators would operate 8,000-gallon capacity water trucks to transport RW to the Greenspot Site 5 days a week for 39 weeks out of the year (9-month recharge schedule), the advanced treatment system would need to produce approximately 80,000 gpd. The appropriate proportions of tertiary and advanced treated water will be treated at the existing BBARWA WWTP and blended in an onsite recycled water tank. A fill station with a small booster pump would be constructed near the recycled water tank for the water trucks to collect the recharge water. For this short term, small scale demonstration project, it is assumed that the brine could be blended with secondary effluent and delivered to the Lucerne Valley Site for irrigation water. As the capacity of the advanced treatment system and the groundwater recharge facilities increase with future expansions, the brine management strategy would shift to effluent mixing coupled with brine reduction and evaporation ponds, as described in Section 5.1.2.1 for Alternative 2.

The demonstration Greenspot Recharge Site is assumed to be 0.7-acres to allow for more than 0.5-acres of area for surface water spreading and sufficient space for maintenance access and berms. It is assumed 1 extraction well with 100 gpm capacity will be constructed downgradient of the Greenspot Recharge Site. To avoid the stranded assets in future expansions of the project, this well would have 100 gpm capacity to be consistent with the full-scale recharge application. As recharge volume increases in later phases of the project, the remaining five wells would need to be constructed.

In addition to the 2 FTE water truck operators, it is estimated that 0.75 FTE are required for operation and maintenance of the advanced treatment systems and the recharge facilities. The capacity selected for the advanced treatment plant and the recharge facility must align with manufacturer specifications for skid-mounted advanced treatment systems. Also, the quantity of water delivered to the recharge site is dependent on the size of the water tank truck and the staffing available for operation of the truck.

Due to the small size and skid mounted design of the demonstration scale treatment equipment, it may be difficult to incorporate this equipment into a future larger scale expansion of the treatment system, resulting in two separate treatment systems, or possibly the abandonment of the demonstration scale equipment. While minimizing the initial capital investment, this scenario does not provide significant improvements that can be easily expanded for future phases.

5.2 NON-RECYCLED WATER ALTERNATIVE

BBLDWP previously evaluated a supplemental water supply concept to provide imported water to the Valley. In June 2005, Camp Dresser & McKee, Inc. (CDM) prepared a cost estimate for a pipeline from Lucerne Valley to Big Bear Lake by way of the Morongo Pipeline. In a previous report by CDM from December 2004, it was determined that the most cost-effective path for the pipeline was along Highway 18. It was assumed that 1,000 AFY of water would be conveyed to the Valley for the purposes of estimating costs for imported water purchase, treatment plant capital and operation and maintenance costs, and the pipeline and booster pumps capital and operation and maintenance costs. For the purposes of comparison in this study, the capital and O&M costs assumed in the CDM analysis were escalated to the cost basis of this Study. The estimated unit cost for this imported water concept is $5,630/AF. However, the Big Bear Agencies do not currently have supply contracts with any State Water Contractors and it may not be possible to secure them. Additionally, State Water Project water deliveries have declined in recent years and are subject to further reductions based on environmental and hydrologic factors. An imported water supply would not be a sustainable or drought proof supply for the Valley.

5.3 NO PROJECT ALTERNATIVE

The No Project Alternative would not require any upgrades to the BBARWA WWTP and the secondary effluent would continue to be discharged outside of the Valley for crop irrigation in the Lucerne Valley. The No Project alternative would not provide any benefits to the Valley.

5.4 WATER CONSERVATION/REDUCTION ANALYSIS

In order to meet conservation targets and the recent drought mandates, BBLDWP and BBCCSD have pursued multiple water use efficiency measures and actions, including water use restrictions and multiple water conservation incentive programs. The current Demand Management Measures implemented by each agency are summarized in Table 5-11. As shown in Figure 2-2, water demands have declined significantly since 2013 as a result of these conservation efforts.

Table 5-11 Demand Management Measures Implemented by BBLDWP and BBCCSD

Retail Agency Demand Management Measure	BBLDWP Measures (4)	BBCCSD Measures (8)
Water Waste Prevention Ordinances	Water Conservation Program Policy No. 2014-02 includes several indoor and outdoor water waste prevention policies.	Ordinance No. 2016-05 imposes water waste prohibitions for increasingly stringent water-supply shortage stages
Metering	Initiated Advanced Metering Infrastructure project to better track water system demands in real time and measure the effects of conservation measures.	Currently, all water services are metered and Ordinance Nos. 29 and 4S were enacted to declare foals pertaining to water meters
Conservation Pricing	Applies tiered rate structure to encourage minimization of water use.	Applies tiered rate structure to encourage minimization of water use.
Public Education and Outreach	Conducts water supply and conservation public education through local newspapers, social media and radio advertisements and manages a Xeriscape Demonstration Garden to provide ideas for residential drought tolerant landscape.	Conducts water conservation education and outreach through public water conservation awareness program and sponsors the local Xeriscape Demonstration Garden.
Distribution System Real Loss Management Program	The DWP conducts regular mass balance audits of metered water production versus metered water sales to detect unusual changes in the water operation, and performs hydraulic modeling to identify existing system deficiencies.	Staff performs regular inspections or contracts leak detection companies to check for system leaks. Completed AWWA Water Audit for 2015.
Water Conservation Program Coordination	Employs one full-time staff person as Water Conservation and Public Information Specialist and one part-time Water Conservation Technician to manage the responsibilities of the water conservation program.	BBCCSD's conservation program is managed by the Water Department Superintendent with support from Water Department Staff. The shared responsibilities are equivalent to a full-time conservation coordinator's responsibilities
Other	Offers indoor conservation consults/audits, landscape surveys, turf buyback programs and provides rebates to customers for performing high efficiency appliance retrofits	Reviews effectiveness of demand management measures by continually observing water production and usage. Educational outreach directed at younger customers to encourage continued future water conservation.

Outdoor water use conservation measures would reduce the irrigation demands that could be served with recycled water under Alternative 1. This would result in a lower potable water offset and a higher cost per AF of recycled water put to beneficial use.

Indoor water use conservation measures would reduce wastewater generation and would result in a lower recycled water production volume that can be put to beneficial use for groundwater recharge alternatives; this may result in a higher cost per AF of recycled put to beneficial use.

Implementation of private greywater systems would decrease wastewater generation, as well as water consumption. BBLDWP estimated 600 AFY would be saved if their customers used greywater to irrigate their landscaping (4). While greywater systems provide an opportunity to increase the sustainable use of resources, widespread implementation in the Big Bear Valley would have an impact on the volume and strength of wastewater available for future reuse projects. The greatest barrier to implementation of greywater systems in existing buildings is the user conversion costs. Greywater system conversions require plumbing modifications inside and outside the building and construction of a treatment system. Typically, greywater systems are implemented at sites with new construction where the treatment system and plumbing connections are constructed concurrently with the structure.

5.5 ALTERNATIVES ANALYSIS

5.5.1 Qualitative Evaluation Criteria

Each alternative was screened using the following qualitative screening criteria:

- Promotes Beneficial Management of Water Resources
- O&M Complexity
- Ease of Implementation
- Benefit to the Valley Community

Each criterion has a corresponding scoring approach. The scoring approaches and definition of each criterion are provided in Appendix H. The scoring approach was then weighted based on the importance of the criteria to the project's goals and objectives. For each alternative, the weighted score for the screening criteria was summed to find the qualitative total. Finally, each alternative was ranked based on the qualitative score total.

5.5.2 Quantitative Analysis Summary

Each alternative was compared based on unit cost and recycled water yield. Table 5-12 summarizes the results from the quantitative comparison. For the purposes of the alternatives evaluation, only Segment 1.1 of Alternative 1 was included because it has the lowest unit cost and does not rely on highly uncertain customers such as the gold course. For Alternative 3, the Low Range cost was included in the evaluation for simplicity, although the High Range cost would not change the overall ranking.

Table 5-12. Recycled Water Alternatives Quantitative Analysis Summary

Alternative	Alternative 1 Irrigation (Segment 1.1)	Alternative 2 Greenspot	Alternative 3 Sand Canyon (Low Range)	Alternative 3 Sand Canyon (High Range)	Alternative 4 Greenspot & Sand Canyon
Total Capital Cost	$3,257,000	$44,533,000	$23,255,000	$24,315,000	$69,700,000
Annual O&M Cost	$65,000	$1,539,000	$1,174,000	$1,259,000	$2,726,000
Recycled Water Yield (AFY)	54	1,000	520	500	1,750
Unit Cost ($/AF)	$3,960	$3,580	$4,310	$4,750	$3,390
Net Present Value	$5,087,000	$88,172,000	$56,759,000	$60,247,000	$147,270,000

5.5.3 Alternative Ranking Criteria and Scoring Results

For the alternative analysis, each alternative was compared and ranked on the basis of qualitative criteria, beneficial use yield and unit cost. Each alternative received a ranking between 1 and 3. The ranking system is summarized in Table 5-13.

Table 5-13. Alternative Ranking Criteria

Criteria	Ranking of 1	Ranking of 3
Qualitative	Lowest weighted score	Highest weighted score
Unit Cost	Lowest Unit Cost	Highest Unit Cost
Water Available for Beneficial Use	Largest Recycled Water amount used	Smallest Recycled Water amount used

As shown in Figure 5-14, Alternative 4 ranked first in the two of the three alternative ranking criteria categories and highest overall; therefore, Alternative 4 was selected as the top ranked alternative. Alternative 1 ranked the lowest.

5.5.4 Preferred Alternatives

Alternative 4 was highest ranked and is recommended for implementation as the ultimate project, although it can be implemented in phases over time. At full scale, Alternative 4 would beneficially use nearly all of the treated effluent within the Valley.

	Assigned Scores (1, 2 or 3; 3 being the best)					Weighted Scores (Assigned Scores x Weighting Factors)			
Qualitative/Non-Economic Criteria	**Alternative 1 (Segment 1.1)**	**Alternative 2**	**Alternative 3 (Low Range)**	**Alternative 4**	**Weighting Factors** (1-4, 4 being most important)	**Alternative 1 (Segment 1.1)**	**Alternative 2**	**Alternative 3 (Low Range)**	**Alternative 4**
Promotes Beneficial Management of Water Resources	1	2	3	3	3	3	6	9	9
O&M Complexity	3	2	2	1	2	6	4	4	2
Ease of Implementation	3	1	1	1	1	3	1	1	1
Benefit to Bear Valley Community	1	2	2	3	4	4	8	8	12
Total (Non-Economic/Qualitative)	8	7	8	8		16	19	22	24

Quantitative Criteria	**Alternative 1 (Segment 1.1)**	**Alternative 2**	**Alternative 3 (Low Range)**	**Alternative 4**
Capital Cost	$3,257,000	$44,533,000	$23,255,000	$69,700,000
Annual O&M	$65,000	$1,539,000	$1,174,000	$2,726,000
Beneficial Use Yield (AFY)	54	1000	520	1750
Unit Cost ($/AF)	**$3,960**	**$3,580**	**$4,310**	**$3,390**

Ranking	**Alternative 1 (Segment 1.1)**	**Alternative 2**	**Alternative 3 (Low Range)**	**Alternative 4**
Qualitative/Non-Economic	4	3	2	1
Beneficial Use Yield (AFY)	5	2	3	1
Unit Cost ($/AF)	2	1	3	3
Overall Rank	**4**	**2**	**3**	**1**

Figure 5-14. Alternative Evaluation Results

6 RECOMMENDED FACILITIES PROJECT PLAN

As discussed in Section 5.5, Alternative 4 was ranked the highest and is the recommended alternative for implementation. There is sufficient treated effluent available to provide RW for artificial recharge at both Greenspot and Sand Canyon.

As described in Section 5.1.4.6, a demonstration scale or phased project may be considered for the Alternative 4 implementation. Greenspot has been thoroughly studied and modeled; therefore, there is little risk in establishing the Greenspot site to initiate the Valley's RW program. A phased approach to implementing 25% of the Valley's potential RW use yield sets the agencies up for modular expansion to eventually reuse all the potential RW, while maintaining all assets for use in later phases. Due to the low beneficial use yield of the demonstration project and the likelihood for stranded assets due to the small scale, it is recommended the agencies pursue a phased Alternative 4 project rather than a demonstration scale project if the potential refinements to Alternative 4 were to be considered.

6.1 RECYCLED WATER YIELD

The potential recycled water yield of Alternative 4 is summarized in Table 6-1.

Table 6-1. Summary of Alternative 4 Recycled Water Yield

Alternative	Potential Water Use, AFY
Alternative 4 – Greenspot & Sand Canyon Recharge	1,750

6.2 TREATMENT IMPROVEMENTS

A portion of the flow will require advanced treatment to meet recycled water blending requirements and to comply with groundwater quality objectives. The advanced treatment process train would consist of:

1. MF/UF
2. RO
3. UV/AOP
4. Brine Disposal

The combination of MF, RO and UV/AOP is considered the conventional indirect potable reuse treatment train.

The brine stream generated from the RO process in Alternative 4 would be treated and disposed of using effluent mixing coupled with brine reduction and evaporation ponds at the LV Site. Alternatively, the Project Team has expressed an interest in exploring the concept of constructing brine storage and evaporation ponds on the BBARWA WTP site to avoid the cost of the brine pipeline to the LV Site. As previously stated, this brine management strategy must be reevaluated following issuance of the new LV Site TDS limit. The issuance of the TDS limit will occur after the approval of the TDS study, which is due to the State Board by December 31, 2017.

The treatment capacity of Alternative 4 is summarized in Table 6-2.

Table 6-2. Treatment Capacity Summary for Alternative 4

Alternative	Tertiary Treatment		Advanced Treatment		Total Blended Water Produced, MGD
	Capacity, MGD	% of Total Recharge Water	Capacity, MGD	% of Total Recharge Water	
Alternative 4: Greenspot & Sand Canyon Recharge	1.78	22%	1.43	78%	1.56

6.3 RECHARGE AND DISTRIBUTION IMPROVEMENTS

Alternative 4 requires construction of an onsite storage tank, a water truck fill station and recharge facilities. A summary the improvements is presented in Table 6-3. A map of Alternative 4 is shown in Figure 6-1.

Table 6-3. Alternative 4 Facilities Summary

Facility	Capacity
Storage, MG	1.56
Pump Station, gpm	1,100
Pipeline (length, ft/dia)	50,200 / 12”
Recharge Basin, acres	9.5
New Extraction Wells	6
New Monitoring Wells	4

6.4 COST ESTIMATE

The cost estimate for Alternative 4 is summarized in Table 6-4.

Table 6-4. Cost Summary for Alternative 4

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF	Net Present Value
Alternative 4: Greenspot & Sand Canyon Recharge	$69,700,000	$2,726,000	1,750	$3,390	$147,936,000

The SWRCB Water Recycling Funding Program received funding from the 2014 California Water Bond (Prop 1) and is currently offering grant funding for water recycling projects. This grant program, which is described in more detail in Section 8.2.1, is offering 35% grants, with a maximum grant amount of $15,000,000. To illustrate the benefits of this grant program, Table 6-5 summarizes the local portion of the project costs if a 35% grant is received to reduce the local capital contribution.

Table 6-5. Cost Summary Including 35% Grant for Alternative 4

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF	Net Present Value
Alternative 4: Greenspot & Sand Canyon Recharge	$45,305,000	$2,726,000	1,750	$2,750	$124,180,000

There may be opportunities to leverage other grant funding programs, such as the USDA Rural Development Water and Environment Program, to further reduce the portion of project costs that must be funded locally.

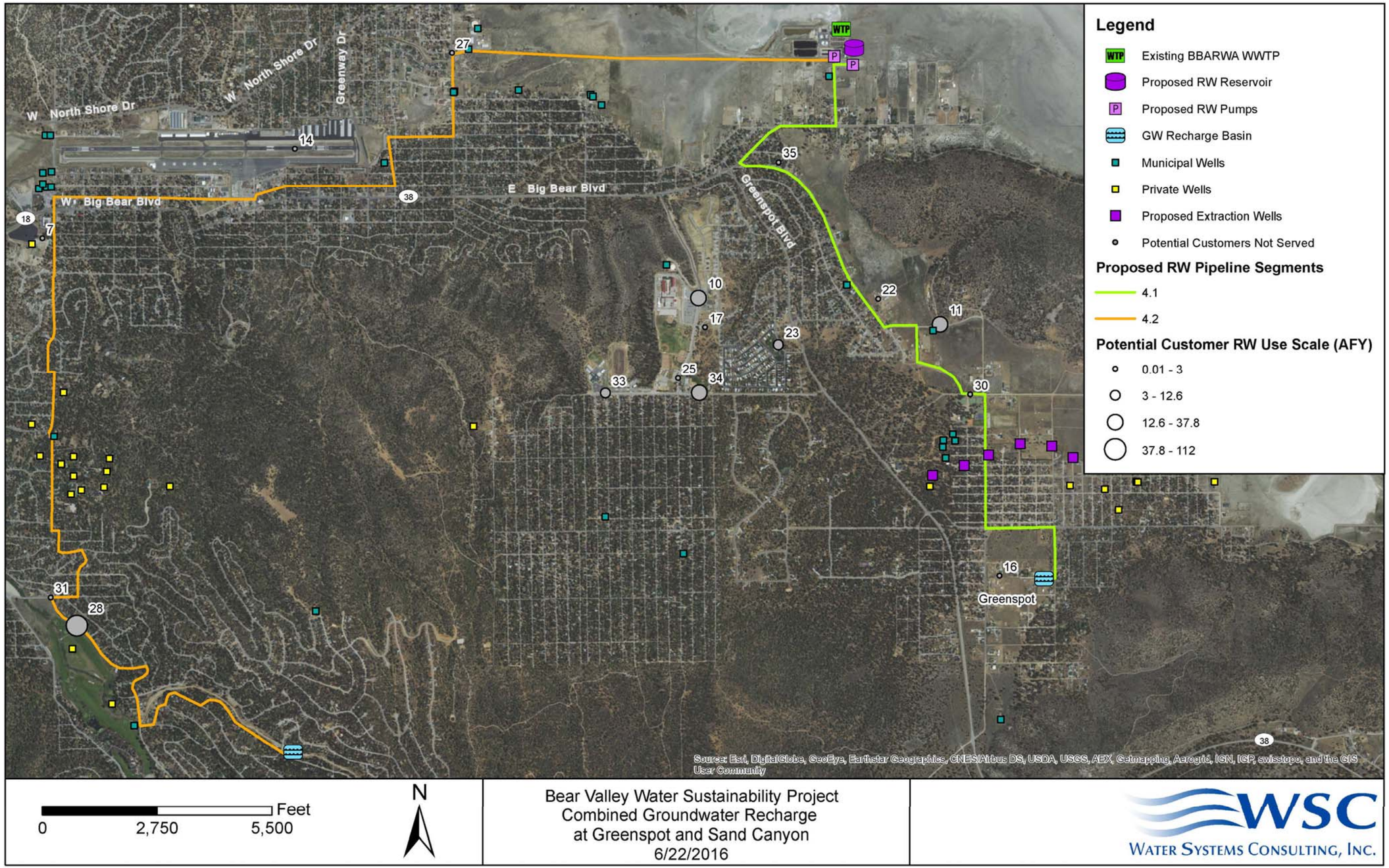

Figure 6-1. Alternative 4 Overview

7 IMPLEMENTATION PLAN

This Chapter describes what the Project Team will need to consider and address when implementing the selected recycled water project(s).

7.1 NEXT STEPS FOR IMPLEMENTATION

The next steps towards the implementation of the recommended groundwater recharge projects are summarized below. The next steps apply to both the Greenspot and Sand Canyon recharge projects unless otherwise stated.

- Quantify dilution credit
  - Sand Canyon Site will require a complete hydrogeologic analysis in order to quantify credits
  - Greenspot Site will require an update to the prior hydrogeologic analysis using the existing groundwater model
- Coordinate with the SAWPA BMPTF to assess assimilative capacity for TDS
- Perform a brine analysis for the Sand Canyon recharge alternative to confirm whether brine generated at the satellite facility could be discharged to the BBARWA plant without impacting the ability to meet discharge requirements
- Target optimization of brine management at the existing BBARWA WWTP by evaluating:
  - alternative treatment technologies for a portion of the advanced treatment to minimize brine produced
  - new and emerging technologies that could reduce brine disposal costs
  - local brine evaporation scenarios and sites
- Perform additional field investigations and perform groundwater model analysis for the Sand Canyon Site to explore operational scenarios and the impact on groundwater levels and travel time
- Perform additional modeling for the Greenspot Recharge Site to further explore operational scenarios and validate the number of new production wells needed.
- Public outreach to enhance public engagement and support for the project
- Outreach to public universities and Water Environment & Reuse Foundation to discuss potential partnering opportunities for inland potable reuse research.
- Establish monitoring system for funding program solicitations related to demonstration recycled water projects.

7.2 PERMITTING REQUIREMENTS

7.2.1 Tentative Water Recycling Requirements of the Santa Ana RWQCB

In order to implement the recommended recycled water projects, BBARWA will need to initiate a permit reopener and renewal process with the Santa Ana RWQCB to obtain coverage for the proposed advanced treatment upgrades, waste effluent discharge and recharge. BBARWA will need to submit a Report of Waste Discharge to the Santa Ana RWQCB and an Engineering Report to Santa Ana RWQCB and DDW. The Engineering Report will need to include:

- Description of the proposed advanced treatment at the WWTP
- A hydrogeological assessment of the proposed Groundwater Replenishment Reuse Project (GRRP's) setting, including:
    - a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;
    - a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and
    - based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts:
        - the existing hydrogeology and the hydrogeology anticipated as a result of the operation of the GRRP
        - maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.
- A map of the GRRP site showing (1) the location and boundaries of the GRRP; (2) a boundary representing a zone of controlled drinking water well construction based on required retention times, (3) a secondary boundary representing a zone of potential controlled drinking water well construction, depicting the zone within which a well would extend the boundary in paragraph (2) to include existing or potential future drinking water wells, thereby requiring further study and potential mitigating activities prior to drinking water well construction; and (4) the location of all monitoring wells and drinking water wells within two years travel time of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions
- Justification of the required Response Retention Time and a protocol to be used to establish the required retention times
- A protocol describing the actions to be taken following construction of the upgrades to demonstrate that all treatment processes have been installed and can be operated to achieve their intended function
- Demonstration that the project sponsor possesses adequate managerial and technical capability to assure compliance with the regulations
- An emergency response plan for an alternative source of potable water supply or treatment at a drinking water well if the GRRP causes the well to no longer be safe for drinking purposes
- A contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the use area

Water recycling requirements for the GRRP will be in accordance with the Groundwater Recharge Regulations and are anticipated to include the requirements presented in Table 7-1. Figure 7-1 illustrates the anticipated Santa Ana RWQCB permitting process required.

Table 7-1. Tentative Water Recycling Requirements

Element	Surface Recharge
Treatment	RO and AOP treatment to meet blending and/or Basin Plan requirements
Retention time	Minimum 2 months
Recycled Water Max Initial Contribution (RWC_{max})	Up to 100% with RO and AOP
Total Nitrogen	Average < 10 mg/L
Total Organic Carbon (TOC)	< 0.5 mg/L
Monitoring Wells	2 monitoring wells down gradient of the GRRP

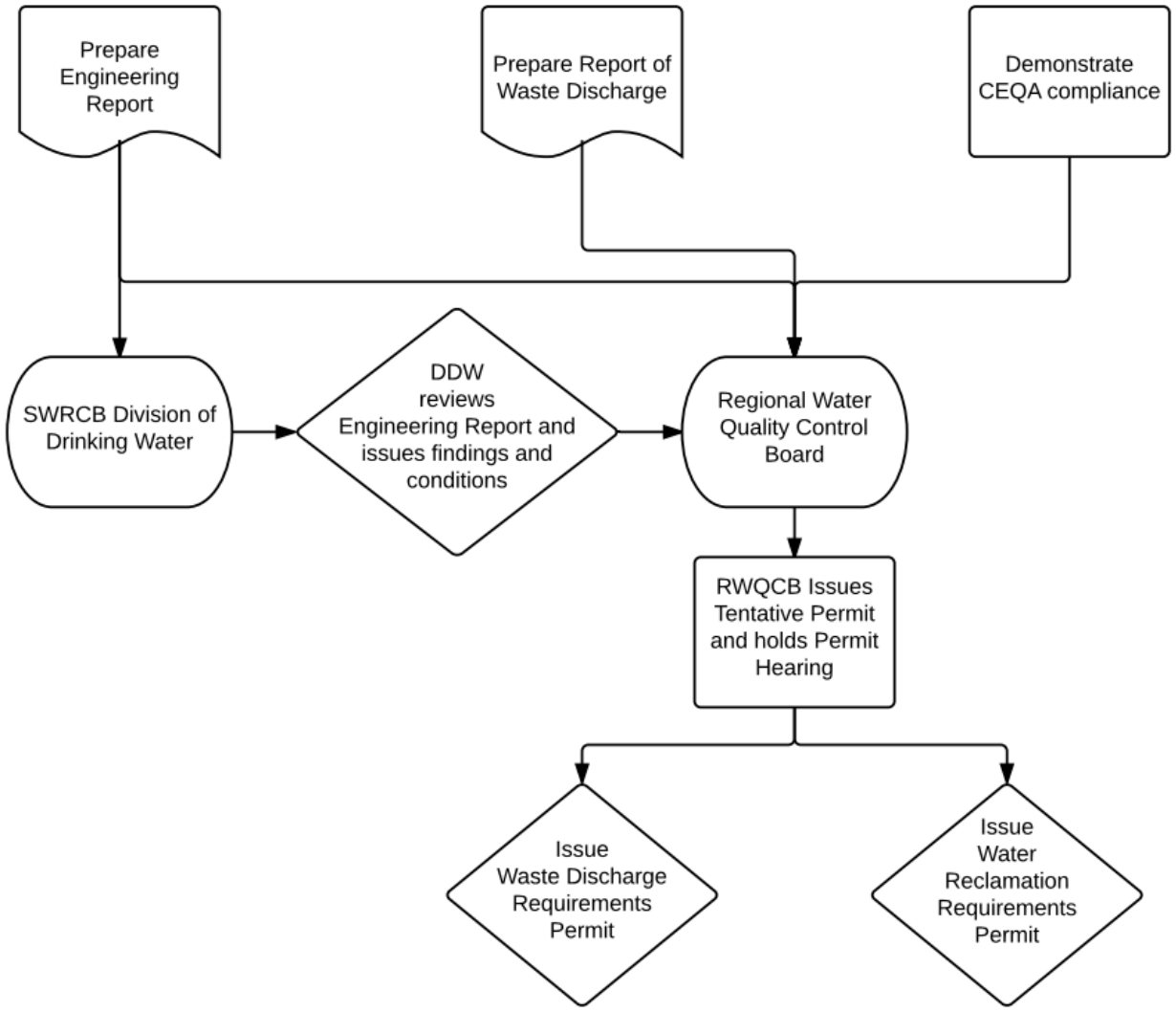

Figure 7-1. Permitting Process

Prior to the operation of the GRRP, the Project Team will also be required to develop and implement the following:

- An industrial pretreatment and pollutant source control program and maintain a source control program. As a component of the source control program, an outreach program to industrial, commercial, and residential communities discharging to the WWTP will be needed for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source.[1]
- An Operation Optimization Plan which identifies and describes the operations, maintenance, analytical methods and monitoring necessary for the GRRP to meet the requirements of the Groundwater Recharge Regulations.

7.2.2 Infrastructure Permits

It is anticipated that the Project Team will need to obtain multiple permits to construct the recommended projects including, but not limited to, the following:

- Caltrans encroachment permits for pipeline with Caltrans Right-of-Way
- The City of Big Bear Lake and/or San Bernardino County encroachment permits for improvements within their Rights-of-Way
- Grading permits for treatment upgrades, recharge basins, and extraction well sites
- NPDES General Construction Permit
- Building permits
- Authority to Construct and Permit to Operate the WWTP upgrades from the South Coast Air Quality Management District

7.3 ENVIRONMENTAL DOCUMENTATION REQUIREMENTS (CEQA)

In accordance with the California Environmental Quality Act (CEQA), it is anticipated the Project Team will prepare an Initial Study (IS) followed by an Environmental Impact Report (EIR) for the recommended project. In anticipation of applying for federal funding sources, the Project Team may also prepare an Environmental Assessment (EA) and an Environmental Impact Statement (EIS) to comply with the National Environmental Policy Act (NEPA).

[1] It is anticipated BBARWA's existing Ordinances No. 69 & O.03-2002 may be used to demonstrate compliance with the requirements of both programs.

7.4 BENEFICIARIES

The beneficiaries of this project include potable water customers of the BBLDWP, BBCCSD and private well pumpers in the Valley. The potable water users benefit from a new source of supply which is local, sustainable and highly reliable, even in times of drought.

Wastewater disposal for the BBARWA's wastewater customers is currently being achieved effectively through treatment and discharge to the Lucerne Valley Site for crop irrigation; therefore, the wastewater customers are not considered a beneficiary of this project. Although no significant near term changes are anticipated to the Colorado WDR that regulates this discharge, it is foreseeable that water quality and resulting treatment requirements will become more stringent in the future as more constituents are regulated and/or detection levels are lowered. In this situation, the wastewater customers would also receive benefits from the treatment upgrades proposed by the recommended project.

7.5 COORDINATION AND GOVERNANCE

It is recommended the Project Team continue discussions with each other regarding funding, financing and cost sharing for subsequent planning and design activities as well as fixed and variable project costs.

7.6 PUBLIC OUTREACH

Depending on the relative public acceptability of a GRRP, there may be a need for a public information program, which could take many different forms. It is recommended that the Project Team engage in a proactive public outreach program in coordination with other existing or planned outreach programs.

8 CONSTRUCTION FINANCING PLAN AND ANNUAL OPERATING BUDGET

Planning a recycled water program and building recycled water infrastructure requires a significant upfront capital investment. Additionally, adequate funding for annual O&M is necessary to ensure successful operation. Developing and implementing a recycled water program will require the project partners to develop a sound financial plan.

It is anticipated that the project will be funded through a combination of grants, low interest loans, cost-sharing contributions from the Project Team, and potentially other mechanisms.

8.1 ANNUAL OPERATING BUDGET

Table 8-1 summarizes the potential annual capital payment (based on 100% loan) and O&M costs for the recommended recharge projects.

Table 8-1. Estimated Project Annual Cost

	Greenspot & Sand Canyon Recharge
Annual Capital Payment	**$ 3,198,000**
Annual O&M Cost	
Pipeline	$ 100,000
Storage	$ 20,000
Pump Station Maintenance	$ 37,000
Pump Station Power	$ 111,300
Tertiary Treatment	$ 226,000
Advanced Treatment	$ 994,000
Brine Management System	$ 1,113,000
Compliance for Recycled Water	$ 76,250
Recharge Basin	$ 48,000
Total Annual O&M	**$ 2,726,000**
Total Annual Cost	**$ 5,924,000**

8.2 FUNDING OPPORTUNITIES

Pursuing project funding will require an upfront investment by the Project Team, and grant funding is anticipated to be highly competitive. The recommended recycled water project is anticipated to be attractive to grant funding agencies because it meets several objectives commonly prioritized by funding programs, including:

- Relies upon and strengthens local and regional partnerships
- Develops a new, local, sustainable water supply that benefits regional communities
- Improve water supply reliability
- Improves groundwater basin quality

The following sections present potential grant and loan funding opportunities that may be available for the project, including the recently approved 2014 California Water Bond (Prop 1).

8.2.1 Grant and Loan Programs

Funding opportunities for recycled water projects are available from several state and federal sources, including the SWRCB, Department of Water Resources (DWR), United States Bureau of Reclamation (USBR), USDA, California Energy Commission (CEC), and the U.S. Environmental Protection Agency (EPA). Several of these programs are responsible for administering the funds made available by the 2014 Water Bond (Prop 1). Funding programs are available to fund project activities from preliminary planning to construction. A summary of eligible funding programs is presented in Table 8-2.

Table 8-2. Eligible Funding Programs

Funding Program	Applicability to BVWSP	Available Funding	Project Deadlines	DAC Eligibility	Application Schedule	Reimbursable Funds Prior to Start Date	Required Documents
WFRP-Construction Grant/Loan Program	Funding for construction of water recycling projects	Grants up to 35% up to maximum of $15 million. Loans/financing available for 100% of eligible costs. Repayment term up to 30 years. Interest rate is set to half of the most recent General Obligation bond rate.	Total eligible project capacity shall be delivered within 5 calendar years of operation from the date of Initiation of Operations 50% of eligible project capacity must serve existing users	A **small** DACs may receive up to 40% in grants up to $20 million[1]	Applications are accepted on a continuous basis	The applicant may satisfy the local match requirement through other sources, including its own revenues, for example, where it has incurred and paid costs for studies and other directly associated planning and design incurred prior to the grant award date	CEQA
CWSRF-Wastewater Treatment Projects and Recycling Funding	Low interest financing for wastewater treatment facilities. Construction of publically owned treatment facilities. Wastewater treatment, local sewers, sewer interceptors, water reclamation, storm water treatment, combined sewers	30-year financing term at interest rate set to half of the most recent General Obligation bond rate[2]	No specific project timeline. Projects prioritized by "Readiness to proceed"	No preference/requirement for DAC	Applications are accepted on a continuous basis	Applicants may start construction prior to the effective date of the financing agreement, but will not receive reimbursement of construction costs incurred prior to the effective date, and are not guaranteed financing approval and an executed financing agreement.	CEQA+
USDA Rural Development-Water & Waste Disposal Loan & Grant Program	Funding for acquisition, construction or improvement of sewer collection, transmission, treatment and disposal facilities.	Up to 40-year financing term with fixed interest rates dependent on median household income and need for project. State or local match of 25% required. Grants may be combined with loans.	No specific project timeline.	DAC preferred/no requirement for DAC. Financing terms dependent on community MHI.	Applications are accepted on a continuous basis	Any costs including design, engineering during construction, construction, legal fees and land acquisition incurred prior to the date of award must be submitted to the USDA in writing to be considered for reimbursement.	NEPA
USBR WaterSMART Water and Energy Efficiency Grant	Project can demonstrate a benefit to an endangered threatened species, and reduce water and energy consumption. Would support alternatives for groundwater recharge	Funding Group I: Up to $300,000 up to two years. Funding Group II: Up to $1,500,000 up to three years	2 Years for Funding Group I. 3 Years for Funding Group II	No preference/requirement for DAC	Deadline has passed for 2016 grants. Application released between October-December, and due approximately 3 months after release date. Applicants should receive funding by summer of the following year	Any costs including design, construction plans, environmental compliance costs incurred prior to the date of award may be submitted for consideration for reimbursable expense	NEPA
USBR WaterSMART Title XVI Water Reclamation and Reuse Program	Funding for construction of projects that reclaim and reuse. Reclaimed water can be used for a variety of purposes such as environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, or recreation	Financing for construction projects is less than $20 million or 25% of total project cost. Funding for projects approved by congress and sponsored by congressman. 6 years since last construction authorization.	Typically, 24-36 months to complete tasks in agreement[5]	No preference/requirement for DAC	Deadline has passed for 2016 grants. Application released between October-December of this year. Applications due approximately 3 months after release date. Applicants should receive funding by summer of the following year	Any costs including design, construction plans, environmental compliance costs incurred prior to the date of award may be submitted for consideration for reimbursable expense	NEPA
USBR WaterSMART Title XVI Water Reclamation and Reuse Program	Funding for planning/feasibility study for recycled water project. Reclaimed water can be used for a variety of purposes such as environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, or recreation	Federal share for 50% of Feasibility Study	Typically, 18 months to complete tasks in agreement[3]	No preference/requirement for DAC	Deadline has passed for 2016 grants. Applications likely to be released in January of 2016	Any costs including design, construction plans, environmental compliance costs incurred prior to the date of award may be submitted for consideration for reimbursable expense	NEPA
Integrated Regional Water Management (IRWM) - Implementation Grant Program	Provides funding for implementation projects that support integrated water management	Minimum local funding match of 25%	No specific time to completion listed. Project must be implementation ready to apply for funding	MHI<80% of Statewide annual MHI	Deadline has passed for 2016 grants. Applications for 2017 likely to be due August 2016, and awarded January 2017	Reimbursable funds after effective date are for engineering, design, land and easement, legal fees, preparation of environmental documentation, environmental mitigation, and project implementation. Grant application preparation prior to effective date is reimbursable	CEQA
I-Bank Infrastructure State Revolving Fund	Provide financing for infrastructure and economic development projects	$50,000 - $25 million. Most recent interest rates between 2-3%	No specific time to completion listed. Project must be implementation ready to apply for funding	No DAC requirement; staff may adjust interest rate based on factors including MHI on a case by case basis	Continuous application process		CEQA

Notes:
1. Eligible communities include those with a population <20,000. Disadvantaged Communities (DAC) are those with MHI<80% of Statewide MHI. Severely DACs are those with MHI<60%.
2. Current CWSRF interest rate is 1.7%, 10 year range of 2.5% to 3%. No funding limit.
3. Extensions are allowed on a case-by-case basis.

9 CONCLUSIONS AND RECOMMENDATIONS

The implementation of a Bear Valley Water Sustainability Project that retains highly treated water in the Valley for beneficial use would provide a sustainable and drought proof source of supply that would support current and future residents and businesses long into the future. However, even with taking advantage of current funding programs, such a project would represent a significant investment for the community. The costs and long term benefits to the community should be carefully considered when determining the timing for implementation of the Bear Valley Water Sustainability Project.

Key next steps towards the implementation of the recommended groundwater recharge project were identified in Section 7.1. At a minimum, it is recommended that the Project Team consider the following two activities to continue to build a foundation for the potential future implementation of a groundwater recharge project.

- Coordinate with the SAWPA BMPTF regarding the assimilative capacity assessment process for TDS and consider adding the Big Bear Valley Groundwater Management Zone to the periodic update process.
- Continue public outreach to enhance public engagement and support for a groundwater recharge project in the Valley.

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Appendix A. WDR R7-2016-0026 and WDR R8-2005-004

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

BOARD ORDER R7-2016-0026

WASTE DISCHARGE REQUIREMENTS
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

The California Regional Water Quality Control Board, Colorado River Basin Region (Colorado River Basin Water Board) finds that:

1. Big Bear Area Regional Wastewater Agency (BBARWA or Discharger), P. O. Box 517, Big Bear City, California 92314, owns 480 acres in the Lucerne Valley, of which 340 acres are irrigated with recycled water from the Discharger's Wastewater Treatment Plant (WWTP). There are an additional 140 acres available for irrigation, also in the Lucerne Valley. BBARWA's WWTP provides sewerage service to the City of Big Bear Lake, Big Bear City Community Services District, and County Service Area 53-B. The WWTP is located at 122 Palomino Drive, Big Bear City, California 92314, and has a design treatment capacity of 4.89 million gallons-per-day (MGD) and a hydraulic capacity of 9.2 MGD.

2. The WWTP is located outside the boundary of the Colorado River Basin Water Board and is regulated by the California Regional Water Quality Control Board, Santa Ana Region (Santa Ana Water Board) under Waste Discharge Requirements (WDRs) Order R8-2005-0044.

3. The WWTP consists of: preliminary treatment, secondary treatment, and sludge drying and treatment. Secondary treated wastewater from the WWTP is disposed through three possible discharge points that are designated in Board Order R8-2005-0044 as Point 001, Point 002 and Point 003. The discharges from the WWTP at Points 002 and 003 are regulated by the Santa Ana Water Board. Most of the treated wastewater is discharged through Discharge Point 001 into the Lucerne Valley to irrigate fodder, fiber, and seed crops.

4. This Board Order regulates the discharge from the WWTP at Point 001. Infrastructure associated with this discharge includes a concrete-lined reservoir and two overflow ponds that are used to dispose of treated recycled wastewater by percolation and evaporation in the Lucerne Valley (Lucerne Valley Facility) located on Assessor's Parcel Number (APN) 0449-082-040000.

5. The Lucerne Valley Facility has been subject to WDRs adopted in Colorado River Basin Water Board Order 01-156 adopted November 14, 2001.

6. The WDRs are being updated to comply with current laws and regulations as set forth in the California Water Code (CWC) and the California Code of Regulations (CCR) and to incorporate any changes in ownership or operation undertaken by the Discharger.

7. The Lucerne Valley Facility is assigned California Integrated Water Quality System (CIWQS) number CW- CW-208930; Waste Discharger Identification (WDID) number 7A360100011, and GeoTracker Global ID number WDR100027897.

Wastewater Treatment and Discharge

8. The Lucerne Valley Facility is located on 480 acres owned by BBARWA and located near the intersection of State Hwy 247 (Old Woman Springs Road) and Camp Rock Road in the Lucerne Valley of San Bernardino County in Section 14, Township 4 North, Range 1 East, San Bernardino Base & Meridian, as shown in Attachment A, Vicinity Map, incorporated herein, and made part of this Board Order by reference.

9. Wastewater that is discharged at the Lucerne Valley Facility goes through preliminary and secondary treatment at the WWTP before it is sent via gravity to the concrete reservoir at the Lucerne Valley Facility. The WWTP components that are used for treatment are described below:

   a. Preliminary Treatment. Untreated wastewater flows to the preliminary treatment system, which consists of bar screens, aerated grit chamber with grit washer, and a flow bypass channel. This treatment stage removes screenings, rag material and grit.

   b. Secondary Treatment. Effluent flows by gravity from the preliminary treatment system to three parallel oxidation ditches for secondary (biological) treatment and timed processes for nutrient (nitrogen) removal. The number of ditches in operation depends on the seasonal fluctuations of the influent flow. The effluent from the oxidation ditches flows into a system of three secondary clarifiers for removal of floatable and settleable solids/materials. The secondary treated effluent flows to two cement-lined balancing chambers and then flows to equalization storage ponds at the WWTP until pumped for offsite irrigation disposal. A process flow diagram of the WWTP is shown on Attachment B, incorporated herein, and made part of this Board Order by reference.

   c. Offsite Irrigation/Disposal. Undisinfected secondary treated wastewater is pumped from the WWTP's main pump building (5.2 MGD) or auxiliary pump building (9.2 MGD) approximately 16.5 miles to an offsite 2.26-million gallon concrete-lined reservoir (undisinfected secondary recycled water reservoir). This reservoir is located one mile south of the irrigation site. Wastewater from the reservoir flows by gravity through an outfall line connected to the irrigation system. In the event of an overflow at the concrete-lined reservoir, the wastewater flows by gravity to earthen overflow ponds located adjacent to the irrigation site.

10. Approximately 2.01 MGD of undisinfected secondary recycled water (as defined in Title 22 California Code of Regulations Section 60301.900) is discharged to the Lucerne Valley Facility for irrigation of fodder and fiber crops. Undisinfected secondary wastewater has been approved by the California Department of Public Health (DPH) [now State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW)] for irrigation use at this site. Approximately 340 acres are being irrigated at the Lucerne Valley Facility, with an additional 140 acres available for irrigation at the site. The effluent discharge limit of 4.8 MGD in this Board Order is based on the capacity of the irrigated crops to take up nitrogen. The Lucerne Valley Facility site layout is shown in Attachment C, incorporated herein, and made part of this Board Order by reference.

11. The SWRCB's Division of Drinking Water has established statewide reclamation criteria in Title 22 CCR Section 60301 et seq. for the use of recycled water and has developed guidelines for specific uses. Title 22 CCR Section 60304(d)(4) allows the use of undisinfected secondary recycled water for the surface irrigation of fodder and fiber crops and pasture for animals not producing milk for human consumption. BBARWA's Title 22

Engineering Report was initially approved on November 3, 1980, by the California DHS, (now DDW). The Title 22 report was last updated November 4, 1998, to allow for the use of tertiary treated wastewater in the Big Bear Area.

12. The grazing of sheep on the irrigation site has been allowed under certain conditions, as outlined in a letter from Colorado River Basin Water Board staff dated November 15, 1994, and under the conditions shown in Discharge Specification D.22 of this Order.

13. No sewage sludge is discharged at the recycled water reuse site.

14. BBARWA's Self-Monitoring Reports (SMRs) from April 2011 through March 2016 characterize the WWTP effluent as follows:

Constituent	Units	Average	Maximum	Minimum
Flow	MGD	2.01	4.18	1.42
20° C BOD_5[1]	mg/L[2]	6	17	2
TSS[3]	mg/L	13	48	5
pH	s.u.[4]	7.8	8.0	7.4
TDS[5]	mg/L	450	519	354
Nitrate as N	mg/L	3.5	21.6	0.1
Total Nitrogen	mg/L	6.9	28	1.9
Chloride	mg/L	52	61	34
Sulfate	mg/L	40	48	26
Fluoride	mg/L	0.37	0.54	0.24
Boron	mg/L	0.18	0.25	<0.1

Hydrogeologic Conditions at the Lucerne Valley Facility

15. BBARWA installed one groundwater monitoring well in 1979 and three more groundwater monitoring wells in 1991 (MW-1, MW-2 and MW-3). Monitoring well MW-3 replaced the 1979 monitoring well, which was never monitored because the groundwater level is below the bottom of the well. Previous monitoring did not require depth to groundwater monitoring; however, the Discharger's reports indicate that MW-1 is the upgradient well. This Board Order will require depth to groundwater monitoring in order to establish the groundwater gradient.

[1] 5-day biochemical oxygen demand at 20 degrees Celsius.
[2] milligrams per Liter
[3] Total Suspended Solids
[4] Standard pH units
[5] Total Dissolved Solids

16. An irrigation well (14M1) was installed immediately northwest of the overflow ponds in 1986. The distance from well 14M1 to the nearest overflow pond is 180 feet.

17. BBARWA has reported that the depth to groundwater at the Lucerne Valley Facility is a minimum 150 feet below ground surface.

18. Groundwater monitoring data collected from monitoring wells MW-1, MW-2 and MW-3 during the period from 2009 to the present show the following average characteristics:

Constituent	Units	MW-1	MW-2	MW-3
Depth to Groundwater[6]	ft	176	130	141
TDS	mg/L	464	718	619
Total Nitrogen	mg/L	10.6	16.2	17.6
Nitrate as Nitrogen	mg/L	9.4	15.6	17.2
Sulfate	mg/L	63.3	203	173
Chloride	mg/L	106	122	135
Fluoride	mg/L	0.25	0.14	0.25
Boron	mg/L	<0.01	<0.01	<0.01
VOCs – MTBE	ug/L	9.0	ND	ND
VOCs – Methylene Chloride	ug/L	ND	1.4	1.1
VOCs – Bromomethane	ug/L	ND	ND	1.3

19. An analysis of groundwater monitoring data in monitoring wells MW1, MW2 and MW3 from 2000 to the present indicates that concentrations for nitrate, sulfate and chloride are decreasing in the downgradient wells (MW2 and MW3) and increasing in the upgradient well (MW1). This Board Order will require that the Discharger submit a technical report providing an analysis of the water quality impacts by nitrogen and TDS to groundwater resulting from the discharge and to report annual trend monitoring of the data collected in the groundwater monitoring network. The monitoring frequency for total nitrogen and nitrate in the groundwater monitoring wells will be increased from annually to monthly for 12 months and quarterly thereafter to establish groundwater gradient and flow direction. In addition, this Board Order will require annual reporting of nitrogen application of fertilizers and in farming practices and provide a nitrogen and water use balance for the recycled water used on-site.

20. Annual precipitation in the Lucerne Valley region averages about 5.5 inches. Annual evapotranspiration rate is approximately 68 inches.

21. The project lies beyond the toe of a large alluvial fan emanating from the mouth of Cushenbury Canyon in the eastern portion of Lucerne Valley.

[6] Measurement made in 2004.

22. There are several domestic wells in the vicinity of the on-site evaporation/percolation ponds.

23. Water supply to the Big Bear area communities is from numerous groundwater production wells located in Big Bear Valley. TDS in the water supply averages about 280 mg/L based on data reported in the BBARWA's SMRs from 2008 through 2015.

24. Regional groundwater flow in the irrigation and disposal area is generally to the northwest.

25. BBARWA conducted a geotechnical study referenced as *Geotechnical Study, Irrigation Site, Lucerne Valley Area, San Bernardino County, California for Big Bear Area Regional Wastewater Agency, July 29, 1977,* as an initial investigation of the site for use for irrigation. The report shows that the site is underlain by soils consisting of fine to coarse, clean to silty sands containing various amounts of grave from 5 to 24 feet below ground surface. Beneath this, to a depth of 60 to 100 feet below ground surface, the soil consists of fine to medium silty sands containing varying amounts of gravel, and is locally cemented with calcium carbonate accumulated during deposition of the sediments. Bedrock underlies the older alluvium at a depth of 400 to 600 feet.

Basin Plan, Beneficial Uses, and Regulatory Considerations

26. The Water Quality Control Plan for the Colorado River Basin Region of California (Basin Plan), which was adopted on November 17, 1993, and amended on November 13, 2012, designates the beneficial uses of ground and surface waters in this Region, and contains implementation programs and policies to achieve water quality objectives, including narrative objectives for ground water quality, in Chapter 3, section IV, Ground Water Objectives.

27. The discharge is within the Lucerne Hydrologic Unit. The beneficial uses of groundwater in the Lucerne Hydrologic Unit include:

    a. Municipal supply (MUN),

    b. Industrial supply (IND), and

    c. Agricultural supply (AGR).

28. These WDRs implement numeric and narrative water quality objectives for ground and surface waters established by the Basin Plan. The numeric objectives for groundwater designated for municipal and domestic supply are the maximum contaminant levels (MCLs) specified in sections 64431, 64444, and 64678 of Title 22 of the California Code of Regulations (CCR), and the bacteriological limits specified in section 64426.1 of Title 22, CCR.

29. It is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. This order promotes that policy by requiring discharges to meet maximum contaminant levels designed to protect human health and ensure that water is safe for domestic use.

30. Section 13267 of the CWC authorizes the Colorado River Basin Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (MRP) establishes monitoring and reporting requirements to implement federal and state

requirements.

31. This Order establishes WDRs pursuant to Division 7, Chapter 4, Article 4, of the CWC for discharges that are not subject to regulation under Clean Water Act (CWA) section 402 (33 U.S.C. section 1342).

32. Pursuant to CWC section 13263(g), the discharge of waste is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

33. The discharge authorized by this Board Order, and treatment and storage facilities associated with discharges of treated municipal wastewater, except for discharges of residual sludge and solid waste, are exempt from the requirements of the Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste, as set forth in Title 27, CCR, Division 2, Subdivision 1. This exemption is based on section 20090(a) of Title 27, which states in relevant part that discharges of domestic sewage or treated effluent are exempt provided that such discharges are regulated by WDRs, or for which WDRs have been waived, and which are consistent with applicable water quality objectives, and treatment or storage facilities.

Groundwater Degradation

34. State Water Board Resolution 68-16, "Policy with Respect to Maintaining High Quality Waters of the State"(Resolution 68-16) states:

    "Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies."

    Resolution 68-16 further states:

    "Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control [BPTC] of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

35. Some degradation of groundwater from the discharge to the evaporation/percolation ponds is consistent with Resolution 68-16, provided that the degradation:

    a. Is confined to a reasonable area;

    b. Is minimized by means of full implementation, regular maintenance, and optimal operation of BPTC measures;

    c. Is limited to waste constituents typically encountered in domestic wastewater; and

    d. Does not result in the loss of any beneficial use as prescribed in the applicable basin plan, or violation of any water quality objective.

36. The discharge of wastewater as permitted by Order R7-2016-0026 and Order R8-2005-

0044 reflects BPTC. The controls assure the discharge does not create a condition of pollution or nuisance, and that water quality will be maintained, which is consistent with the anti-degradation provisions of Resolution No. 68-16. The Discharger incorporates:

a. A WWTP that provides treatment to secondary standards and nitrification/denitrification processes;

b. An operation and maintenance manual;

c. Staffing to assure proper operation and maintenance;

d. A network of groundwater monitoring wells at the recycle site;

e. A requirement for an Irrigation Management Plan; and

f. A standby emergency power generator of sufficient size to operate the treatment plant and ancillary equipment during periods of loss of commercial power.

Accordingly, the discharge as authorized is consistent with the anti-degradation provisions of Resolution 68-16 and the applicable water quality objectives.

Constituents of Concern

37. Constituents in domestic wastewater effluent that present the greatest risk to groundwater quality are nitrogen, coliforms (pathogen-indicator organisms), and TDS. Recycled water used for irrigation at the Lucerne Valley Facility is treated to secondary standards and has undergone substantial removal of soluble organic matter, solids, and nitrogen treatment.

38. Title 22, CCR, section 64431, Maximum Contaminant Level (MCL) for Nitrate plus Nitrite as Nitrogen is 10 mg/L. To account for the fate of transport for the various components of Total Nitrogen, as a conservative value it is assumed that all nitrogen present converts to nitrate/nitrite. BBARWA's SMRs report an average of 6.9 mg/L for Total Nitrogen between April 2011 and March 2015. Prior to the operation of nitrification/denitrification processes at the WWTP, groundwater analyses at the irrigation and disposal site demonstrated degradation by nitrates. This Board Order will require the Discharger to provide a technical report in the form of a study that analyses the impacts to groundwater by the discharge and an evaluation of water quality trends. In addition, this Board Order will implement a monthly average effluent limitation of 10 mg/L for total nitrogen as a means to mitigate groundwater degradation.

39. While secondary treatment reduces fecal coliform densities by 90 to 99%, the remaining organisms in effluent are still 10^5 to 10^6 MPN/100 ml (United States Environmental Protection Agency, Design Manual, Municipal Wastewater Disinfection; October 1986). Given the depth to groundwater, it is not likely that pathogen-indicator bacteria will reach groundwater at densities exceeding those prescribed in Title 22, CCR.

40. The typical incremental addition of dissolved salts from domestic water usage is 150 to 380 mg/L. Domestic water supply to the Big Bear area communities showed an average concentration of about 280 mg/L during the period of 2011 to 2016. From April 2011 to March 2016 treated wastewater discharged had an average TDS concentration of approximately 450 mg/L. Thus, the average TDS increase over the domestic water supply in the discharge during the same time period was about 170 mg/L. Treated wastewater discharged by the WWTP has a TDS limit of a maximum of 400 mg/L above the domestic source water as regulated by Board Order 01-156. This Board Order will

require the Discharger to provide a technical report in the form of a study that analyzes the impacts to groundwater by the discharge and an evaluation of water quality trends. The results of the study will be used to establish an appropriate effluent limitation for TDS.

CEQA and Public Participation

41. In accordance with section 15301, Chapter 3, Title 14, CCR, the issuance of these WDRs, which govern the operation of an existing facility involving negligible or no expansion of use beyond that previously existing, is exempt from the provisions of the California Environmental Quality Act (CEQA, Pub. Resources Code, section 21000 et seq.).

42. The Colorado River Basin Water Board has notified the Discharger and all known interested agencies and persons of its intent to draft WDRs for this discharge, and has provided them with an opportunity for a public meeting and an opportunity to submit comments.

43. The Colorado River Basin Water Board, in a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, that Board Order 01-156 is rescinded upon the effective date of this Order, except for enforcement purposes, and, in order to meet the provisions contained in Division 7 of the California Water Code, and regulations adopted thereunder, the Discharger shall comply with the following:

A. Effluent Limitations

1. Effluent discharged into the overflow evaporation/percolation ponds for disposal shall not exceed the following effluent limits:

Constituent	Units	30-Day Arithmetic Mean	7-Day Arithmetic Mean	Daily Maximum
20° C BOD_5	mg/L	30	45	-----
Total Suspended Solids	mg/L	30	45	-----
Chloride	mg/L	60	-----	80
Sulfate	mg/L	60	-----	80
Boron	mg/L	-----	-----	0.75
Total Nitrogen	mg/L	10	-----	-----

2. The 30-day average daily dry weather discharge for irrigation shall not exceed 4.8 MGD.

3. Effluent discharge for irrigation shall not have a pH below 6.0 or above 9.0.

B. Groundwater Limitations

1. Discharge at the Lucerne Valley Facility shall not cause groundwater to:

   a. Contain constituents in excess of California MCLs, as set forth in the California Code

of Regulations, Title 22, section 64426.1 for bacteriological constituents; section 64431 for inorganic chemicals; section 64444 for organic chemicals; and section 64678 for determination of exceedances of lead and copper action levels.

b. Contain taste or odor-producing substances in concentrations that adversely affect beneficial uses as a result of human activity.

C. Discharge Prohibitions

1. Discharge of waste classified as "hazardous", as defined in Title 23, CCR, section 2521(a), or "designated", as defined in California Water Code section 13173, is prohibited.

2. Discharge of treated wastewater at a location other than the designated disposal areas or as recycled water used for irrigation at approved use areas, is prohibited.

3. The discharge of recycled water to any drainage courses or surface waters is prohibited.

4. Discharge of waste to land not owned or authorized for such use by the Discharger is prohibited.

5. Surfacing or ponding of wastewater outside of the designated disposal locations is prohibited.

6. Bypass, overflow, discharge, or spill of untreated or partially treated waste is prohibited.

7. Application recycled water and fertilizers containing nitrogen at a rate greater than the agronomic uptake rate of the crops grown is prohibited.

D. Discharge Specifications

1. The discharge shall not cause pollution or nuisance as defined in sections 13050(l) and 13050(m) of Division 7 of the California Water Code, respectively.

2. A minimum depth of freeboard of two (2) feet shall be maintained at all times in the overflow earthen basins and concrete-lined reservoir.

3. The overflow ponds shall be managed to prevent breeding of mosquitoes. In particular:
    a. An erosion control program should assure that small coves and irregularities are not created around the perimeter of the water surface.
    b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.
    c. Dead algae, vegetation, and debris shall not accumulate on the water

4. All storage and disposal areas shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

5. The overflow ponds shall have sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, ancillary inflow, and infiltration during the non-irrigation season. Design seasonal precipitation shall be based on total

annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.

6. Public contact with non-disinfected wastewater shall be precluded through such means as fences, signs, and other acceptable alternatives. The non-disinfected wastewater is not approved for off-site distribution. Conspicuous signs shall be posted in a prominent location in each area where non-disinfected wastewater is stored on-site. Each sign or label with "Non-disinfected wastewater - No body contact or drinking" wording shall be displayed as well as the international warning symbol.

7. Objectionable odors originating at the Lucerne Valley Facility shall not be perceivable beyond the limits of the wastewater treatment and disposal area.

8. The overflow ponds and concrete-lined reservoir shall be maintained so they will be kept in aerobic conditions.

9. The dissolved oxygen content in the upper zone (one foot) of the concrete reservoir and overflow ponds shall not be less than 1.0 mg/L.

10. There shall be no surface flow of wastewater away from the designated disposal areas.

11. On-site wastes, including windblown spray from recycled water application, shall be strictly confined to the lands specifically designated for the disposal operation, and on-site irrigation practices shall be managed so there is no runoff of effluent from irrigated areas.

12. No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

13. No spray irrigation of any recycled water shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground or schoolyard.

14. Except as allowed under Section 7604 of Title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

15. Undisinfected secondary recycled water, as defined in Title 22, Section 60301.900 is limited only for irrigation in the following applications:

    a. Orchards where the recycled water does not come into contact with the edible portion of the crop,

    b. Vineyards where the recycled water does not come into contact with the edible portion of the crop,

    c. Non-food bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

    d. Fodder and fiber crops and pasture for animal not producing milk for human consumption,

e. Seed crops not eaten by humans,

f. Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans, and

g. Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

16. No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with edible portions of food crops eaten raw by humans.

17. The storage, delivery, or use of recycled water shall not individually or collectively, directly or indirectly, result in pollution, or adversely affect water quality, as defined in the CWC.

18. The delivery or use of recycled water shall be in conformance with the reclamation criteria contained in Title 22, or amendments thereto, for the irrigation of food crops, irrigation of fodder, fiber, and seed crops, landscape irrigation, supply of recreational impoundments and ground water recharge.

19. Prior to delivering recycled water to any new user, BBARWA shall submit to the Colorado River Basin Water Board a report discussing any new distribution system being constructed by the Discharger to provide service to the new user.

20. Recycled water shall not be delivered to any new user who has not first received a discharge permit from the Colorado River Basin Water Board and approval from the SWRCB's Division of Drinking Water.

21. Treated or untreated sludge or similar solid waste materials shall be disposed at locations approved by the Colorado River Basin Water Board's Executive Officer.

22. Grazing of sheep on the irrigation site is allowed only under the following conditions, unless otherwise approved by the Colorado River Basin Water Board 's Executive Officer:

    a. Grazing will only be conducted in October or November after the last cutting of hay has been baled;

    b. Grazing animals will not be allowed into a portion of the site until 10 days after it was last irrigated;

    c. Temporary fences will be erected to contain the grazing animals in an area of 40 acres or less;

    d. Only ewes that are about to lamb or ewes with newly born will be grazed;

    e. No animals will be sold for slaughter within 90 days after grazing.

    f. No milk produced by sheep that have grazed at the irrigation site shall be used for human consumption.

E. Special Provisions

1. Within **three months** of the adoption of this Board Order, the Discharger shall submit a technical report that is a work plan, for approval by the Colorado River Basin Water

Board's Executive Officer, to conduct a study of the groundwater in the vicinity of the recycled water irrigation use site. The objective of the study shall be to address the impacts that the discharges to unlined ponds and the irrigation area have on areal groundwater quality. The Discharger shall submit the final technical report containing the results of the study within **18 months** of the adoption of this Board Order and shall propose recommendations to mitigate the effects of nitrogen loading to groundwater and propose an appropriate effluent limit for TDS.

2. Within six months of the adoption of this Board Order, the Discharger shall prepare and submit an Irrigation Management Plan that includes a water balance and nutrient balance to assure that recycled water is applied at appropriate rates. The Irrigation Management Plan shall be submitted for approval by the Colorado River Basin Water Board's Executive Officer.

3. Within **nine months** of the adoption of this Order, the Discharger shall submit to the Colorado River Basin Water Board office a technical report that includes a copy of the Maintenance and Operations Manual for the Lucerne Valley Facility.

F. Standard Provisions

1. The Discharger shall comply with all of the conditions of this Board Order. Noncompliance is a violation of the Porter-Cologne Water Quality Control Act (CWC, section 13000 et seq.), and is grounds for enforcement action.

2. The Discharger shall comply with Monitoring and Reporting Program R7-2016-0026 and future revisions thereto as specified by the Colorado River Basin Water Board's Executive Officer.

3. The Discharger shall comply with the Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under Monitoring and Reporting Program (MRP) R7-2016-0026, and future revisions thereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and pdf monitoring reports to the State Water Resources Control Board GeoTracker https://geotracker.waterboards.ca.gov/ database. Documents that are normally mailed by the Discharger, such as regulatory documents, narrative technical monitoring program reports, and such reports submissions, materials, data, and correspondence, to the Colorado River Basin Water Board shall also be uploaded into GeoTracker in the appropriate Microsoft software application, such as word, excel, or an Adobe Portable Document Format (PDF) file. Large documents are to be split into manageable file sizes appropriately labelled and uploaded into GeoTracker.

4. All technical reports required in conjunction with this Order are required pursuant to Section 13267 of the CWC, and shall include a statement by the Discharger, or an authorized representative of the Discharger, certifying under penalty of perjury under the laws of the State of California, that the report is true, complete, and accurate.

5. In accordance with California Business and Professions Code Sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of California registered professionals (i.e., civil engineer, engineering geologist, geologist, etc.) competent and proficient in the fields pertinent to the required activities. All technical reports specified herein that contain work plans, that describe the conduct of investigations and studies, or that contain technical conclusions and

recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately qualified professionals, even if not explicitly stated. Each technical report submitted by the Discharger shall contain a statement of qualifications of the responsible licensed professionals as well as the professional's signature and/or stamp of the seal. Additionally, to the extent that preparation of a required technical report involves field activities, field activities shall be conducted under the direct supervision of one or more of these professionals.

6. The Discharger shall not cause degradation of any water supply in accordance with State Water Board Resolution 68-16.

7. Standby power generating facilities shall be available to operate the plant during a commercial power failure.

8. Adequate measures shall be taken to assure that flood or surface drainage waters do not erode or otherwise render portions of the discharge facilities inoperable.

9. The use of recycled water at the Lucerne Valley Facility shall be supervised by persons possessing certification of appropriate grade pursuant to section 3680, Chapter 26, Division 3, Title 23 of the California Code of Regulations.

10. The Discharger shall at all times properly operate and maintain all systems and components of collection, treatment and control, installed or used by the Discharger to achieve compliance with this Board Order. Proper operation and maintenance includes effective performance, adequate process controls, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities/systems when necessary to achieve compliance with this Board Order. All systems in service or reserved shall be inspected and maintained on a regular basis. Records of inspections and maintenance shall be retained, and made available to the Colorado River Basin Water Board's Executive Officer on request.

11. The Discharger shall ensure that all site-operating personnel are familiar with the content of this Board Order, and shall maintain a copy of this Board Order at the site.

12. The Discharger shall allow the Colorado River Basin Water Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter the premises regulated by this Board Order, or the place where records are kept under the conditions of this Board Order;

    b. Have access to and copy, at reasonable times, records kept under the conditions of this Board Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Board Order; and

    d. Sample or monitor at reasonable times, for the purpose of assuring compliance with this Board Order or as otherwise authorized by the California Water Code, any substances or parameters at this location.

13. Ponds shall be managed to prevent breeding of mosquitoes. In particular,

    a. An erosion control program should assure that small coves and irregularities are not

created around the perimeter of the water surface.

b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.

c. Dead algae, vegetation, and debris shall not accumulate on the water surface.

14. Disposal of oil and grease, biosolids, screenings, and other solids collected from liquid wastes shall be pursuant to Title 27, and the review and approval of the Colorado River Basin Water Board Executive Officer.

15. Any proposed change in use or disposal of biosolids requires the approval of the Colorado River Basin Water Board Executive Officer, and U.S. Environmental Protection Agency Regional Administrator, who must be notified at least 90 days in advance of the change.

16. Sludge use and disposal shall comply with Federal and State laws and regulations, including permitting requirements, and technical standards in 40 CFR Part 503. If the State and Colorado River Basin Water Boards are delegated the authority to implement 40 CFR Part 503 regulations, this Order may be revised to incorporate appropriate time schedules and technical standards. The Discharger shall comply with the standards and time schedules in 40 CFR part 503, whether or not part of this Order.

17. The Discharger shall provide a plan as to the method, treatment, handling and disposal of sludge that is consistent with all State and Federal laws and regulations and obtain prior written approval from the Colorado River Basin Water Board specifying location and method of disposal, before disposing of treated or untreated sludge, or similar solid waste.

18. The Discharger shall maintain a permanent log of all solids hauled away from the treatment facility for use/disposal elsewhere and shall provide a summary of the volume, type (screenings, grit, raw sludge, digested sludge), use (agricultural, composting, etc.), and the destination in accordance with the MRP of this Board Order. Sludge that is stockpiled at the treatment facility shall be sampled and analyzed for those constituents listed in the sludge monitoring section of the MRP of this Board Order and as required by Title 40, Code of Federal Regulations, Part 503. The results of the analyses shall be submitted to the Colorado River Basin Water Board as part of the MRP.

19. The Discharger shall provide a report to the Colorado River Basin Water Board when it determines that the plant's average dry-weather flow rate for any month exceeds 80 percent of the design capacity. The report should indicate what steps, if any, the Discharger intends to take to provide for the expected wastewater treatment capacity necessary when the plant reaches design capacity.

20. Prior to implementing a modification that results in a material change in the quality or quantity of wastewater treated or discharged, or a material change in the location of discharge, the Discharger shall report all pertinent information in writing to the Colorado River Basin Water Board, and obtain revised requirements.

21. Prior to a change in ownership or management of the Lucerne Valley Facility, the Discharger shall transmit a copy of this Board Order to the succeeding owner/operator, and forward a copy of the transmittal letter to the Colorado River Basin Water Board.

22. The Discharger shall provide adequate notice to the Colorado River Basin Water Board

Executive Officer of the following:

a. Any substantial change in the volume or character of pollutants introduced into any treatment facility described in the Findings of this Board Order, by an existing or new source; and

b. Any planned physical alteration or addition to the facilities described in this Board Order, or change planned in the Discharger's sludge use or disposal practice, where such alterations, additions, or changes may justify the application of Board Order conditions that are different from or absent in the existing Board Order, including notification of additional disposal sites not reported during the Board Order application process, or not reported pursuant to an approved land application plan.

23. The Discharger shall report orally, any noncompliance that may endanger human health or the environment. The noncompliance shall be reported immediately to the Colorado River Basin Water Board's Executive Officer at (760) 346-7491, and the California Office of Emergency Services at (800) 852-7550 as soon as:

    a. The Discharger has knowledge of the discharge,

    b. Notification is possible, and

    c. Notification will not substantially impede cleanup or other emergency measures.

    During non-business hours, the Discharger shall leave a message on the Colorado River Basin Water Board's office voice recorder at the above listed number. Incident information shall be provided orally as soon as possible and within 24 hours from the time the Discharger becomes aware of the incident. A written report shall also be provided within five (5) business days of the time the Discharger becomes aware of the incident. The written report shall contain a description of the noncompliance and its cause, the period of noncompliance, the anticipated time to achieve full compliance, and the steps taken or planned, to reduce, eliminate, and prevent recurrence of the noncompliance. The Discharger shall report all intentional or unintentional spills in excess of one thousand (1,000) gallons occurring within the Colorado River Basin Water Board's jurisdiction, including the Lucerne Valley Facility or disposal line, in accordance with the above time limits.

24. The Discharger shall report all instances of noncompliance. Reports of noncompliance shall be submitted with the Discharger's next scheduled SMRs or earlier if requested by the Colorado River Basin Water Board's Executive Officer, or if required by an applicable standard for sludge use and disposal.

25. By-pass (i.e., the intentional diversion of waste streams from any portion of the treatment facilities, except diversions designed to meet variable effluent limits) is prohibited. The Colorado River Basin Water Board may take enforcement action against the Discharger for by-pass unless:

    a. By-pass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to be inoperable, or substantial and permanent loss of natural resources reasonably expected to occur in the absence of a by-pass. Severe property damage does not mean economic loss caused by delays in production; and

    There were no feasible alternatives to by-pass, such as the use of auxiliary treatment

facilities or retention of untreated waste. This condition is not satisfied if adequate back-up equipment was not installed to prevent by-pass occurring during equipment downtime, or preventive maintenance.

b. By-pass is:

   i. Required for essential maintenance to assure efficient operation; and

   ii. Neither effluent nor receiving water limitations are exceeded; and

   iii. The Discharger notifies the Colorado River Basin Water Board ten (10) days in advance.

26. In the event of an unanticipated by-pass, the Discharger shall immediately report the incident to the Colorado River Basin Water Board. During non-business hours, the Discharger shall leave a message on the Colorado River Basin Water Board office voice recorder. A written report shall be provided within five business days the Discharger is aware of the incident. The written report shall include a description of the by-pass, any noncompliance, the cause, period of noncompliance, anticipated time to achieve full compliance, and steps taken or planned, to reduce, eliminate, and prevent recurrence of the noncompliance.

27. Federal regulations for storm water discharges require specific categories of facilities which discharge storm water associated with industrial activity (storm water) to obtain National Pollutant Discharge Elimination System (NPDES) permits and to implement Best Conventional Pollutant Technology (BCT) and Best Available Technology Economically Achievable (BAT) to reduce or eliminate industrial storm water pollution.

28. All storm water discharges from this facility must comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies, regarding discharges of storm water to storm water drain systems or other courses under their jurisdiction.

29. Storm water discharges from the facility shall not cause or threaten to cause pollution or contamination.

30. Storm water discharges from the facility shall not contain hazardous substances equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.

31. The Discharger is the responsible party for the waste discharge requirements and the monitoring and reporting program for the facility. The Discharger shall comply with all conditions of these waste discharge requirements. Violations may result in enforcement actions, including Colorado River Basin Water Board Orders or court orders, requiring corrective action or imposing civil monetary liability, or in modification or revocation of these waste discharge requirements by the Colorado River Basin Water Board.

32. This Board Order does not authorize violation of any federal, state, or local laws or regulations.

33. This Board Order does not convey property rights of any sort, or exclusive privileges, nor does it authorize injury to private property or invasion of personal rights, or infringement of federal, state, or local laws or regulations.

34. This Board Order may be modified, rescinded, or reissued, for cause. The filing of a

request by the Discharger for a Board Order modification, rescission or reissuance, or notification of planned changes or anticipated noncompliance, does not stay any Board Order condition. Causes for modification include a change in land application plans, or sludge use or disposal practices, and adoption of new regulations by the State or Colorado River Basin Water Board (including revisions to the Basin Plan), or Federal government.

I, Jose L. Angel, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on June 30, 2016.

Jose L. Angel

JOSE L. ANGEL P.E.
Executive Officer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

MONITORING AND REPORTING PROGRAM R7-2016-0026
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

Location of Discharge:
Section 14, T4N, R1E, SBB&M

A. Monitoring

1. This Monitoring and Reporting Program (MRP) describes requirements for monitoring a wastewater system and groundwater quality (when needed). This MRP is issued pursuant to California Water Code (CWC) section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer.

2. Water Code section 13267 states, in part:

   "In conducting an investigation specified in subdivision (a), the Colorado River Basin Water Board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the Colorado River Basin Water Board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the Colorado River Basin Water Board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

3. Water Code section 13268 states, in part:

   "(a) (1) Any person failing or refusing to furnish technical or monitoring program reports as required by subdivision (b) of section 13267, or failing or refusing to furnish a statement of compliance as required by subdivision (b) of section 13399.2, or falsifying any information provided therein, is guilty of a misdemeanor, and may be liable civilly in accordance with subdivision (b). (b) (1) Civil liability may be administratively imposed by a Colorado River Basin Water Board in accordance with Article 2.5 (commencing with section 13323) of Chapter 5 for a violation of subdivision (a) in an amount which shall not exceed one thousand dollars ($1,000) for each day in which the violation occurs."

4. BBARWA owns and operates the wastewater system that is subject to Board Order R7-2016-0026. The reports are necessary to ensure that the Discharger complies with the Order. Pursuant to Water Code section 13267, the Discharger shall implement the MRP and shall submit the monitoring reports described herein.

5. All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded

on the sample chain of custody form. If composite samples are collected, the basis for sampling (time or flow weighted) shall be approved by Colorado River Basin Water Board staff.

6. Field test instruments (such as those used to test pH, dissolved oxygen, and electrical conductivity) may be used provided that:
   a. The user is trained in proper use and maintenance of the instruments;
   b. The instruments are field calibrated prior to monitoring events at the frequency recommended by the manufacturer;
   c. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
   d. Field calibration reports are submitted as described in the "Reporting" section of this MRP.

7. The collection, preservation and holding times of all samples shall be in accordance with U. S. Environmental Protection Agency (USEPA) approved procedures. Unless otherwise approved by the Colorado River Basin Water Board's Executive Officer, all analyses shall be conducted by a laboratory certified by the State Water Resources Control Board, Division of Drinking Water. All analyses shall be conducted in accordance with the latest edition of the "Guidelines Establishing Test Procedures for Analysis of Pollutants" (40 CFR Part 136), promulgated by the USEPA.

8. All monitoring instruments and devices used by the Discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy. In the event that continuous monitoring equipment is out of service for period greater than 24-hours, the Discharger shall obtain representative grab samples each day the equipment is out of service. The Discharger shall correct the cause(s) of failure of the continuous monitoring equipment as soon as practicable. The Discharger shall report the period(s) during which the equipment was out of service and if the problem has not been corrected, shall identify the steps which the Discharger is taking or proposes to take to bring the equipment back into service and the schedule for these actions.

9. The Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Board Order, and records of all data used to complete the application for this Board Order, for a period of at least five (5) years from the date of the sample, measurement, report or application. This period may be extended by request of the Colorado River Basin Water Board's Executive Officer at any time. Records of monitoring information shall include:
   a. The date, exact place, and time of sampling or measurement(s);
   b. The individual(s) who performed the sampling or measurement(s);
   c. The date(s) analyses were performed;
   d. The individual(s) who performed the analyses;
   e. The analytical techniques or method used; and
   f. The results of such analyses.

10. Samples shall be collected at the location specified in the WDRs. If no location is

specified, sampling shall be conducted at the most representative sampling point available.

11. Given the monitoring frequency prescribed by MRP R7-2016-0026, if only one sample is available for a given reporting period, compliance with monthly average, or weekly average Discharge Specifications, will be determined from that sample.

12. If the facility is not in operation, or there is no discharge during a required reporting period, the Discharger shall forward a letter to the Colorado River Basin Water Board indicating that there has been no activity during the required reporting period.

Effluent Monitoring

13. Representative samples of the undisinfected secondary recycled water shall be taken at the WWTP. The samples shall be analyzed for the following constituents:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Irrigation Flow	MGD	Flow Meter Reading	Daily	Monthly
20°C BOD_5	mg/L	24 Hr. Composite	2x/Month	Monthly
Total Suspended Solids	mg/L	24 Hr. Composite	2x/Month	Monthly
pH	s.u. [1]	Grab	Daily	Monthly
Dissolved Oxygen[2]	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids	mg/L	24 Hr. Composite	Monthly	Monthly
Sulfate (SO_4)	mg/L	24 Hr. Composite	Monthly	Monthly
Chloride	mg/L	24 Hr. Composite	2x/Month	Monthly
Fluoride (F)	mg/L	24 Hr. Composite	Monthly	Monthly
Nitrate (NO_3-N) as N	mg/L	24 Hr. Composite	Monthly	Monthly
Total Nitrogen	mg/L	24 Hr. Composite	Monthly	Monthly
VOCs[3]	µg/L[4]	24 Hr. Composite	Annually	Annually

Overflow Pond Monitoring

14. During months when the overflow evaporation/percolation ponds are not used, the Discharger shall report that there has been no activity. During months when the overflow evaporation percolation ponds are in use, the ponds shall be monitored according to the following schedule:

[1] standard pH units
[2] Dissolved Oxygen shall be monitored at the upper one foot layer of the storage or percolation ponds.
[3] Analysis of Volatile Organic Compounds is to be accomplished using the USEPA test methods 601, 602 or 624
[4] micrograms per liter

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Flow Quantity	MGD	Flow Measurement	Daily	Monthly
Dissolved Oxygen	mg/L	Grab	Twice Monthly	Monthly
pH	s.u.	Grab	Twice Monthly	Monthly
Total Dissolved Solids	mg/L	Grab	Twice Monthly	Monthly
Freeboard	ft	Measurement	Twice Monthly	Monthly

Groundwater Monitoring

15. The groundwater monitoring wells shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring[5] Frequency	Reporting Frequency
Depth to Groundwater	ft (msl)[6]	Measurement	Monthly	Monthly
Groundwater Gradient[7]	NA	Direction	Monthly	Monthly
Total Nitrogen	mg/L	Grab	Monthly	Monthly
Nitrate as N	mg/L	Grab	Monthly	Monthly
Chloride	mg/L	Grab	Monthly	Monthly
Fluoride	mg/L	Grab	Monthly	Monthly
Sulfate	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids	mg/L	Grab	Monthly	Monthly
Boron	mg/L	Grab	Monthly	Monthly
VOCs	μg/L	Grab	Annually	Annually

Domestic Water Supply Monitoring

16. The domestic water supply shall be a flow weighted composite sample monitored at the water supply production wells in Big Bear Valley and include notations of which wells are non-operating for a reporting period and in accordance to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Total Dissolved Solids	mg/L	Grab	Annually	Annually

[5] Groundwater monitoring shall be performed monthly for the first 12 months and quarterly thereafter.
[6] Above mean sea level.
[7] Groundwater flow direction.

B. Reporting

1. The Discharger shall inspect and document any operation/maintenance problems by inspecting each unit process. Operation and Maintenance reports shall be submitted to the Colorado River Basin Water Board Office annually, containing documentation showing the calibration of flow meters and equipment as performed in a timely manner, modifications and updates to the Operation and Maintenance Manual, and modifications and updates to the Agency's waste water ordinance or rules and regulations.

2. The Discharger shall annually report a trend monitoring analysis for total nitrogen and nitrates in the groundwater in the vicinity of the recycled water use site. The analysis shall be reported with the Discharger's annual Self-Monitoring Report (SMR).

3. The Discharger shall provide an annual nitrogen balance for the recycled water use site which includes nitrogen loading by application of recycled water and the use of fertilizers for farming. Nitrogen balance shall consider nitrogen uptake by crops grown and provide documentation of crop-specific nitrogen uptake rates. The analysis shall be reported with the Discharger's annual SMR.

4. The Discharger shall provide an operator certification status update including number of staff and grade certification annually.

5. SMRs shall be certified under penalty of perjury to be true and correct, and shall contain the required information at the frequency designated in this MRP.

6. Each Report must contain an affirmation in writing that:

   "All analyses were conducted at a laboratory certified for such analyses by and in accordance with current USEPA procedures or as specified in this Monitoring and Reporting Program."

7. Each Report shall contain the following completed declaration:

   "I certify under the penalty of law that this document, including all attachments and supplemental information, was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment.

   Executed on the _____day of _____ at _____

   _____(Signature)

   _____(Title)"

8. The SMRs, and other information requested by the Colorado River Basin Water Board, shall be signed by a principal executive officer or ranking elected official.

9. A duly authorized representative of the Discharger may sign the documents if:

   a. The authorization is made in writing by the person described above;

b. The authorization specified an individual or person having responsibility for the overall operation of the regulated disposal system; and

c. The written authorization is submitted to the Colorado River Basin Water Board's Executive Officer.

10. The Discharger shall attach a cover letter to the SMRs. The information contained in the cover letter shall clearly identify violations of the WDRs; discuss corrective actions taken or planned and the proposed time schedule of corrective actions. Identified violations should include a description of the requirement that was violated and a description of the violation.

11. Daily, weekly, and monthly monitoring shall be included in the monthly monitoring report. Monthly monitoring reports shall be submitted to the Colorado River Basin Water Board by the 15th day of the following month. Quarterly monitoring reports shall be submitted by January 15th, April 15th, July 15th and October 15th. Annual monitoring reports shall be submitted by January 31st of the following year.

12. The Discharger shall comply with the Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under Monitoring and Reporting Program (MRP) R7-2016-0026, and future revisions thereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and pdf monitoring reports to the State Water Resources Control Board GeoTracker database. Documents that are 2.0 MB or larger should be broken down into smaller electronic files, labelled properly and uploaded into GeoTracker.

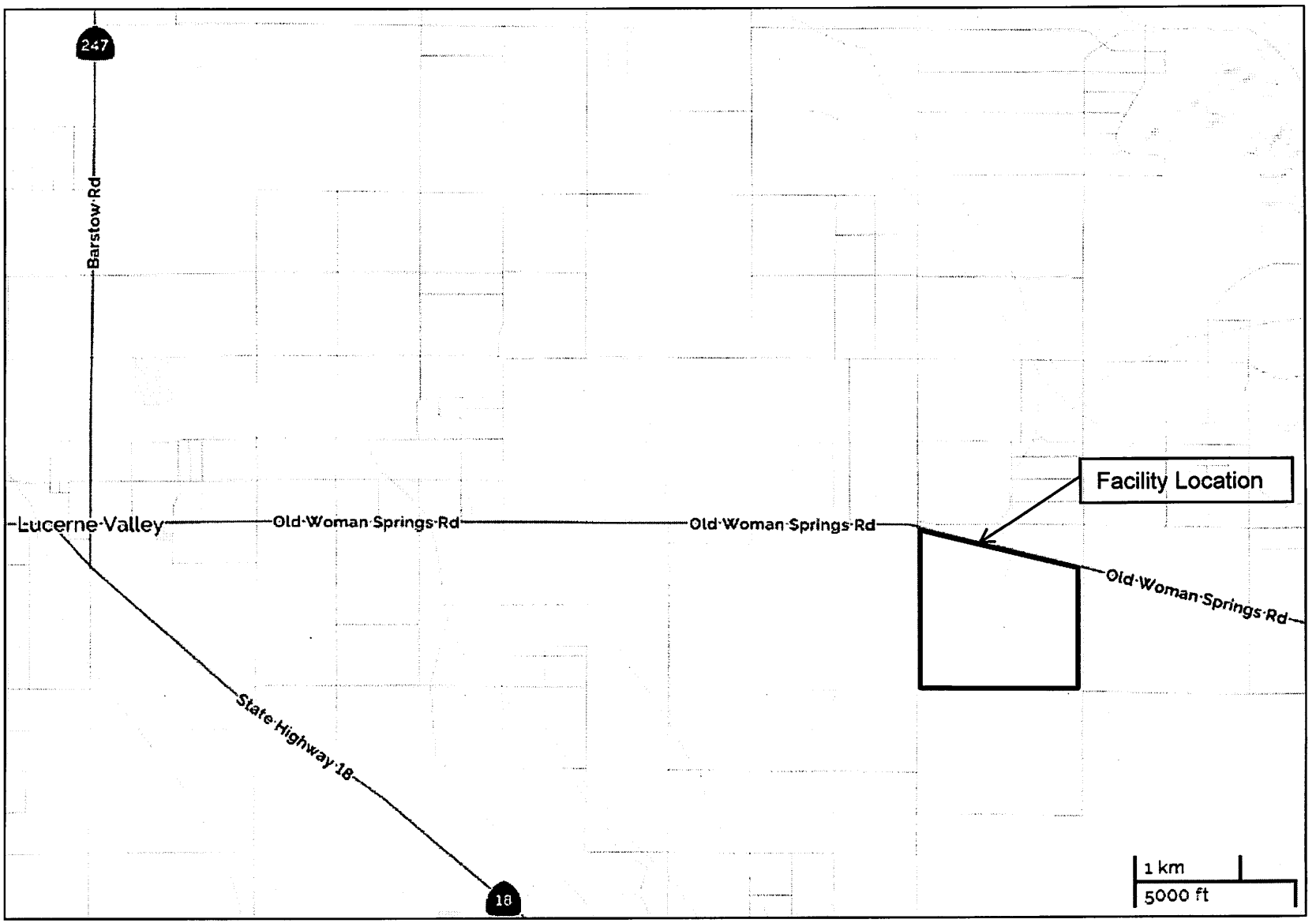
Jose L. Angel

JOSE L. ANGEL P.E.
Executive Officer

6/30/2016

Date

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

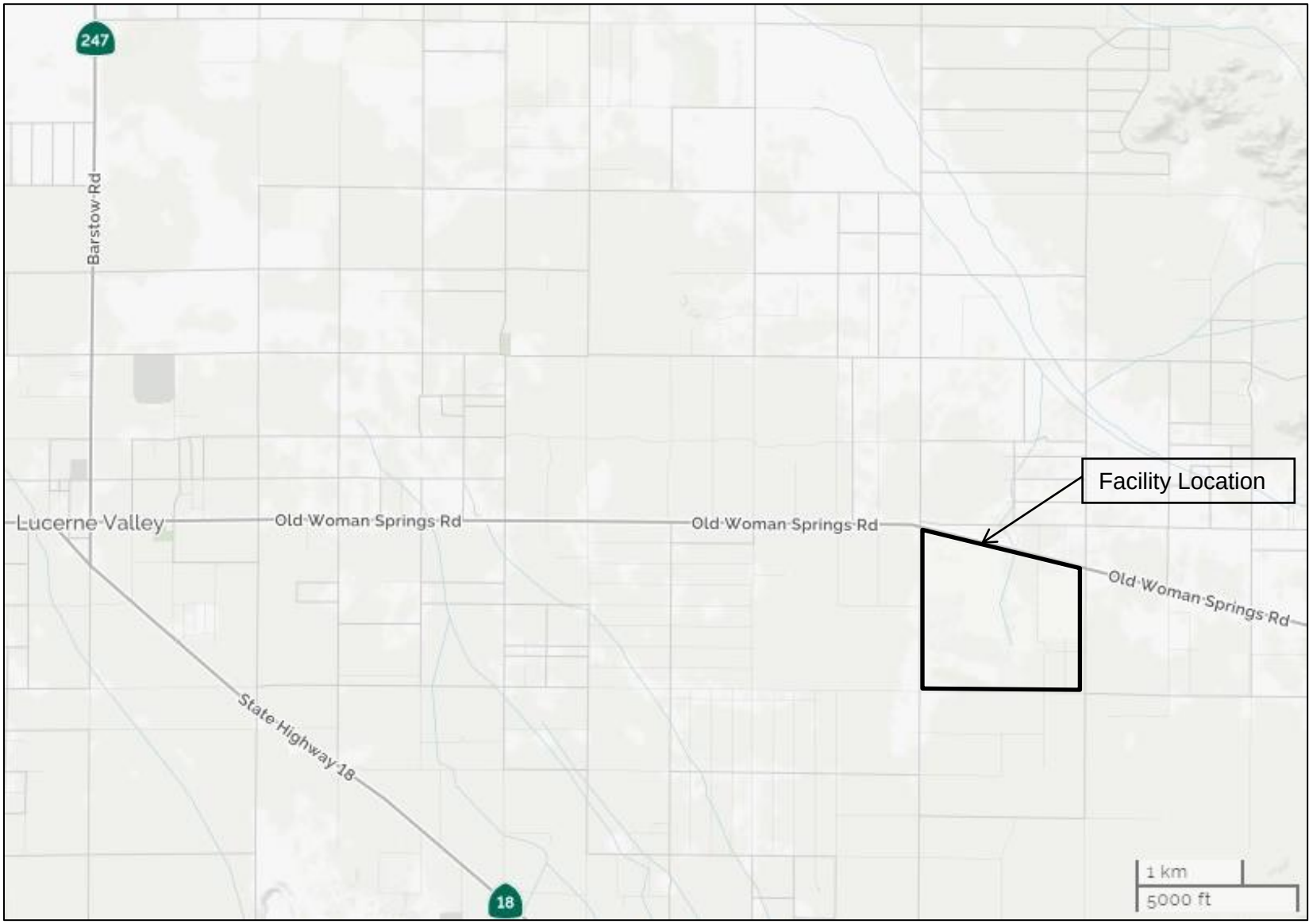


BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County
Section 14, T4N, R1E, SBB&M

ATTACHMENT A – VICINITY MAP

Board Order R7-2016-0026

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION



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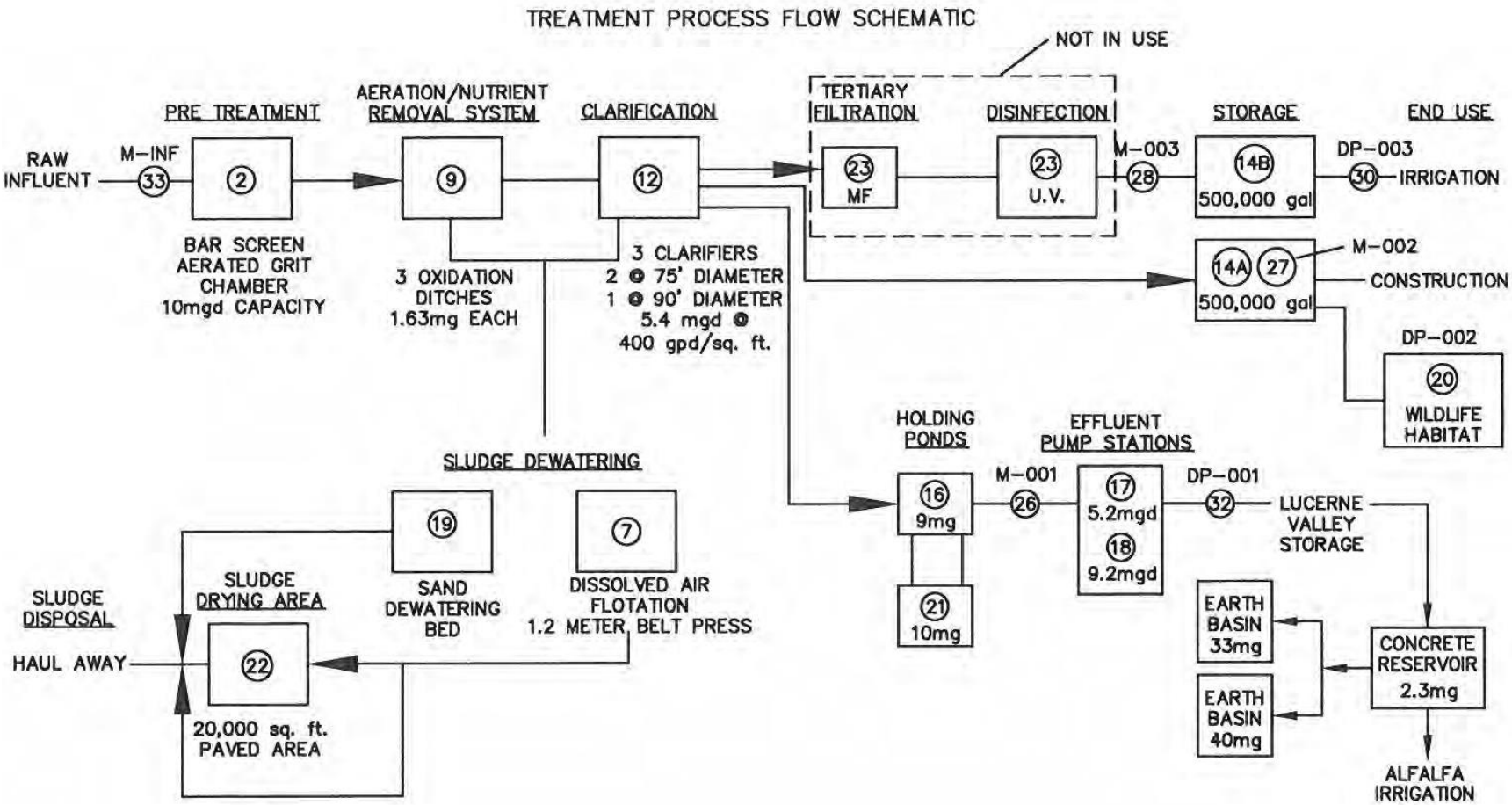

BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
Lucerne Valley – San Bernardino County

California Regional Water Quality Control Board

Santa Ana Region

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Alan C. Lloyd, Ph.D.
Agency Secretary

Arnold Schwarzenegger
Governor

ORDER NO. R8-2005-0044

WASTE DISCHARGE AND PRODUCER/USER WATER RECYCLING REQUIREMENTS

The following Discharger is authorized to discharge in accordance with the Waste Discharge Requirements set forth in this Order:

Discharger	**Big Bear Area Regional Wastewater Agency**
Name of Facility	**Regional Treatment Plant, Big Bear City**
Facility Address	**122 Palomino Drive**
	Big Bear City, CA 92314
	San Bernardino

The Discharger is authorized to discharge from the following discharge points as set forth below:

Discharge Point	Effluent Description	Discharge Point Latitude	Discharge Point Longitude	Receiving Water	Disposal Site	Recycling Reuse
001	Secondary effluent without disinfection	34 ° 26' 20" N	116 ° 51' 20" W	Lucerne Hydrologic Unit	Storage Ponds in Lucerne Valley	Irrigation in Lucerne Valley[1]
002	Secondary effluent with disinfection	34 ° 16' 10" N	116 ° 49' 00" W	State surface water: Storage pond in Baldwin Lake; Big Bear Valley groundwater management zone	--	construction and wildlife habitat
003	Tertiary effluent with disinfection	34 ° 16' 10" N	116 ° 49' 00" W	Big Bear Valley groundwater management zone	--	Irrigation

This Order was adopted by the Regional Water Board on:	**June 24, 2005**
This Order shall become effective on:	**June 24, 2005**

[1] The Colorado River Basin Regional Water Quality Control Board (Region 7) has issued waste discharge requirements for the use of the recycled wastewater in the Lucerne Valley.

IT IS HEREBY ORDERED, that Order No. 00-12 is superseded upon the effective date of this Order except for enforcement purposes, and, in order to meet the provisions contained in Division 7 of the California Water Code (CWC) and regulations adopted thereunder, the Discharger shall comply with the requirements in this Order.

I, Gerard J. Thibeault, Executive Officer, do hereby certify that Order No. R8- 2005-0044 with all attachments is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Santa Ana Region, on June 24, 2005.

Gerard J. Thibeault, Executive Officer

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
REGION 8, SANTA ANA REGION

ORDER NO. R8-2005-0044

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I. FACILITY INFORMATION

The following Discharger is authorized to discharge in accordance with the Waste Discharge Requirements set forth in this Order:

Discharger	**Big Bear Area Regional Wastewater Agency**
Name of Facility	**Regional Treatment Plant, Big Bear City**
Facility Address	**122 Palomino Drive**
	Big Bear City, CA 92314
	San Bernardino
Facility Contact, Title, and Phone	**Joseph Hanford, Interim Plant Superintendent (909) 584-4018**
Mailing Address	**P. O. BOX 517, 122 Palomino Drive, Big Bear City, CA 92314**
Type of Facility	**POTW**
Facility Design Flow	**4.89 million gallons per day (mgd)**

II. FINDINGS

The California Regional Water Quality Control Board, Santa Ana Region (hereinafter Regional Water Board), finds:

A. **Background.** Big Bear Area Regional Wastewater Agency (hereinafter Discharger) is currently discharging pursuant to Order No. 00-12 and National Pollutant Discharge Elimination System (NPDES) Permit No. CA8000344. The Discharger submitted a Report of Waste Discharge, dated August 26, 2004, and applied for renewal of waste discharge requirements to discharge up to 4.89 mgd of secondary treated and/or up to 1.0 mgd of tertiary treated wastewater from the Regional Treatment Plant, hereinafter Facility. The application was deemed complete on February 14, 2005.

The discharger has eliminated two previous discharge locations into the waters of the U.S. These two discharge locations were Discharge Serial No. 002 (East end of Stanfield Marsh) and 003 (Baldwin Lake Stickleback habitat). The discharger plans to deliver recycled water to a pond in Baldwin Lake to create a wildlife habitat area. Based on the U.S. Army Corps of Engineers' determination, the pond within the Baldwin Lake area is not considered waters of the U.S. Therefore, this Order is issued as Waste Discharge and Producer/User Water Recycling Requirements; an NPDES permit is no longer necessary.

B. **Facility Description.** The Discharger owns and operates a POTW. The treatment system consists of: preliminary treatment, secondary treatment, tertiary treatment, disinfection system, and sludge treatment system. Most of the treated wastewater is discharged through Discharge Point 001 (see table on cover page) into storage ponds in the Lucerne Valley for use in irrigation of fodder, fiber and seed crops. A minimal volume of treated wastewater is discharged through Discharge Points 002 and 003 for recycling and reuse at various sites for irrigation, dust control at construction sites, and wildlife habitat restoration in the Baldwin Lake. Attachment B provides a map of the area around the facility. Attachment C provides a flow schematic of the facility.

Stormwater runoff from the three discharge points of the RTP discharges into a flood zone, which is located at the east side of the plant. In heavy storm seasons, there is the possibility of overflow from the flooding zone into offsite surface waters.

C. **Legal Authorities.** This Order is issued pursuant to Chapter 5.5, Division 7 of the California Water Code (CWC). This Order serves as Waste Discharge Requirements (WDRs) pursuant to Article 4, Chapter 4 of the CWC.

This Order also includes requirements based on Title 22, Division 4, Chapter 3, of California Code of Regulations, which specifies regulations for the use of recycled water for irrigation and construction purposes.

D. **Background and Rationale for Requirements.** The Regional Water Board developed the requirements in this Order based on information submitted as part of the application and through monitoring and reporting programs. Attachments A through F, which contain background information and rationale for Order requirements, are hereby incorporated into this Order and, thus, constitute part of the Findings for this Order.

E. **California Environmental Quality Act (CEQA).** The project involves the update of waste discharge requirements for an existing facility and, as such, is exempt from the California Environmental Quality Act (Public Resources Code, Section 21100 et. seq.) in accordance with Section 15301, Chapter 3, Title 14, California Code of Regulations.

F. **Water Quality Control Plans.** The Regional Water Board adopted a revised Water Quality Control Plan for the Santa Ana Region (hereinafter Basin Plan) that became effective on January 24, 1995. The Basin Plan designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters in the Santa Ana Region addressed through the plan. More recently, the Basin Plan was amended significantly to incorporate revised boundaries for groundwater subbasins, now termed "management zones", new nitrate-nitrogen and TDS objectives for the new management zones, and new nitrogen and TDS management strategies applicable to both surface and ground waters. This Basin Plan Amendment was adopted by the Regional Board on January 22, 2004. The State Water Resources Control Board and Office of Administrative Law (OAL) approved the Amendment on September 30, 2004 and December 23, 2004, respectively.

These Basin Plan changes did not affect groundwater in the Big Bear area, apart from the re-designation of the Big Bear Valley groundwater subbasin as a groundwater management zone. Beneficial uses applicable to the Big Bear Valley Groundwater Management Zone and Lucerne Hydrologic Unit are as follows:

Discharge Point	Receiving Water Name	Beneficial Use(s)
001	Lucerne Hydrologic Unit	Based on Region 7's Basin Plan. 1. Municipal supply 2. Industrial supply 3. Agricultural supply
002	A pond in Baldwin Lake; and Big Bear Valley groundwater management zone	Beneficial Uses for Baldwin Lake: Intermittent: 1. Water contact recreation (REC-1), 2. Non-contact water recreation (REC-2), 3. Warm freshwater habitat (WARM), 4. Cold freshwater habitat (COLD), 5. Preservation of biological habitats of special significance (BIOL), 6. Wildlife habitat (WILD), and 7. Rare, threatened or endangered species (RARE). Beneficial Uses for groundwater management zone: Present or Potential: Municipal and domestic supply, industrial service supply.
003	Big Bear Valley groundwater management zone	Beneficial Uses for ground water management zone: Present or potential: Municipal and domestic supply, industrial service supply.

Requirements of this Order specifically implement the applicable Water Quality Control Plans.

G. **Industrial Stormwater Requirements.** Pursuant to Section 402(p) of the Clean Water Act and Title 40 of the Code of Federal Regulations (CFR) Part 122, 123, and 124, the State Water Resources Control Board adopted general NPDES permits to regulate storm water discharges associated with industrial activities (State Board Order No. 97-03-DWQ) adopted on April 17, 1997. The discharger's stormwater program was regulated previously under Order No. 00-12. For this Order, storm water discharge from the RTP is subject to requirements under the general permit. The discharger shall submit notice of intent to be covered under this general permit and develop and implement Storm Water Pollution Prevention Plans to comply with the general NPDES permit.

H. **Antidegradation Policy.** The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. As discussed in the Fact Sheet (Attachment E), the permitted discharge is consistent with the antidegradation provisions of State Water Board Resolution No. 68-16.

I. **Monitoring and Reporting.** Sections 13267 and 13383 of the CWC authorize the Regional Water Boards to require technical and monitoring reports. The Monitoring and Reporting Program establishes monitoring and reporting requirements to implement State requirements. This Monitoring and Reporting Program is provided in Attachment D.

J. **Biosolids Requirements.** On February 19, 1993, the USEPA issued a final rule for the use and disposal of sewage sludge, 40 CFR, Part 503. This rule requires that producers of sewage sludge meet certain reporting, handling, and disposal requirements. The State of California has not been delegated the authority to implement this program, therefore, the U.S. Environmental Protection Agency is the implementing agency. However, this Order includes Regional Board biosolids requirements.

K. **Notification of Interested Parties.** The Regional Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe Waste Discharge Requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Details of notification are provided in the Fact Sheet (Attachment E) of this Order.

L. **Consideration of Public Comment.** The Regional Water Board, in a public meeting, heard and considered all comments pertaining to the discharge. Details of the Public Hearing are provided in the Fact Sheet (Attachment E) of this Order.

III. DISCHARGE PROHIBITIONS

A. Wastes discharged from each of the following Discharge Points shall be limited to the type of effluent shown in the following table:

Discharge Point	Type of Effluent
001	Secondary effluent without disinfection[a]
002	Secondary effluent with disinfection[b]
003	Tertiary effluent with disinfection

a. Secondary or tertiary effluent with disinfection may also be discharged at this location.
b. Tertiary effluent with disinfection may also be discharged at this location.

B. Discharge of wastewater at a location or in a manner different from that described in A. above is prohibited.
C. The bypass or overflow of untreated wastewater or wastes to surface waters or surface water drainage courses is prohibited
D. The discharge of any substances in concentrations toxic to animal or plant life in the affected receiving water is prohibited.
E. There shall be no visible oil and grease in the discharge.
F. The discharge of any radiological, chemical, or biological warfare agent or high level radiological waste is prohibited.

IV. EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Effluent limitations – Discharge Points – 001, 002, and 003, beginning June 24, 2005:

1. The discharge of wastewater to Lucerne Valley and recycled water reuse for irrigation, construction, and wildlife habitat shall maintain compliance with the following limitations at Discharge Points 001, 002, and 003, with compliance measured at each individual monitoring location as described in the attached Monitoring and Reporting Program (Attachment D). The wastewater shall at all times be oxidized.

FOR DISCHARGE POINTS NO. 001 AND 002			
Parameter	**Units**	**Discharge Limitations**	
		Average Monthly	**Average Weekly**
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	30	45
	lbs/day[1]	1,223	1,835
Total Suspended Solids	mg/L	30	45
	lbs/day[1]	1,223	1,835

FOR DISCHARGE POINT NO. 003			
Parameter	**Units**	**Discharge Limitations**	
		Average Monthly	**Average Weekly**
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	20	30
	lbs/day[2]	167	250
Total Suspended Solids	mg/L	20	30
	lbs/day[2]	167	250

2. The pH of the effluent, measured at each monitoring point, shall at all times be within the range of 6 and 9 pH units.

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1 Based on a design capacity of 4.89 mgd for secondary treatment.
2 Based on a design capacity of 1.0 mgd for tertiary treatment.

3. Percent Removal: The monthly average biochemical oxygen demand and suspended solids concentrations of the discharge shall not be greater than fifteen percent (15%) of the monthly average influent concentrations.

4. TDS Limitations for Discharge Points 002 and 003: for effluent limitations a. and b., below, the lower of the two total dissolved solids limits is the limit.

   a. The 12-month average[3] total dissolved solids concentration shall not exceed 550 mg/l and the 12-month flow weighted average shall not exceed 22,430 lbs/day[4], and
   b. The 12-month average total dissolved solids concentration shall not exceed the 12-month average total dissolved solids concentration in the water supply by more than 250 mg/l.

5. Total Inorganic Nitrogen (TIN) Limitations: The 12-month flow-weighted average TIN concentration shall not exceed 10 mg/l.

6. For Discharge from Discharge Point 003: Tertiary treated recycled water shall at all times be a filtered and subsequently disinfected wastewater that meets the following criteria:

   a. The turbidity of the filtered wastewater does not exceed any of the following:

      i. for micro-filtration:
         1). 0.2 NTU more than 5 percent of the time within a 24-hour period; and
         2). 0.5 NTU at any time.

      ii. for media filtration:
         1). 2 NTU more than 5 percent of the time within a 24-hour period; and
         2). 5 NTU at any time.

   b. Disinfected tertiary wastewater shall meet the following criteria:

      i. The median concentration of total coliform bacteria measured in the disinfected effluent shall not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed.
      ii. The number of total coliform bacteria shall not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period.
      iii. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

7. For Discharge Point 002: wastewater shall at all times be an oxidized and subsequently disinfected wastewater that meets the following criteria:

   a. The median concentration of total coliform bacteria in the disinfected effluent shall not exceed an MPN of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed[5].

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[3] See Section VII. D Compliance Determination.
[4] Calculated from 4.89 mgd x 8.34 x 550 mg/l.

b. The number of total coliform bacteria shall not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.

B. Reclamation Specifications- Discharge Points 002 and 003

1. The use of recycled water shall only commence after final approval for such use is granted by the California Department of Health Services (CDHS). The Discharger shall provide the Regional Board with a copy of the CDHS approval letter within 30 days of the approval notice.

2. The Discharger shall be responsible for assuring that recycled water is delivered and utilized in conformance with this Order, the recycling criteria contained in Title 22, Division 4, Chapter 3, Sections 60301 through 60355, California Code of Regulations, and the "Guidelines for Use of Reclaimed Water" by the California Department of Health Services. The discharger shall conduct periodic inspections of the facilities of the recycled water users to monitor compliance by the users with this Order.

3. The Discharger shall establish and enforce Rules and Regulations for Recycled Water users, governing the design and construction of recycled water use facilities and the use of recycled water in accordance with the uniform statewide recycling criteria established pursuant to the California Water Code Section 13521.

   a. Use of recycled water by the discharger shall be consistent with its Rules and Regulations for Recycled Water Use.

   b. Any revisions made to the Rules and Regulations shall be subject to the review of the Regional Board, the California Department of Health Services, and the County of San Bernardino Department of Environmental Health. The revised Rules and Regulations or a letter certifying that the discharger's Rules and Regulations contain the updated provisions in this Order, shall be submitted to the Regional Board within 60 days of adoption of this Order by the Regional Board.

4. The Discharger shall, within 60 days of the adoption of this Order, review and update as necessary its program to conduct compliance inspections of recycled water reuse sites. Inspections shall determine the status of compliance with the discharger's Rules and Regulations for Recycled Water Use.

5. The storage, delivery, or use of recycled water shall not individually or collectively, directly or indirectly, result in a pollution or nuisance, or adversely affect water quality, as defined in the California Water Code

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[5] Title 22, 60301.225.

6. Prior to delivering recycled water to any new individual residential user, small commercial, or construction project users in accordance with BBARWA's "Temporary Use Policy for Private Residences", the discharger shall obtain items a. through f. listed below for review and approval by the discharger's supervisor responsible for the operation of the recycled water distribution system. For all other new users, the discharger shall submit to the California Department of Health Services for review and approval a report containing items a. through f. listed below:

   a. The average number of persons estimated to be served at each use site area on a daily basis.
   b. The specific boundaries of the proposed use site area including a map showing the location of each facility, drinking water fountain, and impoundment to be used.
   c. The person or persons responsible for operation of the recycled water system at each use area.
   d. The specific use to be made of the recycled water at each use area.
   e. The methods to be used to assure that the installation and operation of the recycled system will not result in cross connections between the recycled water and potable water piping systems. This shall include a description of the pressure, dye or other test methods to be used to test the system.
   f. Plans and specifications which include following:
      i. Proposed piping system to be used.
      ii. Pipe locations of both the recycled and potable systems.
      iii. Type and location of the outlets and plumbing fixtures that will be accessible to the public.
      iv. The methods and devices to be used to prevent backflow of recycled water into the potable water system.
      v. Plan notes relating to specific installation and use requirements.

7. The user shall designate an on-site supervisor responsible for the operation of the recycled water distribution system. The supervisor shall be responsible for enforcing this Order, prevention of potential hazards, the installation, operation and maintenance of the distribution system, maintenance of the distribution and irrigation system plans in "as-built" form, and for the distribution of the recycled wastewater in accordance with this Order.

V. RECEIVING WATER LIMITATIONS

A. Groundwater Limitations

1. The discharge shall not cause the underlying groundwater to be degraded, to exceed water quality objectives, unreasonably affect beneficial uses, or cause a condition of pollution or nuisance.

2. The discharge, in combination with other sources, shall not cause underlying groundwater to contain waste constituents in concentrations greater than background water quality.

VI. PROVISIONS

A. General Provisions:

1. Neither the treatment nor the discharge of waste shall create, or threaten to create, a nuisance or pollution as defined by Section 13050 of the California Water Code.

2. The discharger shall maintain a copy of this Order at the site so that it is available to site operating personnel at all times. Key operating personnel shall be familiar with its content.

3. The discharger shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any requirements specified in this Order, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. The discharger shall optimize chemical additions needed in the treatment process to meet waste discharge requirements so as to minimize total dissolved solid increases in the recycled water.

5. The provisions of this Order are severable, and if any provision of this Order, or the application of any provisions of this Order to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Order shall not be affected thereby.

6. Collected screenings, sludge, and other solids removed from liquid wastes shall be disposed of in a manner approved by the Regional Board's Executive Officer.

7. If the discharger demonstrates a correlation between the biological oxygen demand (BOD5) and total organic carbon (TOC) concentrations in the effluent to the satisfaction of the Executive Officer, compliance with the BOD5 limits contained in this Order may be determined based on analyses of the TOC of the effluent.

8. In the event of any change in control or ownership of land or waste discharge facility presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Regional Board.

9. The treatment facilities shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

B. Monitoring and Reporting Program Requirements

The Discharger shall comply with the Monitoring and Reporting Program, and future revisions thereto, in Attachment D of this Order. This monitoring and reporting program may be modified by the Executive Officer at any time during the term of this Order, and may include an increase or a reduction in the number of parameters to be monitored, the frequency of the monitoring or the number and size of samples to be collected. Any increase in the number of parameters to be monitored, the frequency of the monitoring or the number and size of samples to be collected may be reduced back to the levels specified in the original monitoring and reporting program at the discretion of the Executive Officer.

C. Special Provisions

1. Construction, Operation and Maintenance Specifications

   a. The discharger's wastewater treatment plant shall be supervised and operated by persons possessing certificates of appropriate grade pursuant to Title 23, Division 3, Chapter 14, California Code of Regulations.

   b. The discharger shall provide safeguards to assure that should there be reduction, loss, or failure of electric power, the discharger will comply with the requirements of this Order.

   c. The discharger shall update as necessary, the "Operation and Maintenance Manual (O&M Manual)" which it has developed for the treatment facility to conform to latest plant changes and requirements. The O&M Manual shall be readily available to operating personnel onsite. The O&M Manual shall include the following:

      i. Description of the treatment plant table of organization showing the number of employees, duties and qualifications and plant attendance schedules (daily, weekends and holidays, part-time, etc). The description should include documentation that the personnel are knowledgeable and qualified to operate the treatment facility so as to achieve the required level of treatment at all times.

      ii. Detailed description of safe and effective operation and maintenance of treatment processes, process control instrumentation and equipment.

      iii. Description of laboratory and quality assurance procedures.

      iv. Process and equipment inspection and maintenance schedules.

      v. Description of safeguards to assure that, should there be reduction, loss, or failure of electric power, the discharger will be able to comply with requirements of this Order.

vi. Description of preventive (fail-safe) and contingency (response and cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. These plans shall identify the possible sources (such as loading and storage areas, power outage, waste treatment unit failure, process equipment failure, tank and piping failure) of accidental discharges, untreated or partially treated waste bypass, and polluted drainage.

2. Special Provisions for Municipal Facilities (POTWs Only)

a. Sludge Disposal Requirements

i. Collected screenings, biosolids, and other solids removed from liquid wastes shall be disposed of in a manner that is consistent with Chapter 15, Division 3, Title 23, of the California Code of Regulations and approved by the Executive Officer.

ii. The use and disposal of biosolids shall comply with existing Federal and State laws and regulations, including permitting requirements and technical standards included in 40 CFR 503.

iii. Any proposed change in biosolids use or disposal practice from a previously approved practice shall be reported to the Executive Officer and EPA Regional Administrator at least 90 days in advance of the change.

iv. The discharger shall take all reasonable steps to minimize or prevent any discharge or biosolids use or disposal that has the potential of adversely affecting human health or the environment.

VII. COMPLIANCE DETERMINATION

Compliance with the effluent limitations contained in Section IV of this Order will be determined as specified below:

A. Average Monthly Effluent Limitation (AMEL).
If the average of daily discharges over a calendar month exceeds the AMEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that month for that parameter (e.g., resulting in 31 days of non-compliance in a 31-day month). The average of daily discharges over the calendar month that exceeds the AMEL for a parameter will be considered out of compliance for that month only. If only a single sample is taken during the calendar month and the analytical result for that sample exceeds the AMEL, the Discharger will be considered out of compliance for that calendar month. For any one calendar month during which no sample (daily discharge) is taken, no compliance determination can be made for that calendar month.

B. Average Weekly Effluent Limitation (AWEL).

If the average of daily discharges over a calendar week exceeds the AWEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that week for that parameter, resulting in 7 days of non-compliance. The average of daily discharges over the calendar week that exceeds the AWEL for a parameter will be considered out of compliance for that week only.

If only a single sample is taken during the calendar week and the analytical result for that sample exceeds the AWEL, the Discharger will be considered out of compliance for that calendar week. For any one calendar week during which no sample (daily discharge) is taken, no compliance determination can be made for that calendar week.

C. Maximum Daily Effluent Limitation (MDEL).

If a daily discharge exceeds the MDEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for that parameter for that 1 day only within the reporting period. For any 1 day during which no sample is taken, no compliance determination can be made for that day.

D. Compliance with the 12-month flow weighted average limit under Effluent Limitations.

A. 4. shall be determined by the arithmetic mean of the last twelve monthly averages.

E. Time Interval.

Compliance determinations shall be based on available analyses for the time interval associated with the effluent limitation. Where only one sample analysis is available in a specified time interval (e.g., monthly or weekly average), that sample shall serve to characterize the discharge for the entire interval. If quarterly sample results show noncompliance with the average monthly limit and that sample result is used for compliance determinations for each month of the quarter, then three separate violations of the average monthly limit shall be deemed to have occurred.

F. For Non-Priority Pollutants.

The discharge shall be considered to be in compliance with an effluent limitation, which is less than or equal to the PQL specified in Attachment D of M&RP No. R8-2005-44 if the arithmetic mean of all test results for the monitoring period is less than the constituent effluent limitation. Analytical results that are less than the specified PQL shall be assigned a value of zero.

ATTACHMENT A – DEFINITIONS

Average Monthly Effluent Limitation (AMEL): the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Effluent Limitation (AWEL): the highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

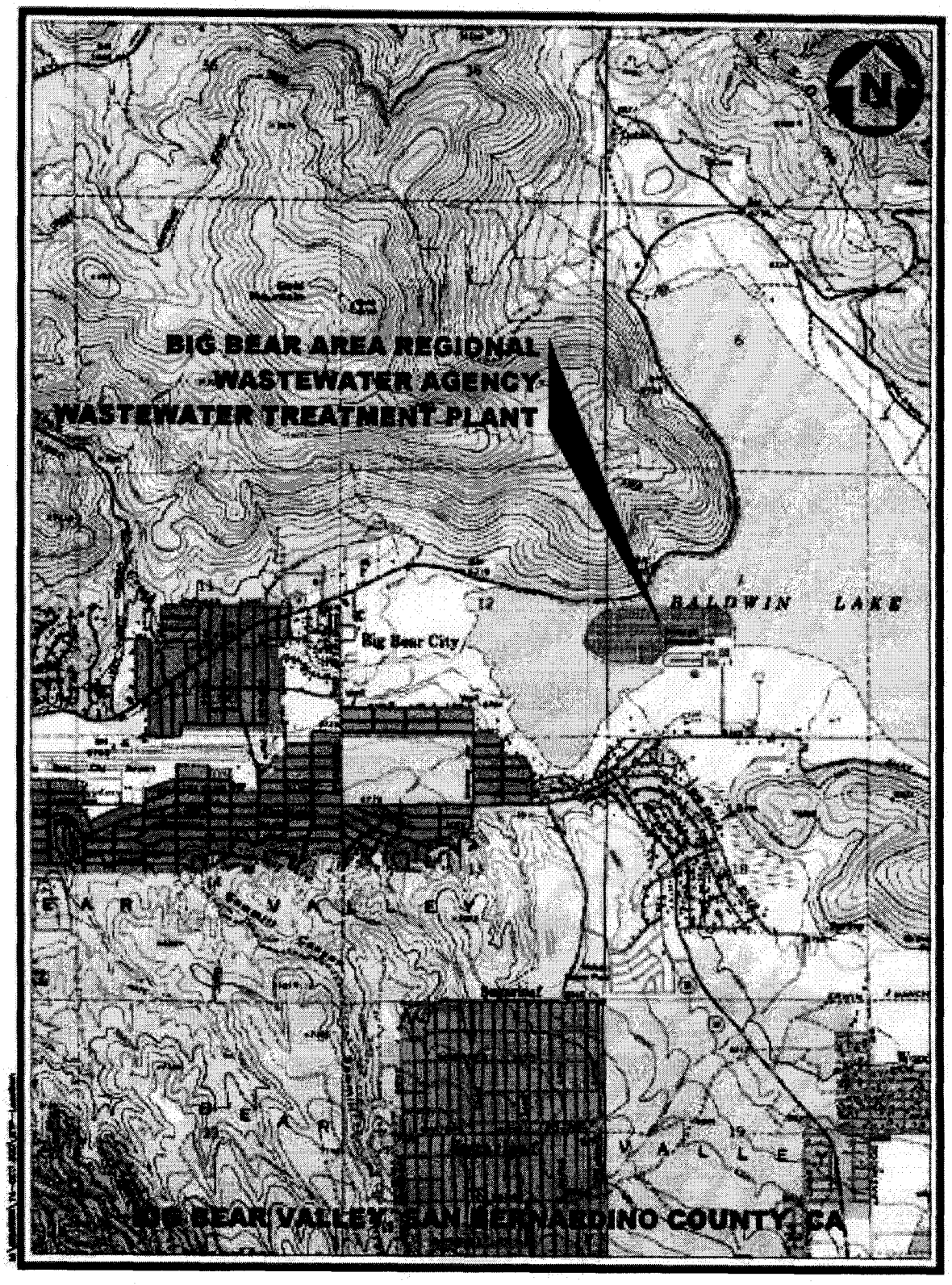
Daily Discharge: Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the Order), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of one day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

Maximum Daily Effluent Limitation (MDEL): the highest allowable daily discharge of a pollutant.

ATTACHMENT B – TOPOGRAPHIC MAP

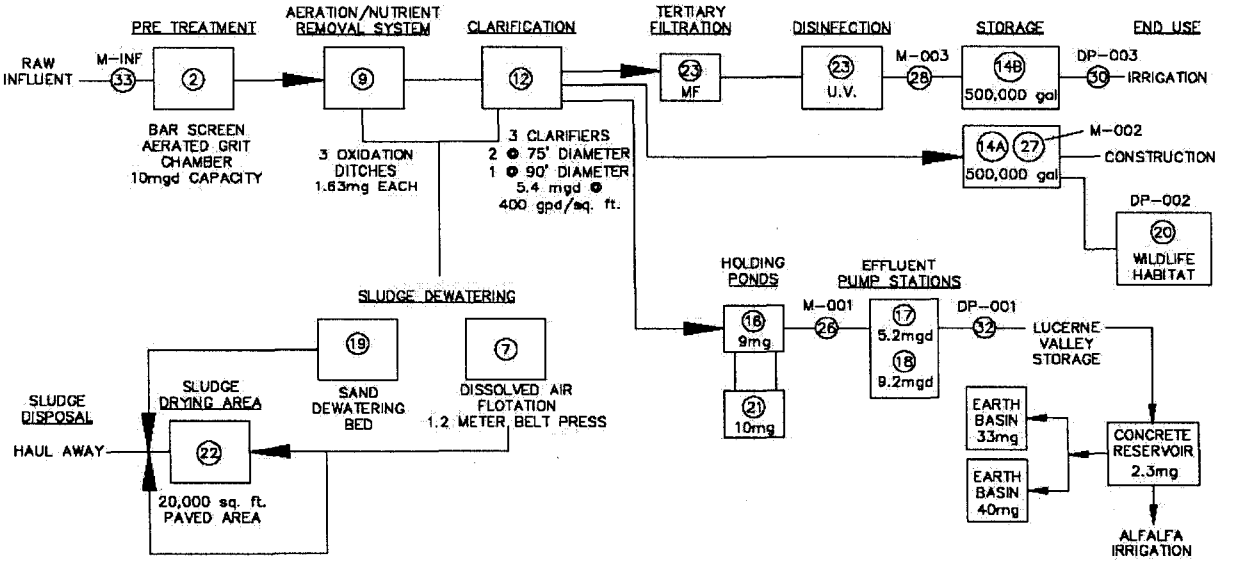


ATTACHMENT C – FLOW SCHEMATIC

FACILITY DESIGNATION

(2) HEADWORKS BUILDING
(7) SLUDGE BUILDING
(9) OXIDATION DITCH/NUTRIENT REMOVAL SYSTEM
(12) CLARIFIER
(14) BALANCING CHAMBERS/RECYCLED WATER STORAGE TANKS
(16) HORSESHOE STORAGE POND
(17) MAIN EFFLUENT PUMP, WAS AND RAS PUMP STATION
(18) AUXILIARY EFFLUENT PUMP STATION
(19) SLUDGE DEWATERING BEDS
(20) WILDLIFE HABITAT AREA
(21) EMERGENCY HOLDING POND
(22) PAVED SLUDGE DRYING AREA
(23) FILTERS/UV OR CHLORINATION FACILITY
(26) SAMPLING/MONITORING LOCATION M001 -- BOD/TSS
(27) SAMPLING/MONITORING LOCATION M002 -- COLIFORM
(28) SAMPLING/MONITORING LOCATION M003 -- COLIFORM/TURBIDITY
(30) DISCHARGE POINT 003
(32) DISCHARGE POINT 001
(33) SAMPLING/MONITORING LOCATION M-INF

TREATMENT PROCESS FLOW SCHEMATIC



BIG BEAR AREA REGIONAL WASTEWATER AGENCY

PROCESS FLOW DIAGRAM

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ATTACHMENT D– MONITORING AND REPORTING PROGRAM (MRP)

CWC sections 13267 and 13383 authorize the Regional Water Quality Control Board (RWQCB) to require technical and monitoring reports. This MRP establishes monitoring and reporting requirements, that implement California regulations.

I. GENERAL MONITORING PROVISIONS

A. All sampling and sample preservation shall be in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association).

B. Chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services or at laboratories approved by the Regional Board's Executive Officer.

C. The discharger shall have and implement an acceptable written quality assurance (QA) plan for laboratory analyses. Duplicate chemical analyses must be conducted on a minimum of ten percent (10%) of the samples, or at least one sample per month, whichever is greater. A similar frequency shall be maintained for analyzing spiked samples.

D. The flow measurement system shall be calibrated at least once per year or more frequently, to ensure continued accuracy.

E. All monitoring instruments and devices used by the discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy. In the event that continuous monitoring equipment is out of service for greater than a 24-hour period, the discharger shall obtain a representative grab sample each day the equipment is out of service. The discharger shall correct the cause(s) of failure of the continuous monitoring equipment as soon as practicable. In its monitoring report, the discharger shall specify the period(s) during which the equipment was out of service and if the problem has not been corrected, shall identify the steps which the discharger is taking or proposes to take to bring the equipment back into service and the schedule for these actions.

F. Monitoring and reporting shall be in accordance with the following:

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
2. The monitoring and reporting of influent, effluent, and sludge shall be done more frequently as necessary to maintain compliance with this Order and or as specified in this Order.
3. Whenever the discharger monitors any pollutant more frequently than is required by this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the discharge monitoring report specified by the Executive Officer.
4. A "grab" sample is defined as any individual sample collected in less than 15 minutes.

5. A composite sample is defined as a combination of no fewer than eight individual grab samples obtained over the specified sampling period. The volume of each individual grab sample shall be proportional to the discharge flow rate at the time of sampling. The compositing period shall equal the specific sampling period, or 24 hours, if no period is specified.
6. 24-hour composite samples shall be collected continuously during a 24-hour operation of the facility.
7. Daily samples shall be collected on each day of the week.
8. Monthly samples shall be collected on any representative day of each month.
9. Quarterly samples shall be collected by any representative day of March, June, September, and December.
10. Annual priority pollutant samples shall be collected in December.

II. MONITORING LOCATIONS

The Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order:

Discharge Point Name	Monitoring Location Name	Monitoring Location Description
--	M-INF #33	Influent line before Barscreen
001	M-001 #26	Junction Manhole after Holding Ponds
002	M-002 #27	South Balancing Chamber, Pond 14A
003	M-003 #28	Effluent line before pond 14B
--	S-001	Water Supply

III. INFLUENT MONITORING REQUIREMENTS

Monitoring Location M-INF

The Discharger shall monitor the **influent to the facility** at **Monitoring Location M-INF** as follows:

Parameter	Units	Sample Type	Minimum Sampling Frequency
Flow	MGD	Recorder	Continuous
Biochemical Oxygen Demand$_5$	mg/l	24-Hour Composite	Monthly
Suspended Solids	mg/l	24-Hour Composite	Monthly

IV. EFFLUENT MONITORING REQUIREMENTS

Monitoring Locations at M-001, M-002, and M-003

The Discharger shall monitor the effluent at the Monitoring Locations listed above for the following constituents:

Parameter	Units	Sample type	Minimum Sampling Frequency	Sample Location
Flow[1]	MGD	Recorder/totalizer	Continuous	-----
Turbidity[2]	NTU	Recorder	Continuous	M-003
pH	pH unit	Recorder	Continuous	M-001
pH[3]	pH unit	Grab	Daily	M-002 or M-003
Specific Conductivity	µmhos	Grab	Daily	M-001; M-002[3]; M-003[3]
Total Coliform Organisms[3]	MPN per 100m/l	Grab	Daily	M-002 M-003
Biochemical Oxygen Demand$_5$	mg/l	24-Hour composite	Weekly	M-001[4] M-003[5]
Total Suspended Solids	mg/l	24-Hour composite	Weekly	M-001[4] M-003[5]
Total Inorganic Nitrogen	mg/l	24-Hour composite	Monthly	M-001
Total Dissolved Solids[3]	mg/l	24-Hour composite	Monthly	M-002; M-003
Hardness	mg/l	24-Hour composite	Quarterly	M-001
Sodium	mg/l	24-Hour composite	Quarterly	M-001
Chloride	mg/l	24-Hour composite	Quarterly	M-001
Sulfate	mg/l	24-Hour composite	Quarterly	M-001
Total Phosphorous	mg/l	24-Hour composite	Monthly	M-001
EPA Priority Pollutants Metals *(items #1-#13)* see attachment D-11	µg/l		Annually	M-001
Remaining EPA Priority Pollutants *(Volatile Organics items #17-#55)*-see attachment D-11	µg/l	Grab	Annually	M-001

1 The daily flow to each discharge point shall be recorded.
2 Whenever recycled water is discharged or used at Discharge Serial No. 003.
3 Whenever recycled water is discharged or used at Discharge Serial No. 002 *or* 003.
4 The weekly 24-Hour composite sample for BOD_5 and TSS taken from sample location M-001 shall be representative of Serial Discharge No. 001 and 002.
5 The weekly 24-Hour composite sample for BOD_5 and TSS taken from sample location M-003 whenever recycled water is discharged or used at Serial Discharge No. 003.

V. RECLAMATION MONITORING REQUIREMENTS

Whenever recycled water is supplied to a user, the volume and type of recycled water, the user of recycled water, the locations of those sites including the names of the groundwater management zone underlying the recycled water use sites, type of use (e.g. irrigation, industrial, etc) and the dates at which water is supplied shall be recorded. A summary report of water use by groundwater management zones shall be submitted quarterly. This report shall be included in the annual report.

VI. OTHER MONITORING REQUIREMENTS

A. WATER SUPPLY MONITORING

1. Once every three years, a sample of each source of the water supplied to the sewered area shall be obtained and analyzed for the following constituents:

Specific Conductance	Total Dissolved Solids	pH
Sodium	Total Hardness	
Chloride	Nitrate	

2. All of the above constituents shall be expressed in "mg/l" except specific conductance and pH, which shall be expressed in "micromhos/cm" and "pH units," respectively.

3. Monthly reports shall be submitted stating the amount (in percentage or acre-feet) supplied to the sewered area from each source of water and the resulting flow-weighted water supply quality for total dissolved solids, chloride, nitrate, sodium, and total hardness.

B. BIOSOLIDS MONITORING

The discharger shall maintain a permanent log of solids hauled away from the treatment facilities for use/disposal elsewhere, including the date hauled, the volume or weight (in dry tons), type (screening, grit), and destination. This information shall be reported annually.

VII. REPORTING REQUIREMENTS

A. Reporting Requirements

1. All analytical data shall be reported with method detection limit[1] (MDLs) and with identification of either practical quantitation levels (PQLs[2]) or limits of quantitation (LOQs).

2. Laboratory data for effluent samples must quantify each constituent down to the PQLs specified in Attachment "D-9" or to lower PQLs achieved by the discharger. Any internal quality control data associated with the sample must be reported when requested by the Executive Officer. The Regional Board will reject the quantified laboratory data if quality control data is unavailable or unacceptable.

3. Discharge monitoring data shall be submitted in a format acceptable by the Regional Board. Specific reporting format may include preprinted forms and/or electronic media. The results of all monitoring required by this Order shall be reported to the Regional Board, and shall be submitted in such a format as to allow direct comparison with the limitations and requirements of this order.

4. The discharger shall tabulate the monitoring data to clearly illustrate compliance and/or noncompliance with the requirements of the Order.

5. For every item of monitoring data where the requirements are not met, the monitoring report shall include a statement discussing the reasons for noncompliance, and of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time, and an estimate of the date when the discharger will be in compliance. The discharger shall notify the Regional Board by letter when compliance with the time schedule has been achieved.

6. The reports for December shall include a roster of plant personnel, including job titles, duties, and level of State certification for each individual.

7. By March 1 of each year, the discharger shall submit an annual report to the Regional Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the discharger shall discuss the compliance record and the corrective actions taken or planned that may be needed to bring the discharge into full compliance with the waste discharge requirements. The annual report shall include a summary of the quality assurance (QA) activities for the previous year.

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[1] The standardized test procedure to be used to determine the method detection limit (MDL) is given at Appendix B, 'Definition and Procedure for the Determination of the Method Detection Limit' of 40 CFR 136.

[2] PQL is the lowest concentration of a substance which can be determined within ± 20 percent of the true concentration by 75 percent of the analytical laboratories tested in a performance evaluation study. Alternatively, if performance data are not available, the PQL is the method detection limit (MDL) x 5 for carcinogens and MDL x 10 for noncarcinogens.

8. The discharger shall assure that records of all monitoring information are maintained and accessible for a period of at least five years from the date of the sample, report, or application. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or by the request of the Regional Board at any time. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The individual(s) who performed the sampling, and/or measurements;

   c. The laboratory which performed the analyses;

   d. The date(s) analyses were performed;

   e. The individual(s) who performed the analyses;

   f. The analytical techniques or methods used, including any modification to those methods;

   g. All sampling and analytical results, including

      i. units of measurement used;
      ii. minimum reporting limit for the analysis (minimum level, practical quantitation level (PQL));
      iii. results less than the reporting limit but above the method detection limit (MDL);
      iv. data qualifiers and a description of the qualifiers;
      v. quality control test results (and a written copy of the laboratory quality assurance plan);
      vi. dilution factors, if used; and
      vii. sample matrix type.

   h. All monitoring equipment calibration and maintenance records;

   i. All original strip charts from continuous monitoring devices;

   j. All data used to complete the application for this Order; and,

   k. Copies of all reports required by this Order.

   l. Electronic data and information generated by the Supervisory Control And Data Acquisition (SCADA) System.

9. All reports and/or information submitted to the Regional Board shall be signed by a responsible officer or duly authorized representative of the discharger and shall be submitted under penalty of perjury.

10. The discharger, unless otherwise specified elsewhere in this M&RP, shall deliver a copy of each monitoring report in the appropriate format to:

California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3348

B. Self Monitoring Reports (SMRs)

1. At any time during the term of this Order, the State or Regional Water Board may notify the Discharger to electronically submit self-monitoring reports. Until such notification is given, the Discharger shall submit self-monitoring reports in accordance with the requirements described below.

2. The Discharger shall submit quarterly and annual Self Monitoring Reports including the results of all required monitoring using USEPA-approved test methods or other test methods specified in this Order. Quarterly reports shall be due on May 1, August 1, November 1, and February 1 following each calendar quarter; Annual reports shall be due on March 1 following each calendar year.

3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule:

Sampling Frequency	Monitoring Period Begins On...	Monitoring Period	SMR Due Date
Continuous	June 24, 2005	All	May 1 August 1 November 1 February 1
1 / day	June 24, 2005	Midnight through 11:59 PM or any 24-hour period that reasonably represents a calendar day for purposes of sampling.	"
1/ week	Sunday following June 24, 2005 or on June 24, 2005 if on a Sunday	Sunday through Saturday	"
1 / month	First day of calendar month following June 24, 2005	1st day of calendar month through last day of calendar month	"
1 / quarter	Closest of January 1, April 1, July 1, or October 1 following June 24, 2005	January 1 through March 31 April 1 through June 30 July 1 through September 30 October 1 through December 31	May 1 August 1 November 1 February 1
1 / year	January 1 following June 24, 2005	January 1 through December 31	March 1

5. The Discharger shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations.

6. The Discharger shall attach a cover letter to the SMR. The information contained in the cover letter shall clearly identify violations of the WDRs; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation.

7. SMRs must be submitted to the Regional Water Board, signed and certified to the address listed below:

Gerard J. Thibeault, Executive Officer
California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3348

VIII. PQL and EPA PPL

PRACTICAL QUANTITATION LEVELS FOR COMPLIANCE DETERMINATION			
	Constituent	**RL, µg/l**	**Analysis Method**
1	Arsenic	7.5	GF/AA
2	Barium	20	ICP/GFAA
3	Cadmium	15	ICP
4	Chromium (VI)	15.0	ICP
5	Cobalt	10.0	GF/AA
6	Copper	19.0	GF/ICP
7	Cyanide	50.0	335.2/335.3
8	Iron	100.0	ICP
9	Lead	26.0	GF/AA
10	Manganese	20.0	ICP
11	Mercury	0.5	CV/AA
12	Nickel	50.0	ICP
13	Selenium	14.0	GF/HYDRIDE GENERATION
14	Silver	16.0	ICP
15	Zinc	20	ICP
16	1,2 - Dichlorobenzene	5.0	601/602/624
17	1,3 - Dichlorobenzene	5.0	601
18	1,4 - Dichlorobenzene	5.0	601
18	2,4 - Dichlorophenol	10.0	625/604
20	4 - Chloro -3-methylphenol	10.0	625/604
21	Aldrin	0.04	608
22	Benzene	1.0	602/624
23	Chlordane	0.30	608
24	Chloroform	5.0	601/624
25	DDT	0.10	608
26	Dichloromethane	5.0	601/624
27	Dieldrin	0.10	608
28	Fluorantene	10.0	625/610
29	Endosulfan	0.50	608
30	Endrin	0.10	608
31	Halomethanes	5.0	601/624
32	Heptachlor	0.03	608
33	Hepthachlor Epoxide	0.05	608
34	Hexachlorobenzene	10.0	625
35	Hexachlorocyclohexane		
	Alpha	0.03	608
	Beta	0.03	608
	Gamma	0.03	608
36	PAH's	10.0	625/610
37	PCB	1.0	608
38	Pentachlorophenol	10.0	625/604
39	Phenol	10.0	625/604
40	TCDD Equivalent	0.05	8280
41	Toluene	1.0	602/625
42	Toxaphene	2.0	608
43	Tributyltin	0.02	GC
44	2,4,6-Trichlorophenol	10.0	625/604

EPA PRIORITY POLLUTANT LIST

Metals		Acid Extractibles		Base/Neutral Extractibles (continuation)	
1.	Antimony	45.	2-Chlorophenol	91.	Hexachloroethane
2.	Arsenic	46.	2,4-Dichlorophenol	92.	Indeno (1,2,3-cd) Pyrene
3.	Beryllium	47.	2,4-Dimethylphenol	93.	Isophorone
4.	Cadmium	48.	2-Methyl-4,6-Dinitrophenol	94.	Naphthalene
5a.	Chromium (III)	49.	2,4-Dinitrophenol	95.	Nitrobenzene
5b.	Chromium (VI)	50.	2-Nitrophenol	96.	N-Nitrosodimethylamine
6.	Copper	51.	4-Nitrophenol	97.	N-Nitrosodi-N-Propylamine
7.	Lead	52.	3-Methyl-4-Chlorophenol	98.	N-Nitrosodiphenylamine
8.	Mercury	53.	Pentachlorophenol	99.	Phenanthrene
9.	Nickel	54.	Phenol	100.	Pyrene
10.	Selenium	55.	2, 4, 6 – Trichlorophenol	101.	1,2,4-Trichlorobenzene
11.	Silver	**Base/Neutral Extractibles**		**Pesticides**	
12.	Thallium	56.	Acenaphthene	102.	Aldrin
13.	Zinc	57.	Acenaphthylene	103.	Alpha BHC
Miscellaneous		58.	Anthracene	104.	Beta BHC
14.	Cyanide	59.	Benzidine	105.	Delta BHC
15.	Asbestos (not required unless requested)	60.	Benzo (a) Anthracene	106.	Gamma BHC
16.	2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)	61.	Benzo (a) Pyrene	107.	Chlordane
Volatile Organics		62.	Benzo (b) Fluoranthene	108.	4, 4' - DDT
17.	Acrolein	63.	Benzo (g,h,i) Perylene	109.	4, 4' - DDE
18.	Acrylonitrile	64.	Benzo (k) Fluoranthene	110.	4, 4' - DDD
19.	Benzene	65.	Bis (2-Chloroethoxy) Methane	111.	Dieldrin
20.	Bromoform	66.	Bis (2-Chloroethyl) Ether	112.	Alpha Endosulfan
21.	Carbon Tetrachloride	67.	Bis (2-Chloroisopropyl) Ether	113.	Beta Endosulfan
22.	Chlorobenzene	68.	Bis (2-Ethylhexyl) Phthalate	114.	Endosulfan Sulfate
23.	Chlorodibromomethane	69.	4-Bromophenyl Phenyl Ether	115.	Endrin
24.	Chloroethane	70.	Butylbenzyl Phthalate	116.	Endrin Aldehyde
25.	2-Chloroethyl Vinyl Ether	71.	2-Chloronaphthalene	117.	Heptachlor
26.	Chloroform	72.	4-Chlorophenyl Phenyl Ether	118.	Heptachlor Epoxide
27.	Dichlorobromomethane	73.	Chrysene	119.	PCB 1016
28.	1,1-Dichloroethane	74.	Dibenzo (a,h) Anthracene	120.	PCB 1221
29.	1,2-Dichloroethane	75.	1,2-Dichlorobenzene	121.	PCB 1232
30.	1,1-Dichloroethylene	76.	1,3-Dichlorobenzene	122.	PCB 1242
31.	1,2-Dichloropropane	77.	1,4-Dichlorobenzene	123.	PCB 1248
32.	1,3-Dichloropropylene	78.	3,3'-Dichlorobenzidine	124.	PCB 1254
33.	Ethylbenzene	79.	Diethyl Phthalate	125.	PCB 1260
34.	Methyl Bromide	80.	Dimethyl Phthalate	126.	Toxaphene
35.	Methyl Chloride	81.	Di-n-Butyl Phthalate		
36.	Methylene Chloride	82.	2,4-Dinitrotoluene		
37.	1,1,2,2-Tetrachloroethane	83.	2-6-Dinitrotoluene		
38.	Tetrachloroethylene	84.	Di-n-Octyl Phthalate		
39.	Toluene	85.	1,2-Dipenylhydrazine		
40.	1,2-Trans-Dichloroethylene	86.	Fluoranthene		
41.	1,1,1-Trichloroethane	87.	Fluorene		
42.	1,1,2-Trichloroethane	88.	Hexachlorobenzene		
43.	Trichloroethylene	89.	Hexachlorobutadiene		
44.	Vinyl Chloride	90.	Hexachlorocyclopentadiene		

Note: All laboratory analyses shall be performed in accordance with test procedures under 40 CFR 136 (latest edition) and shall meet the minimum levels specified in Appendix 4 of the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

Revised: 1/12/2005

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ATTACHMENT E – FACT SHEET

As described in Section II of this Order, this Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

I. ORDER INFORMATION

The following table summarizes administrative information related to the facility.

WDID	**8 360108001**
Discharger	**Big Bear Area Regional Wastewater Agency**
Name of Facility	**Regional Treatment Plant, Big Bear City**
Facility Address	**122 Palomino Drive**
	Big Bear City, CA 92314
	San Bernardino
Facility Contact, Title and Phone	**Joseph Hanford, Interim Plant Superintendent (909) 584-4018**
Authorized Person to Sign and Submit Reports	**Steven Schindler, General Manager, (909) 584-4018 Joseph Hanford, Interim Plant Superintendent**
Mailing Address	**P. O. BOX 517, 122 Palomino Drive, Big Bear City, Ca 92314**
Billing Address	**SAME**
Type of Facility	**POTW**
Major or Minor Facility	**Major**
Threat to Water Quality	**2**
Complexity	**B**
Pretreatment Program	**N**
Reclamation Requirements	**Producer/User**
Facility Permitted Flow	**4.89 mgd**
Facility Design Flow	**4.89 mgd**
Watershed	**Big Bear Lake**
Receiving Water	**pond in the Baldwin lake, Big Bear Valley Groundwater management zone**
Receiving Water Type	**surface water in the state and groundwater**

A. Big Bear Area Regional Wastewater Agency (hereinafter Discharger) is the owner and operator of Regional Treatment Plant (hereinafter Facility), a POTW.

B. The Facility discharges wastewater to ponds and irrigation and construction sites that overlie the Lucerne Hydrologic Unit (Region 7) or the Big Bear Valley groundwater management zone. The discharges are currently regulated by Order No. 00-12, which was adopted on February 25, 2000 and expired on February 1, 2005.

C. The Discharger filed a report of waste discharge and submitted an application for renewal of its Waste Discharge Requirements (WDRs) on August 25, 2004. Supplemental Information was requested on January 14, 2005 and following in February 2005. Information was received on January and February 2005. A site visit was conducted on April 11, 2005, to observe operations and collect additional data to develop limitations and conditions.

II. FACILITY DESCRIPTION

A. Description of Wastewater and Biosolids Treatment or Controls

Big Bear Area Regional Wastewater Agency (BBARWA) is a joint powers authority consisting of Big Bear City Community Services District, City of Big Bear Lake and San Bernardino County Service Area 53-B. BBARWA owns and operates a Regional Treatment Plant (RTP) located at 122 Palomino Drive, Big Bear City, in the SW¼ of Section 7, T2N, R2E, SBB&N. The RTP is adjacent to the Baldwin Lake and protected by a dike. The RTP is located at elevation of approximately 6714 feet, which is 3 feet above the estimated 100-year flood elevation of the Baldwin Lake.

Discharges from the facility are currently regulated under Order No. 00-12, NPDES No. CA80000344. That Order expired on February 1, 2005 and was not administratively extended. On August 26, 2004, BBARWA submitted a Report of Waste Discharge for the renewal of waste discharge requirements for BBARWA's Regional Treatment Plant (RTP).

The RTP treats commercial and domestic wastes from the City of Big Bear Lake, Big Bear City Community Services District and County Service Area 53-B. In 2003, the total equivalent dwelling units (EDUs) in the service area were 23,800 units with an estimated population of 59,500 on full or part time basis.

The RTP is designed to secondarily treat up to 4.89 million gallons per day (mgd) of wastewater and tertiary treat up to 1.0 mgd of wastewater. The RTP currently treats an annual average flow at 2.2 mgd. Of the effluent flow, up to 0.07 mgd is for recycled water reuse in the Big Bear area and up to 2 mgd is used for irrigation of alfalfa in Lucerne Valley.

The RTP treatment system consists of the following:

1. Preliminary treatment consists of bar screens and an aerated grit chamber;
2. Secondary treatment utilizes oxidation ditches, secondary clarifiers, and symbio process for nutrient removal;
3. Tertiary treatment consists of micro-filtration and/or 6 gpm reverse osmosis;
4. Disinfection of secondary treated effluent is done by chlorination while tertiary treated effluent is disinfected through ultraviolet light;
5. Sludge treatment system consists of sand dewatering bed, dissolved air flotation unit and belt filter press; sludge is hauled away. The discharger added a 20,000 square foot asphalt bed for further sludge drying.

B. Discharge Points and Receiving Waters

As previously noted, the RTP currently discharges 2.2 mgd of secondary treated wastewater and 0.03 mgd tertiary treated wastewater. The treated wastewater is either discharged to one or more of the following Discharge Points:

001. Secondary treated, but non-disinfected effluent is discharged to effluent storage ponds No. 16 and 21 prior to discharged to the pipeline to Lucerne Valley[1], where the effluent is used for irrigation of fodder, fiber and seed crops. If there is no demand of water for irrigation, the recycled water is stored in two earth basins for evaporation/percolation disposal in Lucerne Valley.

002. Secondary treated and chlorinated effluent is stored in pond No. 14A. Stored water is hauled by tanker truck for delivery to individual recycled water users at construction sites.

BBARWA proposes to convert its existing disposal pond located in the Baldwin Lake into a Wildlife Habitat Area (WHA). This area is surrounded by dike separating it from the remainder of the Baldwin Lake. The top of the dike has a general elevation of 6699 to 6700 feet, about 4 feet above lake bottom. When water in the Baldwin Lake exceeds 6700 feet elevation, the diked area is inundated. Secondary treated and chlorinated effluent is proposed for reuse at the WHA when there is little or no water in Baldwin Lake. During wet months, there would be no treated effluent delivered to the proposed WHA.

003. Tertiary treated and UV disinfected wastewater is stored in pond No. 14B. Stored wastewater is trucked or piped to individual recycled water users for landscape irrigation.

The Discharger is authorized to discharge from the following discharge points as set forth below:

Discharge Point	Effluent Description	Discharge Point Latitude	Discharge Point Longitude	Receiving Water	Disposal Site	Recycling Reuse
001	Secondary effluent without disinfection	34 ° 26' 20" N	116 ° 51' 20" W	Lucerne Hydrologic Unit	Storage Ponds in Lucerne Valley	Irrigation in Lucerne Valley
002	Secondary effluent with disinfection	34 ° 16' 10" N	116 ° 49' 00" W	State surface water: a pond in Baldwin Lake; Big Bear Valley groundwater management zone	--	construction and wildlife habitat
003	Tertiary effluent with disinfection	34 ° 16' 10" N	116 ° 49' 00" W	Big Bear Valley groundwater management zone	--	Irrigation

[1] The Colorado River Basin Regional Water Quality Control Board (Region 7) has issued waste discharge requirements for the use of the recycled wastewater in the Lucerne Valley.

The facility location map is shown on Attachment "B".

The flow diagram for the wastewater treatment process is shown on Attachment "C".

C. Stormwater Runoff from this Facility

Stormwater runoff from the RTP discharges into a flood zone, which is located at the east side of the plant. The flood zone is about 630 feet long and 60 to 80 feet wide. The flood zone has a holding capacity of about 75,000 gallons. In heavy storm seasons, there is the possibility of overflow from the flooding zone into offsite surface waters.

D. Summary of Existing Requirements and Self-Monitoring Report (SMR) Data

Effluent limitations/Discharge Specifications contained in the current Order for discharges from **Discharge Points 001 and 002, and** Monitoring Location 001 and 002, and representative monitoring data from the term of the previous Order are as follows:

Parameter (units)	Effluent Limitation			Monitoring Data (From April 1, 2002 – To March 31, 2005)		
	Average Monthly	Average Weekly	Maximum Daily	Highest Average Monthly Discharge	Highest Average Weekly Discharge	Highest Daily Discharge
BOD_5 (mg/l)	30	45	45	16	42	42
Suspended Solids (mg/l)	30	45	45	17	38	38
Electroconductivity	NA	NA	NA	745		1157
pH Daily Average Continuous Recorder (SU)	Daily Minimum 6.5	NA	8.5	7.92		8.20
TDS (mg/l)	550[(1)]	NA	NA	436[(1)]	481	481
Total Inorganic Nitrogen (mg/l)	10[(2)]	NA	NA	5.8	26.5	26.5
Chloride(mg/l)	NA	NA	NA	52	60	60
Iron (mg/l)	NA	NA	NA	0.35		0.35
Manganese (mg/l)	NA	NA	NA	0.47		0.47
Sodium (mg/l)	NA	NA	NA	120		120
Sulfate(mg/l)	NA	NA	NA	50	55	55
Total Phosphorus (mg/l)	NA	NA	NA	3.6		3.6
Coliform MPN (Construction Water)	NA	NA	240[(3)]			>1600
Coliform MPN (Irrigation Water)	NA	NA	240[(3)]			70
Fluoride (mg/l)	NA	NA	NA	0.89	0.99	0.99
Nitrate-N (mg/l)	NA	NA	NA		10.7	10.7

(1) - TDS shall not exceed 12-month flow weighted average concentration of 550mg/l and shall not exceed

12-month average TDS of water supply by 250mg/l.
(2) – Discharge shall not exceed 12-month flow weighted average of 10 mg/l total inorganic nitrogen.
(3) – Discharge shall not exceed 240 MPN for 2 consecutive days.

Parameter (units)	Effluent Limitation			Monitoring Data (From April 1, 2002 – To March 31, 2005)		
	Average Monthly	Average Weekly	Maximum Daily	Highest Average Monthly Discharge	Highest Average Weekly Discharge	Highest Daily Discharge
Antimony (ug/l)	NA	NA	NA	<6.0		
Arsenic (ug/l)	NA	NA	NA	<2.0		
Beryllium (ug/l)	NA	NA	NA	<1.0		
Boron (ug/l)	NA	NA	NA	270		
Cadmium (ug/l)	NA	NA	NA	<1.0		
Chromium-Total Cr (ug/l)	NA	NA	NA	<10		
Lead (ug/l)	NA	NA	NA	<5.0		
Mercury (ug/l)	NA	NA	NA	<1.0		
Nickel (ug/l)	NA	NA	NA	<10		
Selenium (ug/l)	NA	NA	NA	<5.0		
Silver (ug/l)	NA	NA	NA	<10		
Thallium (ug/l)	NA	NA	NA	<1.0		
Zinc (ug/l)	NA	NA	NA	96		
Copper (ug/l)	NA	NA	NA	<50		
VOC's EPA 601/602/603 (ug/l)	NA	NA	NA	ND		

E. Compliance Summary

Data review indicated that wastewater discharges from this treatment plant were in full compliance with waste discharge requirements of Order No. 00-12.

F. Planned Changes

The discharger eliminated two existing surface water discharge outfalls: the East end of Stanfield Marsh Outfall 002 and the Baldwin Lake Stickleback Habitat Outfall 003.

The Discharger proposes to deliver ***disinfected secondary treated wastewater*** to the discharger's existing wastewater disposal pond in the Baldwin Lake for the purpose of converting the pond into a Wildlife Habitat Area (WHA) when Baldwin Lake is dry or has little water in it.

III. APPLICABLE PLANS, POLICIES, AND REGULATIONS

Based on the U.S. Army Corps of Engineers, the discharger's existing disposal pond in the Baldwin Lake is not considered waters of the U.S. Consequently, this Order is issued as a Waste Discharge and Producer/User Water Recycling Requirements.

The requirements contained in the proposed Order are based on the requirements and authorities described in this section.

A. Legal Authorities

This Order is issued pursuant to Chapter 5.5, Division 7 of the California Water Code (CWC). This Order serves as Waste Discharge Requirements (WDRs) pursuant to Article 4, Chapter 4 of the CWC for discharges that are not subject to regulation under CWA section 402.

B. California Environmental Quality Act (CEQA)

The project involves the update of waste discharge requirements for an existing facility and, as such, is exempt from the California Environmental Quality Act (Public Resources Code, Section 21100 et. seq.) in accordance with Section 15301, Chapter 3, Title 14, California Code of Regulations.

C. State Regulations, Policies, and Plans

1. **Water Quality Control Plans.**
   The Regional Water Board adopted a Water Quality Control Plan for the Santa Ana River Region (hereinafter Basin Plan) that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. More recently, the Basin Plan was amended significantly to incorporate revised boundaries for groundwater subbasins, now termed "management zones", new nitrate-nitrogen and TDS objectives for the new management zones, and new nitrogen and TDS management strategies applicable to both surface and ground waters. This Basin Plan Amendment was adopted by the Regional Board on January 22, 2004. The State Water Resources Control Board and Office of Administrative Law (OAL) approved the Amendment on September 30, 2004 and December 23, 2004, respectively. Beneficial uses applicable to Big Bear Valley Groundwater Management Zone are as follows:

Discharge Point	Receiving Water Name	Beneficial Use(s)
001	Lucerne Hydrologic Unit	Based on Region 7's Basin Plan. 1. Municipal supply 2. Industrial supply 3. Agricultural supply

Discharge Point	Receiving Water Name	Beneficial Use(s)
002	A pond in Baldwin Lake; and Big Bear Valley groundwater management zone	Beneficial Uses for Baldwin Lake: Intermittent: 1. Water contact recreation (REC-1), 2. Non-contact water recreation (REC-2), 3. Warm freshwater habitat (WARM), 4. Cold freshwater habitat (COLD), 5. Preservation of biological habitats of special significance (BIOL), 6. Wildlife habitat (WILD), and 7. Rare, threatened or endangered species (RARE). Beneficial Uses for groundwater management zone: Present or Potential: 1. Municipal and domestic supply, and 2. industrial service supply. .
003	Big Bear Valley groundwater management zone	Beneficial Uses for ground water management zone: Present or potential: Municipal and domestic supply, industrial service supply.

2. **Antidegradation Policy.** State Water Board Resolution No. 68-16 requires that existing water quality is maintained unless degradation is justified based on specific findings. The permitted discharge is consistent with the antidegradation provision of State Water Board Resolution No. 68-16.

3. **Monitoring and Reporting Requirements**. Sections 13267 and 13383 of the CWC authorize the Regional Water Boards to require technical and monitoring reports. The Monitoring and Reporting Program (MRP) establishes monitoring and reporting requirements to implement federal and State requirements. This MRP is provided in Attachment D.

D. Industrial Stormwater Requirements

Pursuant to Section 402(p) of Clean Water Act and Title 40 of the Code of Federal Regulations (CFR) Part 122, 123, and 124, the State Water Resources Control Board adopted general NPDES permits to regulate storm water discharges associated with industrial activities (State Board Order No. 97-03-DWQ) adopted on April 17, 1997. The discharger shall submit notice of intent to be covered under this general permit and develop and implement Storm Water Pollution Prevention Plans to comply with the general NPDES permit.

IV. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Technology-Based Effluent Limitations

1. Scope and Authority

Regulations promulgated in 40 CFR §125.3(a)(1) require technology-based effluent limitations for municipal Dischargers to be placed in waste discharge requirements based on Secondary Treatment Standards or Equivalent to Secondary Treatment Standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for POTWs [defined in Section 304(d)(1)]. Section 301(b)(1)(B) of that Act requires that such treatment works must, as a minimum, meet effluent limitations based on secondary treatment as defined by the USEPA Administrator.

Based on this statutory requirement, USEPA developed secondary treatment regulations, which are specified in 40 CFR 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

2. Applicable Technology-Based Effluent Limitations

Summary of Technology-based Effluent Limitations
For Secondary Treated Effluent Discharge Points for Discharge Point 001 and 002

Parameter	Units	Effluent Limitations	
		Average Monthly	Average Weekly
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	30	45
	lbs/day[2]	1,223	1,835
Total Suspended Solids	mg/L	30	45
	lbs/day[2]	1,223	1,835

Summary of Technology-based Effluent Limitations
For Tertiary Treated Effluent Discharge Points for Discharge Point 003

FOR DISCHARGE SERIAL NO. 003			
Parameter	Units	Effluent Limitations	
		Average Monthly	Average Weekly
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	20	30
	lbs/day[3]	167	250
Total Suspended Solids	mg/L	20	30
	lbs/day	167	250

[2] Based on a design capacity of 4.89 mgd for secondary treatment.
[3] Based on tertiary flow of 1.0 mgd.

B. Water Quality-Based Effluent Limitations (WQBELs)

1. Basin Plan states that pH value for groundwater discharge shall not be raised above 9 or depressed below 6 as a result of controllable water quality factors.

2. The dissolved mineral content of the waters of the region as measured by the total dissolved solids test shall not exceed the specific objectives as a result of controllable water quality factors. The TDS and TIN limitations are the same as those in the prior Order No. 00-12 to protect groundwater quality.

C. Reclamation Specifications

Section 13523 of the California Water Code provides that a regional board, after consulting with and receiving the recommendations from the CDHS and any party who has requested in writing to be consulted, and after any necessary hearing, shall prescribe water reclamation requirements for water which is used or proposed to be used as recycled water, if, in the judgment of the Board, such requirements are necessary to protect the public health, safety, or welfare. Section 13523 further provides that such requirements shall include, or be in conformance with, the statewide uniform water recycling criteria established by the CDHS pursuant to California Water Code Section 13521.

This Order implements Title 22 Code of Regulations, Division 4, Environmental Health. The coliform limitations are set up for secondary and tertiary treated wastewater, respectively. Turbidity limits are set up for tertiary treated wastewater for irrigation.

D. Final Effluent Limitations

Effluent limitations – Discharge Points – 001, 002, and 003, beginning June 24, 2005:

1. The discharge of wastewater to Lucerne Valley and recycled water reuse for irrigation, construction, and wildlife habitat shall maintain compliance with the following limitations at Discharge Points 001, 002, and 003, with compliance measured at each individual monitoring location as described in the attached Monitoring and Reporting Program (Attachment D). The wastewater shall at all times be oxidized.

FOR DISCHARGE POINTS NO. 001 AND 002			
Parameter	**Units**	**Discharge Limitations**	
		Average Monthly	**Average Weekly**
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	30	45
	lbs/day[4]	1,223	1,835
Total Suspended Solids	mg/L	30	45
	lbs/day[4]	1,223	1,835

[4] Based on a design capacity of 4.89 mgd for secondary treatment.

FOR DISCHARGE POINT NO. 003			
Parameter	**Units**	**Discharge Limitations**	
		Average Monthly	**Average Weekly**
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	20	30
	lbs/day[5]	167	250
Total Suspended Solids	mg/L	20	30
	lbs/day[5]	167	250

2. The pH of the effluent, measured at each monitoring point, shall at all times be within the range of 6 and 9 pH units.

3. Percent Removal: The monthly average biochemical oxygen demand and suspended solids concentrations of the discharge shall not be greater than fifteen percent (15%) of the monthly average influent concentrations.

4. TDS Limitations: for effluent limitations a. and b., below, the lower of the two total dissolved solids limits is the limit. The TDS limitations are applicable for DP Nos. 002 and 003.

   a. The 12-month average[6] total dissolved solids concentration shall not exceed 550 mg/l and the 12-month flow weighted average shall not exceed 22,430 lbs/day[7], and
   b. The 12-month average total dissolved solids concentration shall not exceed the 12-month average total dissolved solids concentration in the water supply by more than 250 mg/l.

5. Total Inorganic Nitrogen (TIN) Limitations: The 12-month flow-weighted average TIN concentration shall not exceed 10 mg/l.

6. For Discharge from Discharge Point 003: Tertiary treated recycled water shall at all times be a filtered and subsequently disinfected wastewater that meets the following criteria:

   a. The turbidity of the filtered wastewater does not exceed any of the following:

      i. for micro-filtration:
         1). 0.2 NTU more than 5 percent of the time within a 24-hour period; and
         2). 0.5 NTU at any time.

      ii. for media filtration:
         1). 2 NTU more than 5 percent of the time within a 24-hour period; and
         2). 5 NTU at any time.

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5 Based on a design capacity of 1.0 mgd for tertiary treatment.
6 See Section VII. D Compliance Determination.
7 Calculated from 4.89 mgd x 8.34 x 550 mg/l.

b. Disinfected tertiary wastewater shall meet the following criteria:

i. The median concentration of total coliform bacteria measured in the disinfected effluent shall not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed.
ii. The number of total coliform bacteria shall not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period.
iii. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

7. For Discharge Point 002: wastewater shall at all times be an oxidized and subsequently disinfected wastewater that meets the following criteria:

a. The median concentration of total coliform bacteria in the disinfected effluent shall not exceed an MPN of 23 per 100 milliliters utilizing the bacteriological results of the last even days for which analyses have been completed[8].

b. The number of total coliform bacteria shall not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.

V. RATIONALE FOR RECEIVING WATER LIMITATIONS

A. Surface Water

Discharge to Discharge Point 002 to the pond (WHA) in the Baldwin Lake takes place in the dry season when the pond is dry or contains no natural flow. Therefore, no surface water limit is needed.

B. Groundwater

The soils in the on-site storage/holding ponds, and the Wildlife Habitat Area in the Baldwin Lake have low percolation rates. However, there is a potential for percolation for recycled water in the irrigation and construction site areas. Therefore, this order established TDS limits and total inorganic nitrogen limit to protect groundwater quality.

VI. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

Sections 13267 and 13383 of the California Water Code authorize the Water Boards to require technical and monitoring reports. The Monitoring and Reporting Program, Attachment D of this Order, establishes monitoring and reporting requirements to implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the Monitoring and Reporting Program for this facility.

[8] Title 22, 60301.220.

A. Influent Monitoring

To monitor influent flow to protect operation of the treatment plant and to identify any pollutant into the plant. BOD/TSS monitoring is to measure the BOD/TSS removal rate.

B. Effluent Monitoring

To determine compliance with effluent limitations, all parameters established in this Order must be monitored and tested. Other parameters, such as priority pollutants and minerals are also required to be monitored based on Basin Plan.

VII. PUBLIC PARTICIPATION

The California Regional Water Quality Control Board, Santa Ana Region (Regional Water Board) is considering the issuance of waste discharge requirements (WDRs) for BBARWA's Regional Treatment Plant. As a step in the WDR adoption process, the Regional Water Board staff has developed tentative WDRs. The Regional Water Board encourages public participation in the WDR adoption process.

A. Notification of Interested Parties

The Regional Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Notification was provided through the posting of Notice of Public Hearing at Big Bear Lake City Hall on May 25, 2005 and posting of Notice of Public Hearing at the Regional Board website.

B. Written Comments

The staff determinations are tentative. Interested persons are invited to submit written comments concerning these tentative WDRs. Comments should be submitted either in person or by mail to the Executive Office at the Regional Water Board at the address above on the cover page of this Order.

To be fully responded to by staff and considered by the Regional Water Board, written comments should be received at the Regional Water Board offices by 5:00 p.m. on **June 6, 2005.**

C. Public Hearing

The Regional Water Board will hold a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date:	**June 24, 2005**
Time:	**9:00 am**
Location:	**City Council Of Loma Linda** **25541 Barton Road** **City Of Loma Linda**

Interested persons are invited to attend. At the public hearing, the Regional Water Board will hear testimony, if any, pertinent to the discharge and WDRs. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing.

Please be aware that dates and venues may change. Our web address is ***http://www.waterboards.ca.gov/santaana*** where you can access the current agenda for changes in dates and locations.

D. Waste Discharge Requirements Petitions

Any aggrieved person may petition the State Water Resources Control Board to review the decision of the Regional Water Board regarding the final WDRs. The petition must be submitted within 30 days of the Regional Water Board's action to the following address:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

E. Information and Copying

The Report of Waste Discharge (RWD), related documents, tentative effluent limitations and special provisions, comments received, and other information are on file and may be inspected at the address above at any time between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Regional Water Board by calling (951) 782-4130.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the WDRs should contact the Regional Water Board, reference this facility, and provide a name, address, and phone number.

G. Additional Information

Requests for additional information or questions regarding this order should be directed to Jane Qiu at (951) 320-2008 or jqiu@waterboards.ca.gov.

Appendix B. Recycled Water Overview

RECYCLED WATER POLICY

The SWRCB adopted the Recycled Water Policy (RW Policy) in February 2009, and subsequently amended it in January 2013. The purpose of the policy was to provide the RWQCBs, proponents of recycled water projects, and the public the appropriate criteria to be used in issuing permits for recycled water projects. The RW Policy established more uniform requirements throughout the State and streamlined the permitting process for the vast majority of recycled water projects. Key components of the RW Policy are summarized below.

Component	Description
Recycled Water Targets	200,000 AFY by 2020 300,000 AFY by 2030
Permitting Process	Recycled water irrigation projects permitted within 120 days (except for unusual requirements) without groundwater monitoring component.
Salt and Nutrient Management Plans	Required for all groundwater basins. Includes identification of salt and nutrient sources, assimilative capacity evaluation, load estimates, fate and transport analysis and implementation measures. Includes anti-degradation analysis for recycled water projects.
Landscape Irrigation Project Requirements	Requirements related to controlling water runoff, salt, and soil nutrients. Provisions for streamlined permitting for projects that meet specific criteria related to application rates, oversight, and controls.
RWQCB Groundwater Requirements	Allows RWQCB to impose more stringent requirements for groundwater recharge projects to address site specific conditions.
Anti-degradation Analysis	Requirements for anti-degradation analysis for groundwater recharge and landscape irrigation projects based on the amount of assimilative capacity use by the project.
CEC Monitoring	Requirements for Constituent of Emerging Concern (CEC) monitoring for groundwater recharge projects.

One of the key components of the RW Policy is the requirement for a Salt and Nutrient Management Plan (SNMP). The RW Policy states that SNMPs should be developed to facilitate basin-wide management of salts and nutrients from all sources in a manner that optimizes recycled water use while ensuring protection of groundwater supply and beneficial uses, agricultural beneficial uses, and human health. The Santa Ana Region Basin Plan includes an SNMP, as described later in this Appendix.

SANTA ANA REGION BASIN PLAN

The Basin Plan establishes water quality standards for the ground and surface waters of the region and includes an implementation plan describing the actions by the Regional Board and others that are necessary to achieve and maintain the water quality standards. The Basin Plan provides general narrative objectives for each water body type and specific numeric objectives for total dissolved solids (TDS), hardness, sodium, chloride, total inorganic nitrogen (TIN), sulfate, and chemical oxygen demand (COD). Most Groundwater Management Zones have numeric objectives for only TDS and TIN.

Some waters in the Region have assimilative capacity for additions of TDS and/or nitrogen. If the current quality of a management zone is the same as or poorer than the specified water quality objectives, then that management zone does not have assimilative capacity. If the current quality is better than the specified water quality objectives, then that management zone has assimilative capacity. The difference between the objectives and current quality is the amount of assimilative capacity available. The amount of assimilative capacity, if any, varies depending on the individual characteristics of the waterbody in question and must be reevaluated over time. As part of the agreement to adopt the 2004 Basin Plan Amendment, the affected parties agreed to recompute ambient water quality for the individual management zones every three years and formed the BMPTF to oversee this effort, among other tasks. Since adoption of the 2004 Basin Plan amendment and per Basin Plan requirements, ambient quality and assimilative capacity findings have been, and will continue to be, updated every three years. The current findings are presented in the Recomputation of Ambient Water Quality in the Santa Ana Watershed for the Period 1993 to 2012 (18). However, this process does not currently include assessment of the Big Bear Valley Groundwater Management Zone.

If a discharger proposes to discharge wastes that are at or below the current ambient TDS and/or nitrogen water quality, then the discharge will not be expected to result in the lowering of water quality, and no antidegradation analysis will be required because TDS and nitrogen objectives are expected to be met. If there is assimilative capacity in the receiving waters for TDS, nitrogen or other constituents, a waste discharge may be of poorer quality than the objectives for those constituents for the receiving waters, as long as the discharge does not cause violation of the objectives, and provided that antidegradation requirements are met. However, if there is no assimilative capacity in the receiving waters, the numerical limits in the discharge requirements cannot exceed the receiving water objectives or the degradation process would be accelerated.

Discharges to waters without assimilative capacity for TDS and/or nitrogen must be held to the objectives of the affected receiving waters. In some cases, compliance with management zone TDS objectives for discharges to waters without assimilative capacity may be difficult to achieve. Poor quality water supplies or the need to add certain salts during the treatment process to achieve compliance with other discharge limitations (e.g., addition of ferric chloride) could render compliance with strict TDS limits very difficult. The Regional Board addresses such situations by providing dischargers with the opportunity to participate in TDS offset programs, such as the use of desalters, in lieu of compliance with numerical TDS limits. These offset provisions are incorporated into waste discharge requirements. Provided that the discharger takes all reasonable steps to improve the quality of the waters influent to the treatment facility (such as through source control or improved water supplies), and provided that chemical additions are minimized, the discharger can proceed with an acceptable program to offset the effects of TDS discharges in excess of the permit limits.

The Basin Plan provides for alternative pathways to obtain approval for discharges that do not meet the conditions described previously.

The Basin Plan provides that a discharger may conduct analyses to demonstrate that discharges at levels higher than the objectives would not cause or contribute to the violation of the established objectives. If the Regional Board approves this demonstration, then the discharger would be regulated accordingly.

Another alternative that dischargers might pursue is revision of the TDS or nitrogen objectives, through the Basin Plan amendment process. Consideration of less stringent objectives would necessitate comprehensive antidegradation review, including the demonstrations that beneficial uses would be protected and that water quality consistent with maximum benefit to the people of the State would be maintained. Several dischargers, including Yucaipa Valley Water District in the Yucaipa Basin, have pursued this "maximum benefit objective" approach, leading to the inclusion of "maximum benefit" objectives and implementation strategies in the Basin Plan. Discharges to areas where the "maximum benefit" objectives apply will be regulated in conformance with these implementation strategies. Any assimilative capacity created by the maximum benefit programs will be allocated to the parties responsible for implementing them.

Anti-Degradation Policy

The RW Policy addresses implementation of the Anti-degradation Policy, as it relates to recycled water projects. In general, the Anti-degradation Policy requires protection of groundwaters and surface waters having quality that is better than that established in effective policies. The policy states that high quality waters shall be maintained unless any change will be consistent with the maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses and will not result in water quality less than that prescribed in the policies.

Beneficial Uses

The Federal Clean Water Act (CWA) requires states to establish water quality standards for surface waters, consisting of use types and water quality criteria. In California, beneficial uses are established for all waters of the state, including both surface water and groundwater, to specify how that water can be used for the benefit of the public and/or wildlife. The State applies WQOs to protect the beneficial use attributed to the water of the state. Of the beneficial uses recognized in the Santa Ana Region, those that apply to waterbodies in the Big Bear Valley are included in the following table.

Beneficial Use Type	Beneficial Use
Municipal and Domestic Supply (MUN)	Community, military, municipal or individual water supply systems. These uses may include, but are not limited to, drinking water supply.
Agricultural Supply (AGR)	Farming, horticulture or ranching. These uses may include, but are not limited to, irrigation, stock watering, and support of vegetation for range grazing.
Industrial Process Supply (PROC)	Industrial activities that depend primarily on water quality. These uses may include, but are not limited to, process water supply and all uses of water related to product manufacture or food preparation.
Groundwater Recharge (GWR)	Natural or artificial recharge of groundwater for purposes that may include, but are not limited to, future extraction, maintaining water quality or halting saltwater intrusion into freshwater aquifers.
Water Contact Recreation (REC 1) [1]	Recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses may include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing and use of natural hot springs.
Non-contact Water Recreation (REC 2) [1]	Recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water would be reasonably possible. These uses may include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing and aesthetic enjoyment in conjunction with the above activities.
Warm Freshwater Habitat (WARM)	Support of warmwater ecosystems that may include, but are not limited to, preservation and enhancement of aquatic habitats, vegetation, fish and wildlife, including invertebrates.
Cold Freshwater Habitat (COLD)	Support of coldwater ecosystems that may include, but are not limited to, preservations and enhancement of aquatic habitats, vegetation, fish and wildlife, including invertebrates.
Preservation of Biological Habitats of Special Significance (BIOL)	Support of designated areas or habitats, including, but not limited to, established refuges, parks, sanctuaries, ecological reserves or preserves, and Areas of Special Biological Significance (ASBS), where the preservation and enhancement of natural resources requires special protection.
Wildlife Habitat (WILD)	Support of wildlife habitats that may include, but are not limited to, the preservation and enhancement of vegetation and prey species used by waterfowl and other wildlife.
Rare, Threatened or Endangered Species (RARE)	Support the habitats of necessary for the survival and successful maintenance of plant or animal species designated under state or federal law as rare, threatened or endangered.
Spawning, Reproduction and Development (SPWN)	Support of high quality aquatic habitats necessary for reproduction and early development of fish and wildlife.

Notes:

1. The REC 1 and REC 2 beneficial use of designations assigned to surface waterbodies in this Region should not be construed as encouraging recreational activities. In some cases, such as Lake Matthews and certain reaches of the Santa Ana River, access to the waterbodies is prohibited because of potentially hazardous conditions and/or because of the need to protect other uses, such as municipal supply or sensitive wildlife habitat. Where REC 1 or REC 2 is indicated as a beneficial use in Table 3-1, the designations are intended to indicate that the uses exist or that the water quality of the waterbody could support recreational uses.

RESTRICTED AND UNRESTRICTED IRRIGATION REGULATIONS

The following section summarizes California Code of Regulations (CCR) Title 22 regulations as well as Santa Ana Basin Plan objectives which will establish regulatory criteria for irrigation projects using recycled water.

CCR – Title 22

Title 22, established and administered by DDW, defines four types of recycled water uses based on the treatment process used and water quality produced. These four types of recycled water are described as follows and as summarized in Appendix B.

- Undisinfected secondary recycled water - Oxidized wastewater that has not been disinfected.
- Disinfected secondary-23 recycled water – Recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a Most Probable Number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.
- Disinfected secondary-2.2 recycled water – Recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period.
- Disinfected tertiary recycled water - Filtered and subsequently disinfected wastewater that meets the following criteria:

  (a) The filtered wastewater has been disinfected by either:

  1. A chlorine disinfection process following filtration that provides a contact time (CT) (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
  2. A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

  (b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters

Treatment Level	Approved Uses	Total Coliform (median)
Undisinfected Secondary	Fodder, Fiber and Seed Crops	N/A
Disinfected Secondary 23	Pasture for Milking Animals Landscape Irrigation[1] Landscape Impoundment Soil Compaction, Dust Control on Roads and Streets	23/100 mL
Disinfected Secondary 2.2	Surface Irrigation of Food Crops Restricted Recreational Impoundment Surface Irrigation of Orchards, Vineyards	2.2/100 mL
Disinfected Tertiary	Spray Irrigation of Food Crops Landscape Irrigation[2] Unrestricted Recreational Impoundment	2.2/100 mL

Notes:
1. Includes restricted access golf courses, cemeteries, freeway landscapes, and landscapes with similar public access.
2. Includes unrestricted access golf courses, parks, playgrounds, schoolyards, and other landscaped areas with similar access.

Disinfected tertiary recycled water can also be used for industrial purposes. These uses are summarized in Appendix B.

Industrial Use	Approved Uses
Supply for Cooling and Air Conditioning	Industrial or commercial cooling or air-conditioning involving cooling tower, evaporative condenser, or spraying that creates mist. Industrial or commercial cooling or air-conditioning not involving cooling tower, evaporative condenser, or spraying that creates mist
Other Allowed Uses	Flushing toilets and urinals Priming drain traps Structural fire fighting Non-structural fire fighting Industrial process water that will not come into contact with workers Industrial process water that may contact workers Industrial boiler feed water Decorative fountains Commercial laundries Consolidation of backfill material around potable water pipelines Dust control on roads and streets Mixing concrete Flushing sanitary sewers Soil compaction Artificial snow making for commercial outdoor use Cleaning roads, sidewalks, and outdoor work areas Commercial car washes, not heating the water, excluding the general public from washing processes

Impounded Recycled Water Regulations – Fish Hatcheries

Recycled water to be used in a fish hatchery may be categorized as impounded water under Title 22, which specifies the following regulations for impounded water:

- Recycled water used as a source of supply for restricted recreational impoundments and for any publicly accessible impoundments at fish hatcheries shall be at least disinfected secondary-2.2 recycled water.

However, there are no known fish hatcheries in California that are using recycled water to raise fish for human consumption. Additional research would be needed to verify whether this is a viable use of recycled water that there are likely other water quality, environmental, and public health considerations that will be controlling and will require a higher level of treatment.

Recycled Water Operational and On-site Requirements

There are operational and on-site requirements for different beneficial uses per Title 22. The Title 22, Recycled Water Ordinance, and recycled water rules and regulations requirements are discussed in the following sections

Use Area Requirements

Title 22 includes two main requirements that will need to be considered during the design phase. Per Title 22, no irrigation with disinfected tertiary recycled water shall take place within 50 ft of any domestic water supply well unless the well meets certain criteria including:

- An annular seal
- Well housing to prevent recycled water spray from contacting the wellhead

Also per Title 22, no impoundment of disinfected tertiary recycled water shall occur within 100 ft of any domestic water supply well.

Recycled Water Ordinance

The purpose of a Recycled Water Ordinance is to establish a water recycling policy and criteria for its use within the agency's jurisdiction. In general, a Recycled Water Ordinance will accomplish the following:

- Establish Administrative Authority
- Establish approved uses of recycled water
- Define areas of potential eligibility for recycled water service
- Specify mandatory and voluntary uses of recycled water, depending on user classifications
- Require installation of transmission and distribution infrastructure
- Provide enforcement and severability clauses

Recycled Water Rules and Regulations

The Rules and Regulations govern the design, construction, and use of both the distribution system, to be operated by BBARWA and/or Project Team and on-site recycled water systems to be operated by the users. In general, the Rules and Regulations document will include the following elements:

- Responsibilities for the Project Team and Users
- Requirements for the design, installation, and inspection of the distribution systems and on-site recycled water systems
- Application procedures and BBARWA approval process
- Operation, Maintenance, and Management responsibilities for Users and the Project Team
- Cross connection control test procedures

- Employee training requirements
- Prohibitions and Enforcement

INDIRECT POTABLE REUSE VIA GROUNDWATER RECHARGE

The following section summarizes CCR Title 22 regulations for IPR projects through groundwater recharge. It also addresses components of the Santa Ana Basin Plan, Anti-Degradation policy addressed in the RW Policy, and the Sustainable Groundwater Management Act (SGMA) that may impact a groundwater recharge recycling.

CCR – Title 22

In response to current drought conditions in California, Senate Bill 104 was signed into law in March 2014. This bill included a requirement for DDW to adopt emergency regulations for groundwater replenishment using recycled water by June 30, 2014. The current Groundwater Recharge Regulations were adopted as an emergency regulation and became effective June 18, 2014. These regulations have been incorporated in the CCR, Title 22.

The Groundwater Recharge Regulations define a Groundwater Replenishment Reuse Project (GRRP) as a project using recycled municipal wastewater for the purpose of replenishment of groundwater that is designated a source of water supply in a Water Quality Control Plan, or which has been identified as a GRRP by the RWQCB. GRRPs can employ surface spreading basins or subsurface injection methods. The Groundwater Recharge Regulations address the following types of recharge:

- Surface spreading without full advanced treatment (FAT)
- Subsurface application (FAT required for the entire flow)
- Surface spreading with FAT

CCR Title 22, Section 60320.201 defines FAT as "the treatment of an oxidized wastewater . . . using a reverse osmosis (RO) and an oxidation treatment process (AOP) . . . ." According to the Groundwater Recharge Regulations, FAT is the required treatment process for groundwater augmentation using direct injection, unless an alternative treatment has been demonstrated to DDW as providing equal or better protection of public health and has received written approval from DDW.

Both surface spreading and subsurface application are considered to be indirect potable reuse (IPR). The specific regulations for these different methods of groundwater recharge are different. However, the regulations generally address the following elements:

- Source control
- Emergency response plan
- Pathogen control
- Nitrogen control
- Regulated chemicals control
- Initial recycled water contribution (RWC)
- Increased RWC
- Advanced treatment criteria
- Application of advanced treatment
- Soil aquifer treatment (SAT) performance (surface application)
- Response retention time

Several of the key regulatory requirements for groundwater recharge are summarized in Appendix B. Additional descriptions of pathogen controls, retention time and the RWC follows.

Pathogen controls include specific provisions for log reduction of microorganisms and treatment process requirements. The treatment process used to treat recharge water for a GRRP must provide treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction from raw sewage to usable groundwater. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.

The Groundwater Recharge Regulations require a minimum "response retention time" or minimum groundwater travel time of two months between the point of surface application or injection, and the point of extraction. Groundwater travel time can be estimated by various methods, including intrinsic tracer studies, numerical modeling, or analytical modeling. Depending on the method used, the "response time credit" is discounted by different factors. The more rigorous the estimating approach, the more advantageous the discounting factor.

The Groundwater Recharge Regulations require that the ratio of purified recycled water to the total injected water, known as the RWC, be determined periodically, and that it is not to exceed a value determined during the DDW's review of the engineering report and the results of public hearings. Only water that is either a DDW-approved drinking water, or meets certain quality criteria (e.g., does not exceed primary or secondary maximum contaminant levels (MCLs) or notification levels) may be used as diluent water. The Groundwater Recharge Regulations allow the RWC to be 100% if it can be demonstrated that sufficient protections are afforded within the total project design and proposed operational scheme.

Element	Surface Recharge	Subsurface Recharge
Required Treatment Level	Disinfected tertiary	100% RO and AOP treatment for the entire waste stream
Retention time[(1)]	Minimum 2 months (however additional treatment may be required for < 6 months)	Minimum 2 months
Recycled Water Max Initial Contribution (RWC_{max})	Up to 20% disinfected tertiary Up to 100% with RO and AOP	Up to 100% with RO and AOP
Total Nitrogen	Average <10 mg/L	Average <10 mg/L
Total Organic Carbon	Mound < 0.5 mg/L ÷ RWC	< 0.5 mg/L
Dilution water compliance calculation	Based on 120-month running average	Based on 120-month running average
Pathogen Reduction[2]	12-log enteric virus reduction, 10-log Giardia cyst reduction, 10-log Cryptosporidium oocyst	

Notes:
1. Must be verified by a tracer study. An 8-month minimum is required for planning level estimates based on numerical modeling.
2. Minimum of 3 barriers and each barrier must achieve a minimum of 1-log reduction. No barrier can achieve more than 6-log.

SURFACE WATER AUGMENTATION AND DIRECT POTABLE REUSE

The SB 918 approved on September 30th, 2010 and subsequent SB 322 approved on October 8th, 2014 require an advisory group and expert panel to investigate and report to Legislature on the feasibility of developing uniform water recycling criteria for DPR and IPR through surface water augmentation. The final expert panel report on the feasibility of DPR is due to legislature on December 31st, 2016.

Uniform criteria for DPR and IPR through surface water augmentation are not currently in place. As a minimum recycled water feasibility studies should aim to meet the requirements established by groundwater recharge regulations.

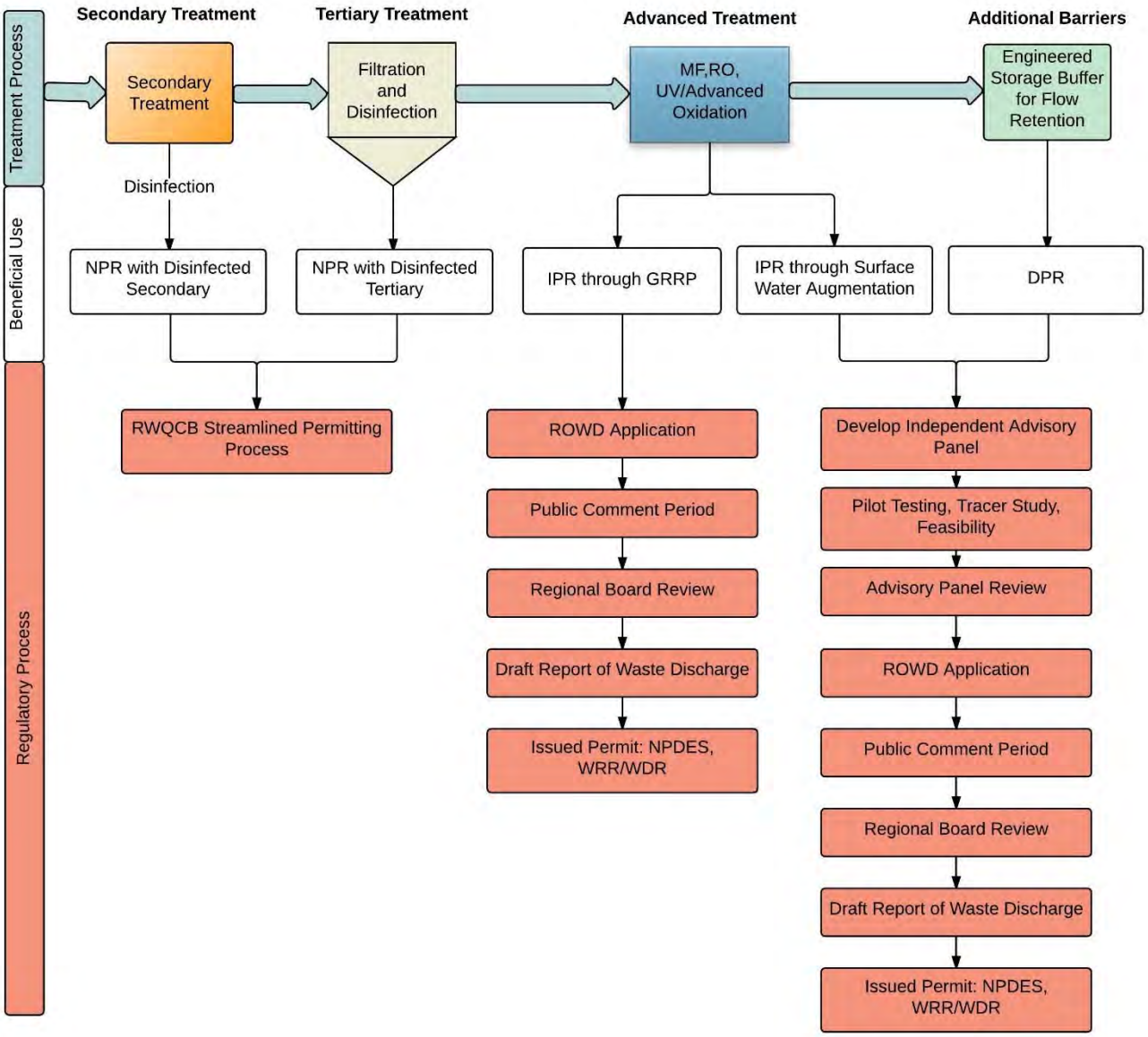
Summary of Permit Requirements

Each type of beneficial reuse or disposal alternative will follow a defined regulatory process to obtain required permits for waste discharge and recycled water reuse. The Waste Discharge Requirements (WDRs) Program regulates point discharges to land or groundwater. Recycled water irrigation and recycled water use are administered under the WRDs Program. The project proponent must file a complete Report of Waste Discharge (ROWD) with the Santa Ana Central to obtain a new or revised WDR. This report must include detailed information about the wastewater treatment facility, description of the discharge type, quality, quantity, interval, and method of discharge, and location of discharge points. The ROWD is reviewed by both the State Division of Drinking Water (DDW) and the RWQCB. A streamlined permitting process is established for irrigation projects. The RW Policy identifies further criteria to provide direction for the SWRCB and RWQCB to permit IPR groundwater recharge and recovery projects. For projects that discharge to the Santa Ana River, a new or revised NPDES permit will be required. Additionally, IPR through surface water augmentation involves a more complicated regulatory process to obtain permitting, including advisory panel review, pilot testing, and tracer studies, as these regulations have not been fully developed. Appendix B provides an overview of the permitting procedure for the various types of recycled water projects.

SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

DWR has developed a Strategic Plan for the SGMA program to protect groundwater basins that provide more than half of California's water use in dry years. Under the new groundwater management legislation, DWR released an initial basin prioritization list on January 31, 2015. The Basin prioritization ranking considers the percent of total groundwater use in the basin as well as the overlying population. The Bear Valley basin is ranked as a medium priority basin.

A local agency, combination of local agencies, or county may establish a Groundwater Sustainability Agency (GSA). It is the GSA's responsibility to develop and implement a GSP that considers all beneficial uses and users of groundwater in the basin. DWR will develop regulations for evaluating GSPs and alternatives to GSPs by June 1, 2016 and GSAs must be formed by June 30, 2017. GSAs must develop GSPs with measureable objectives and interim milestones that ensure basin sustainability. A basin may be managed by a single GSP or multiple coordinated GSPs. By January 21, 2022, high and medium priority basins not in critical overdraft must be managed under a GSP.


Treatment Process
Beneficial Use
Regulatory Process
Secondary Treatment
Tertiary Treatment
Advanced Treatment
Additional Barriers
Secondary Treatment
Filtration and Disinfection
MF,RO, UV/Advanced Oxidation
Engineered Storage Buffer for Flow Retention
Disinfection
NPR with Disinfected Secondary
NPR with Disinfected Tertiary
IPR through GRRP
IPR through Surface Water Augmentation
DPR
RWQCB Streamlined Permitting Process
ROWD Application
Public Comment Period
Regional Board Review
Draft Report of Waste Discharge
Issued Permit: NPDES, WRR/WDR
Develop Independent Advisory Panel
Pilot Testing, Tracer Study, Feasibility
Advisory Panel Review
ROWD Application
Public Comment Period
Regional Board Review
Draft Report of Waste Discharge
Issued Permit: NPDES, WRR/WDR

Appendix C. Water Reuse Timeline and References

A Timeline of the Evolving Wastewater Management In the Big Bear Valley

September 24, 2003

By

Steven C. Schindler, General Manager

Big Bear Area Regional Wastewater Agency

Preface

The Big Bear Valley has seen an ***evolution of wastewater management*** through:

- the developing Big Bear area organizations involved since 1935;
- developing strategies and plans in treatment and disposal of wastewater;
- developing beneficial uses of treated wastewater, both secondary and tertiary;
- more involvement of the regulatory agencies, permitting these beneficial uses;
- developing concepts for advanced, membrane and ultraviolet-based wastewater treatment;
- pilot testing of artificial surface recharge and through-the-earth percolation to aquifers;
- continuing to support interactive, open-door, education-information communications.

So much has transpired since 1935. BBARWA's open-door, education-information communication activities, such as the Water Summit meetings with the public community invited, leads to an underlying question of, "how did we get to where we are today?" This timeline may help answer that question by illuminating Big Bear Valley's legacy in wastewater treatment.

Reading a chronologically written summary of the ***evolution of wastewater management*** could replace counting sheep. Even transforming it into an outline doesn't quite do it. So, I thought a ***timeline format***, which we are now using successfully in ongoing BBARWA projects, would work.

Laying out events from 1935 to 2003 may have resulted in a few omissions and errors. If any are found, I would appreciate any inputs. I plan to periodically expand this timeline portrayal and will be glad to review and incorporate provided inputs.

Steve Schindler

Timeline Summary of Wastewater Management in the Big Bear Area (Page 1 of 2)

1900's | 1900's | 2000's

This timeline provides a brief pictorial summary of sequential events beginning in 1935 regarding wastewater management in the Big Bear Area.

Steven C. Schindler, 9-12-03
General Manager, BBARWA

Big Bear City Sanitary District (BBCSD) Organized.

Big Bear Lake Sanitation District (BBLSD) Organized.

BBLSD constructed primary treatment plant with oxidation/ percolation ponds at China Gardens.

BBLSD constructed sewers in a portion of Big Bear Lake community.

BBCSD assumed operation of Whispering Forest community septic tank system.

35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03

BBCCSD received report on effluent disposal.

BBCCSD agreed to take excess effluent from BBLSD, thereby avoiding enforcement action by RWQCB.

BBCCSD agreed to take increased effluent from BBLSD due to continued overflow/leakage into Big Bear Lake from BBLSD percolation ponds at China Garden.

CSA 53–B organized

Big Bear Valley Wastewater Planning Commission (BBVWPC), a joint association of BBLSD, BBCCSD and San Bernardino County, agreed to prepare a valley-wide plan for sewage treatment, disposal and wastewater management.

RWQCB adopted Basin Plan which prohibited waste discharge from subsurface disposal systems in Big Bear Valley. All existing structures were required to connect to the sewer system by 1977. Exemptions were possible under very limited circumstances.

BBVWPC received report recommending valley-wide treatment and reuse system consisting of greenbelt irrigation on Nelson Ridge with discharge to Baldwin Lake in freezing and inclement weather. BBLSD ponds at Stanfield to be abandoned due to "aesthetic" conditions. All other disposal ponds of BBLSD and BBCCSD to be retained for emergency disposal. BBVWPC to seek regulatory approval and to apply for State and Federal assistance.

BBARWA, a joint powers authorityconsisting of the County of San Bernardino, Big Bear City Community Services District and Big Bear Lake Sanitation District was formed and took over the duties of BBVWPC.

BBARWA received comprehensive wastewater facilities plan regionalizing interceptor sewers, treatment and effluent disposal/management for Big Bear Valley.

BBARWA adopted the 1975 facility plan calling for temporary effluent disposal in Lucerne Valley until such time as a legal and economical means of reuse within Big Bear Valley could be implemented. Regulatory agencies continued to prohibit reuse within Big Bear Valley until then-accepted principles of treatment could assure protection of public health and water quality. BBARWA memorialized its commitment to in-valley reuse in Resolution No. 40, adopted January 6, 1976.

BBARWA updated cost of tertiary treatment in expectation that regulatory authorities might soon reconsider in-valley use.

City of Big Bear Lake incorporated, took over duties of BBLSD and became member of BBARWA.

BBCCSD received report on water resources management plan for Baldwin Lake, to which BBARWA supplied information on costs for a hypothtical reuse of effluent within Baldwin Lake.

BBARWA received report on reuse opportunities within Big Bear Valley that would be created if regulatory authorities changed their "no-discharge" prohibition.

BBARWA updates its reuse opportunities report.

City of Big Bear Lake, Department of Water and Power (DWP) received a report describing how wastewater effluent could be recharged into the groundwaters of Sand Canyon (Moonridge area), complying with proposed State groundwater recharge regulations and supplementing the domestic water supply of the DWP.

BBARWA received a grant from Department of Fish and Game to construct a facility within the 80-acre pond to test the feasibility of using effluent for a wetland wild fowl project. The wetland would also perform tertiary treatment. The ponds were flooded by Baldwin Lake soon thereafter and efforts to locate another project site were unsuccessful. The grant funds were returned to the state.

Expanded On Page 2

BBARWA worked with the Big Bear Municipal Water District and the Natural Heritage Foundation to develop a system for delivering reclaimed water to stickleback ponds at south end of Baldwin Lake and, ultimately, to Stanfield Marsh (not pursued).

BBARWA received costs for a small teriary plant to serve reclaimed water to stickleback ponds in Shay Creek.

San Diego County Water Authority conducted a water repurification feasibility study describing a system and treatment facilities required to ultimately recycle reclaimed wastewater through a domestic water supply reservoir (San Vicente Reservoir) for dilution and insertion into the domestic water system. The proposed treatment processes for both the wastewater and domestic water supply were accepted by State Department of Health Services (DOHS). This acceptance constituted a large breakthrough in DOHS policy and allowed Big Bear area to begin consideration of in-valley reuse, including reuse through Big Bear Lake (not pursued due to better approaches).

BBLSD expanded oxidation/percolation ponds at China Gardens.

BBLSD investigated feasibility of creating wildlife ponds in southern end of Baldwin Lake (not implemented due to local opposition).

BBCSD investigated feasibility of constructing a community collection/treatment and disposal system.

County Service Area (CSA) 53 organized.

Big Bear City Community Services District (BBCCSD) organized.

BBCCSD took over for BBCSD. Voters authorized bonds to construct community sewage system with treatment at the present Big Bear Area Regional Wastewater Agency (BBARWA) site. Disposal was through evaporation in pond located in Baldwin Lake (existing "80"-acre pond).

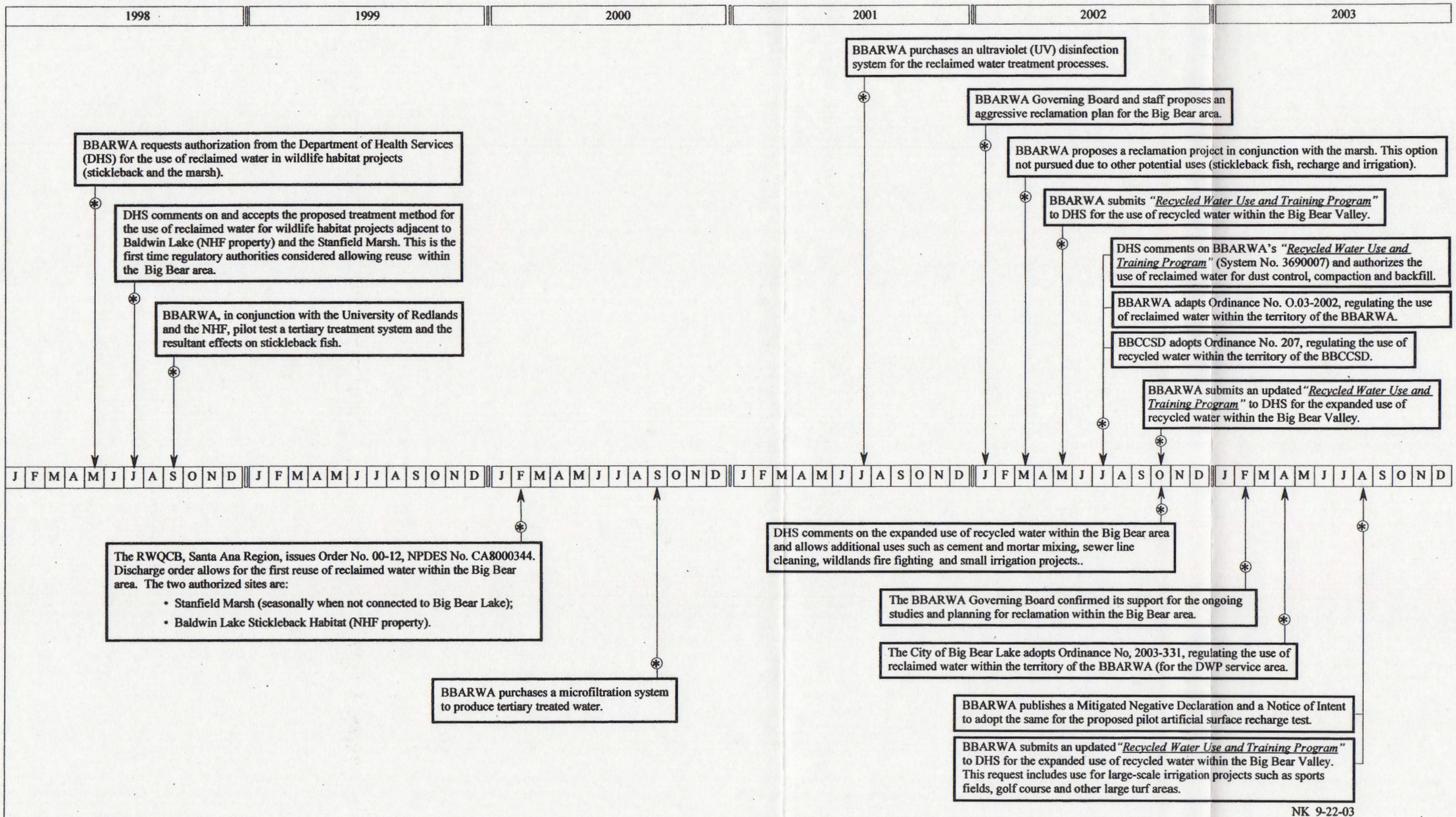
BBLSD percolation ponds overflowed into Big Bear Lake. Caused near-enforcement action by Regional Water Quality Control Board (RWQCB).

Note: ⊛ ⊛↓

denotes activities considering reuse of wastewater within the Big Bear Valley.

NK 9-22-03

Timeline Summary of Wastewater Management in the Big Bear Area (continued) (Page 2 of 2)



Note: ⊛ ⊛

denotes activities considering reuse of wastewater within the Big Bear Valley.

NK 9-22-03

PLEASE NOTE: The Big Bear Area Regional Wastewater Agency (BBARWA) maintains most of the below documents at their offices. The public is invited to review any of these documents at BBARWA's office or the office that the document is located. BBARWA may charge for the cost of documents if copies are requested.

The location of the document is specified by the red lettering at the end.
Big Bear Area Regional Wastewater Agency = (BBARWA)
121 Palomino Drive, Big Bear City, CA 92314

City of Big Bear Lake, Department of Water and Power = (DWP)
41972 Garstin Drive, Big Bear Lake, CA 92315

Big Bear City Community Services District = (CSD)
139 E. Big Bear Blvd., Big Bear City, CA 92314

Partial list of references and work products are listed below:

Wastewater Facilities Plan, Big Bear Area, Collection, Treatment, Disposal, and Reclamation for the BBARWA. Big Bear Area Regional Wastewater Agency. 1975 (BBARWA)

Analysis of Selected Wastewater Reuse Opportunities in Big Bear Valley Final Report. NBS/Lowry. July 1990 (BBARWA)

Geohydrologic Evolution of Artificial Recharge Potential of the Sand Canyon Area. GEOSCIENCE Support Services, Inc. January 1991 (BBARWA)

Report of Waste Discharge/Engineering Report on the Proposed Use of Reclaimed Municipal Wastewater for Groundwater Recharge for the Department of Water and Power City of Big Bear Lake. Black & Veatch. March 1991 (DWP)

Proposed Recycled Water Project "A View to the Future" Engineers Report Pursuant to Section 60323 Title 22, California Code of Regulations. Engineering Resources of Southern California, Inc. November 1998 (BBARWA)

Long Range Facilities Plan. Engineering Resources of Southern California, Inc. March 2000 (BBARWA)

Water Reuse Strategic Plan. Big Bear Area Regional Wastewater Agency. August 2000 (BBARWA)

2000 Urban Water Management Plan. Big Bear City Community Services District. March 2001 (CSD)

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Re-Evaluation of the Maximum Perennial Yield Big Bear Lake Watershed and a Portion of Baldwin Lake Watershed. GEOSCIENCE Support Services, Inc. August 2001 (DWP)

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Economic Value of Reliable Water and Wastewater Services. A&N Technical Services, Inc. October 2002 (BBARWA)

Identification, Evaluation, & Preliminary Analysis of Available Wastewater Treatment Processes (in Support of Groundwater Artificial Surface Recharge): Final Report. SEATRA Systems and Engineering Resources of Southern California, Inc. February 2003 (BBARWA)

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The Big Bear Valley Groundwater Replenishment Study Analysis and Identification of Alternatives to Address Disposal of RO Membrane Concentrated Waste Stream (Brine) Technical Memorandum Report. CH2MHILL. June 2003 (BBARWA)

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Connection Fee Analysis Final Report. So & Associates. September 2003 (BBARWA)

A Timeline of Evolving Wastewater Management in the Big Bear Valley. Schindler. September 2003 (BBARWA)

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Potential Funding Opportunities for the Big Bear Area Regional Wastewater Agency Recycled Water Program. CH2MHILL. March 2004 (BBARWA)

Geohydrologic Analysis of Shay Pond. GEOSCIENCE Support Services, Inc. April 2004 (CSD)

Engineering Report for Water Reuse Permits. Engineering Resources of Southern California, Inc. June 2004 (BBARWA)

Geohydrologic Evolution of Artificial Recharge Potential in the Big Bear Valley, San Bernardino County, California. Volume I and II. GEOSCIENCE Support Services, Inc. July 2004 (BBARWA)

Presentation of Opinion Research Prepared for Big Bear Area Regional Wastewater Agency. Evans/McDonough Company, Inc. August 2004 (BBARWA)

Status Report – Public Outreach Activities. TRG & Associates. August 2004 (BBARWA)

Technical Review Panel comments Regarding BBARWA Groundwater Recharge Program. Bouwer, Cline and Perry. August 2004 (BBARWA)

Recycled Water Master Plan, Final Draft Report. CH2MHill. January 2005 (BBARWA)

Status Report on the Big Bear Area Regional Wastewater Agency Recycled Water Program, Final Report. CH2MHill. February 2005 (BBARWA)

Analysis of Ground Water flow Model Simulations for the Proposed Green Spot Artificial Recharge Site, Draft Report. GEOSCIENCE Support Services, Inc. March 2005 (Still being developed)

BBARWA

Reclaiming Our Community's Vital Water Resources

BIG BEAR AREA
REGIONAL WASTEWATER AGENCY

Appendix D. Potential Recycled Water Users & Demands

User ID	Potential Recycled Water User	Total Annual Demand (AFY)	Max Day Demand (gpm)	Peak Hour Demand (gpm)	Demand Estimate Data Source
1	North Shore Elementary School	8.6	16	49	BBLDWP Consumption Records (2011-2014)
2	Rotary Pine Knot Park	2.6	5	15	BBLDWP Consumption Records (2011-2014)
3	Veterans Park	2.3	4	12	BBLDWP Consumption Records (2011-2014)
4	Meadow Park	0.9	1	4	BBLDWP Consumption Records (2011-2014)
5	Big Bear Middle School	12.6	21	64	BBLDWP Consumption Records (2011-2014)
6	Big Bear Elementary School	5.1	8	23	BBLDWP Consumption Records (2011-2014)
7	Big Bear Snow Play	0.1	0	1	BBLDWP Consumption Records (2011-2014)
8	City of Big Bear Lake City Hall and Village Streetscape	0.6	1	3	BBLDWP Consumption Records (2011-2014)
9	World Mark (Timeshare Resort)	20.6	29	88	BBLDWP Consumption Records (2011-2014)
10	Big Bear High School	22.2	37	110	BBCCSD Consumption Records (2011-2014)
11	Stickleback	37.8	35	35	BBCCSD Consumption Records (2011-2014)
14	Big Bear Airport District (Landscaping Meter)	0.6	1	3	BBCCSD Consumption Records (2011-2014)
15	Church of Jesus Christ Latter Day Saints	1.8	3	9	BBCCSD Consumption Records (2011-2014)
16	Erwin Lake Park	1.6	2	7	BBCCSD Consumption Records (2011-2014)
17	Gold Mountain Memorial Park (Cemetery)	0.0	0	0	BBCCSD Consumption Records (2011-2014)
22	Sonny's Place Equestrian Center	0.0	0	0	BBCCSD Consumption Records (2011-2014)
23	Whispering Pines	8.3	14	41	BBCCSD Consumption Records (2011-2014)
25	Chautauqua High School B	2.1	5	14	BBCCSD Consumption Records (2011-2014)
27	Paradise Park (Proposed)	3.0	6	17	BBCCSD Consumption Records (2011-2014)
28	Big Bear Golf Course	120.0	236	707	BBCCSD Estimate
30	The Ranch	1.6	2	7	BBLDWP 2010 UWMP
31	Alpine Zoo	1.5	4	13	Initial Study for Alpine Zoo
33	Baldwin Lake Elementary	7.7	11	32	2006 RWMP
34	Sugarloaf Park	22.0	31	92	2006 RWMP
35	Otto Lawrence (Inn Der Bach)	0.5	1	2	BBCCSD Consumption Records (2011-2014)

Appendix E. Technical and Financial Assumptions

TECHNICAL ASSUMPTIONS

The table below summarizes the key technical assumptions used to develop the alternatives.

Project Element	Assumption
Dilution Water - Advanced Treated Recycled Water	Advanced treated water qualifies as dilution water will require no dilution water
Dilution Water Sources	Sources are storm water, basin underflow and advanced treated wastewater
Beneficial Yield	Beneficial Yield is equal to the yield entering the recycled water distribution system following the WWTP. It is assumed that 100% of the recycled water recharged is recoverable as supply.
Pipelines	Sized to maintain a headloss gradient of less than 10 ft of headloss per 1000 ft of pipeline during peak hour for irrigation use and average annual for recharge use.
Pump Stations	Capacity based on peak hour demand for irrigation use and average annual for recharge use. (Assumes no gravity system storage) Station efficiency is assumed to be 75% All pumps have Variable Frequency Drives (VFDs)
Storage	Capacity is based on max day demand for irrigation use and average day demand for recharge use
Advanced Treatment Recovery Percentage	The net recovery of water entering the Advanced Treatment process is 85%; 15% is generated as brine.

FINANCIAL ASSUMPTIONS

Planning Level Cost Estimates

The cost opinions (estimates) included in this Study are prepared in conformance with industry practice and, as planning level cost opinions, will be ranked as a Class 4 Conceptual Opinion of Probable Construction Cost as developed by the Association for the Advancement of Cost Engineering (AACE) Cost Estimate Classification System (19). The AACE classification system is intended to classify the expected accuracy of planning level cost opinions, and is not a reflection on the effort or accuracy of the actual cost opinions prepared for the study. According to AACE, a Class 4 Estimate is intended to provide a planning level conceptual effort with an accuracy that will range from -30% to +50% and includes an appropriate contingency for planning and feasibility studies. The conceptual nature of the design concepts and associated costs presented in this Study are based upon limited design information available at this stage of the projects. These cost estimates have been developed using a combination of data from RS Means CostWorks®, recent bids, experience with similar projects, current and foreseeable regulatory requirements and an understanding of the necessary project components. As specific projects progress, the design and associated costs could vary significantly from the project components identified in this Study. Cost opinions are planning level and may not fully account for site-specific conditions that will affect the actual costs, such as soils conditions and utility conflicts.

For projects components where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 4 of 2015, adjusted for San Bernardino, California, is used. Material prices were adjusted in some cases to provide estimates that align closer with actual local bid results. For projects where RS Means CostWorks® data is not available, cost opinions are generally derived from bid prices from similar projects, vendor quotes, material prices, and labor estimates, with adjustments for inflation, size, complexity and location.

Cost opinions are in 2015 dollars (ENR 20 City Average Construction Cost Index of: 10,039 for August 2015).

Markups and Contingencies

For the development of the planning level cost estimates, several markups and contingencies are applied to the estimated construction costs to obtain the total estimated project costs. The markups are intended to account for costs of engineering, design, administration, and legal efforts associated with implementing the project (collectively, Implementation Markup). Contingency accounts for additional construction costs that could not be anticipated at the time of this analysis. A summary of the markups and contingencies applied are presented in the table below.

	Markups and Contingencies
	Construction Subtotal
+	20% of Construction Subtotal for Contingency
+	30% of Construction Subtotal for Non-Potable Reuse Implementation (Alternative 1) 40% of Construction Subtotal for Groundwater Recharge Implementation (Alternatives 2 & 3)
=	**Total Capital Cost**

Excluded cost are as follows:

- Public Information Program. Depending on the relative public acceptability of a major recycled water facility or a group of facilities, there may be a need for a public information program, which could take many different forms. It is recommended that the agencies engage in a proactive public outreach program in coordination with other existing or planned outreach programs.
- Land Acquisition. Additional land and/or easements may need to be acquired in addition to those explicitly accounted for in the cost estimates.

Unit Cost and Net Present Value

Unit costs of the various alternatives are compared using the annual payment method. The unit cost is calculated with this method by adding the annual payment for borrowed capital costs to the annual O&M cost and dividing by the annual project yield. This method provides a simple comparison between alternatives in this RWFPS. The factors described below are used to calculate the unit cost with the annual payment method.

To comply with USDA funding program requirements for a Preliminary Engineering Report, the net present values (NPV) are also calculated for each alternative and treatment option. The NPVs account for capital costs (one-time costs associated with each alternative) and operation and maintenance (O&M) costs (i.e. electrical and maintenance) over a 30-year period. O&M costs are subdivided into Conveyance Pumping Energy costs and Non-Energy costs to enable these costs to be escalated at different rates in the future, recognizing that energy costs are anticipated to rise faster than non-energy costs. Note that unit costs calculated using the NPV will not correspond to the unit costs presented in this report, which are based on the annual payment method.

The assumptions used to calculate the costs for each alternative are summarized in the table below.

Assumption	Current Value	Annual Escalation Rate	Description
Loan Terms	100% loan for 30-year loan term with a 2.2% capital financing rate		Loan term based on CWSRF loan term. Capital financing rate based on SRF previous 10-year average.
Discount Rate			A Discount Rate of 3% is used for the NPV
O&M – Conveyance Pumping Energy	$ 0.14/ KW-hr	3.0 %	Energy escalation based on US Energy Information Administration (USEIA) previous 5-year average electricity rate data for California Commercial rates.
O&M – Non Energy	Varies by facility type, based on capacity or capital cost	2.4%	Non-energy escalation based on California CCI previous 5-year average

Appendix F. Treatment Upgrade Details

ALTERNATIVE 1: DISINFECTED TERTIARY TREATMENT

Alternative 1 requires the RW is treated to disinfected tertiary standards, per the Title 22 Code of Regulations as follows:

- Filtered through a process the produces tertiary effluent with a turbidity that does not exceed an average of 2 NTU within a 24-hour period, 5 NTU (0.2 NTU for MF) more than 5% of the time within a 24-hour period, or 10 NTU at any time (0.5 NTU for MF).
- Disinfected to produce effluent that does not exceed an average MPN of 2.2 per 100 mL in past 7 days or an MPN of 23 per 100 mL in any one sample in past 30 days, and never exceeds an MPN of 240 total coliform bacteria per 100 mL.

The new treatment processes required at the BBARWA WWTP to produce disinfected tertiary include:

- Tertiary filtration
- Disinfection

A process flow diagram (PFD) for Alternative 1 is shown below and each process is described in more detail in the following subsections. The new facilities required for this alternative are outlined in blue.

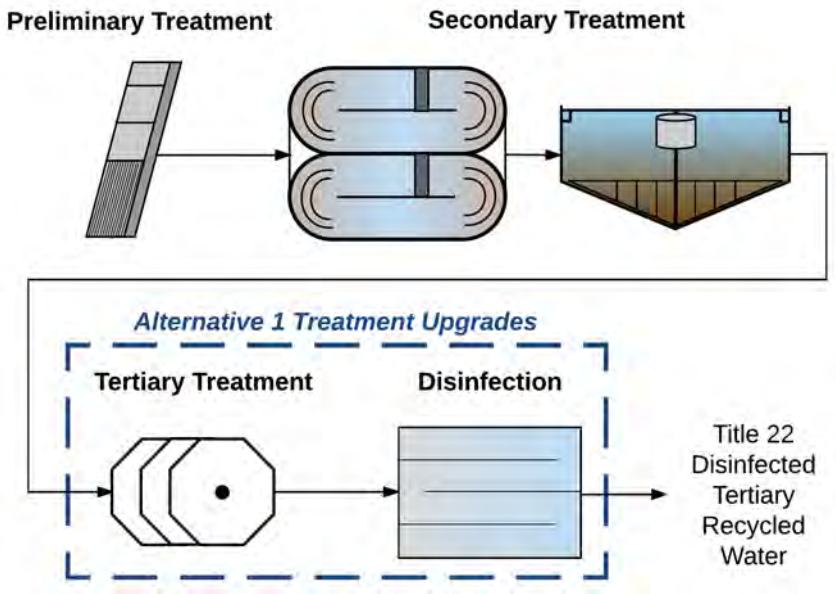


Figure 10-1 Treatment Process Flow Diagram for Alternative 1

Tertiary Filtration

Tertiary filtration is intended to remove TSS from secondary effluent prior to the disinfection process. Either surface filtration or depth filtration mechanisms may be used to perform tertiary filtration. Surface filtration units include cloth-medium surface filters, and depth filtration includes upflow and down flow media filters. Cloth media filters were selected as the tertiary filtration process because the technology is offered by multiple vendors, easy to operate and low cost. Cloth media filter units have a compact footprint and the process can be easily expanded to include additional modules for treating the total Alternative 1 reuse demand of 0.24 MGD.

The surface filtration mechanism of a cloth media filter works by an outside-in pattern of the secondary effluent wastewater flow. The cloth media filters operate submerged, rotating slowly as the water filters through the surface of the cloth, depositing solids on the outside of the media while allowing filtered water (filtrate) to flow by gravity to the effluent channel. Backwash of the cloth media filters is initiated when the solids deposited on the cloth media create too much headloss. During backwash, the flow is reversed as the cloth filters continue to rotate and vacuum suction manifolds are turned on to remove solids that were deposited on the media surface. Intermittent shutdowns are required for more intensive backwash events to remove solids that are not removed from standard backwash cycles. The effluent channel is hydraulically separated from the process tank so headloss can be measured using the water level in the effluent channel. A photo of a cloth media filter unit is shown below.

Operational characteristics that govern design of cloth filters include average and peak hydraulic loading rates (HLR). CDPH has established an allowable peak HLR of 6 gpm/sf for many of the approved cloth surface media filters, although different HLRs may be permitted for varying models of the process. Typically, cloth media filters operate between 2 to 5 gpm/sf during average conditions.

Disinfection

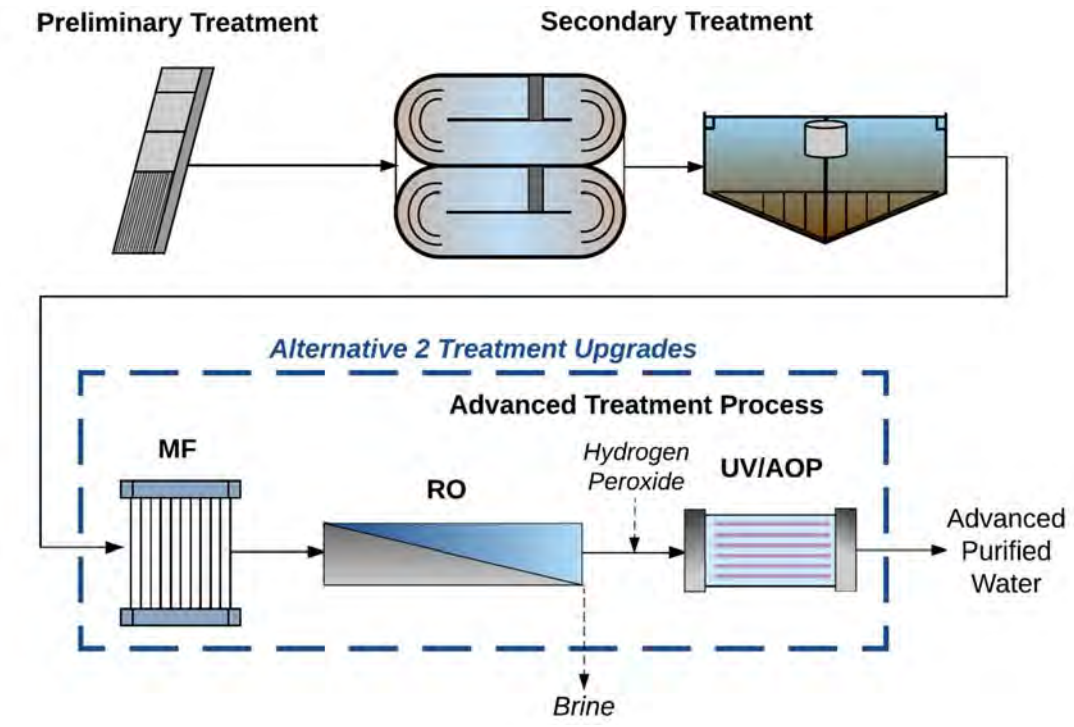
Title 22 standards require the RW used for unrestricted landscape irrigation is "filtered" and "disinfected". The disinfection process is intended to remove and inactivate viruses, bacteria and protozoa from the wastewater to make it safe for RW uses. The most common disinfection processes used for wastewater treatment are ultraviolet disinfection, ozonation and chlorination. Chlorination was selected as the disinfection process because the BBARWA staff is familiar with chlorine dosing systems, and chlorination provides adequate disinfection to reliably produce disinfected tertiary RW.

ALTERNATIVE 2: ADVANCED TREATMENT UPGRADES

For Alternative 2, BBARWA's existing secondary treatment and clarification facilities are assumed to be sufficient for adequate BOD and TSS removal prior to tertiary treatment. The secondary effluent from the existing WWTP would be fed to the advanced treatment process train consisting of:

1. Microfiltration/ultrafiltration (MF/UF)
2. Reverse Osmosis (RO)
3. Ultraviolet Advanced Oxidation (UV/AOP)
4. Brine Reduction

The combination of MF, RO and UV/AOP is considered the conventional indirect potable reuse treatment train. This treatment train meets the criteria in the DDW Regulations Related to Recycled Water (Title 22, Article 5.2). A PFD for Alternative 2 is shown below. The new facilities required for this alternative are outlined in blue.



Microfiltration

MF membranes are an efficient technology for particle removal and pathogen control either in a pressurized or submerged configuration. For the former, water is pumped through the membranes in modules or cartridges. In the latter form, membranes are submerged in tanks and water is pulled through the membranes by vacuum. Overall, membrane filtration provides a near absolute barrier to suspended solids and microorganisms.

For this analysis, pressurized MF membranes were assumed as they generally provide greater efficiency and lower operating costs at this flow range. As water is pushed through the membranes using feed pumps, the suspended solids and microorganisms are retained on the outside of the membrane. As long as the integrity of the membranes are maintained, MF finished water turbidities will be consistently below 0.1 NTU, independent of feed water quality. Due to high-quality effluent produced, MF has been shown to be the preferred pretreatment for RO systems treating wastewater.

Reverse Osmosis

High-pressure membrane processes, such as RO, are typically used for the removal of dissolved constituents including both inorganic and organic compounds. RO is a process in which the mass-transfer of ions through membranes is diffusion controlled. The feed water is pressurized, forcing water through the membranes, thereby concentrating the dissolved solids that cannot pass through the membrane. Consequently, these processes can remove salts, hardness, synthetic organic compounds, disinfection by-product precursors, etc. However, dissolved gases such as hydrogen sulfide (H_2S) and carbon dioxide, and neutral low molecular weight molecules, pass through RO membranes. The rejection by the RO membranes (removal efficiency) is not the same for all dissolved constituents, and is influenced by molecular weight, charge, and other factors.

RO is considered a high-pressure process because it operates from 75 to 1,200 psig, depending upon the TDS concentration of the feed water. Typical operating pressure in a wastewater application is in the range of 150 to 250 psi. Recoveries for RO plants operating on domestic wastewater are around 85 percent depending on the type and concentrations of sparingly soluble salts (calcium sulfate, calcium carbonate, calcium phosphate, silica, etc.) in the feed water. Silica can permanently scale RO membranes when its concentration in the process exceeds about 100 to 120 mg/L. In wastewater applications, calcium phosphate can often be the salt controlling overall recovery.

One of the issues with the RO process is discharge of the concentrate stream. The TDS removed from the feed water is concentrated in the brine stream and needs to be disposed. See Brine Reduction and Disposal.

Ultraviolet Advanced Oxidation Process

In general, advanced oxidation processes are processes that rely on chemical reactions with hydroxyl or other radicals to remove organic compounds in water. For a UV-based advanced oxidation process, a chemical oxidant is added to the process, and with exposure to the UV light, hydroxyl or other radicals are formed. The hydroxyl or other radicals are high-energy, highly reactive molecules that attack chemical bonds of organic molecules and oxidize them. UV/AOP is effective at oxidizing certain CECs such as certain endocrine disrupting compounds, PPCPs, and other microconstituents such as 1,4-dioxane and N-nitrosodimethylamine (NDMA) that can be found in wastewater effluents. In addition, with a UV/AOP process, the UV dose required for radical formation is greater than required for disinfection. Thus, a UV/AOP process provides both a disinfection barrier as well as a microconstituent barrier.

There are several chemical oxidants that can be used in combination with UV to achieve advanced oxidation. Hydrogen peroxide (H2O2) is a common oxidant used for advanced oxidation. Other chemical oxidants that can be combined with UV include ozone and hypochlorite. Each of these chemical oxidants have advantages and disadvantages.

Brine Reduction and Disposal

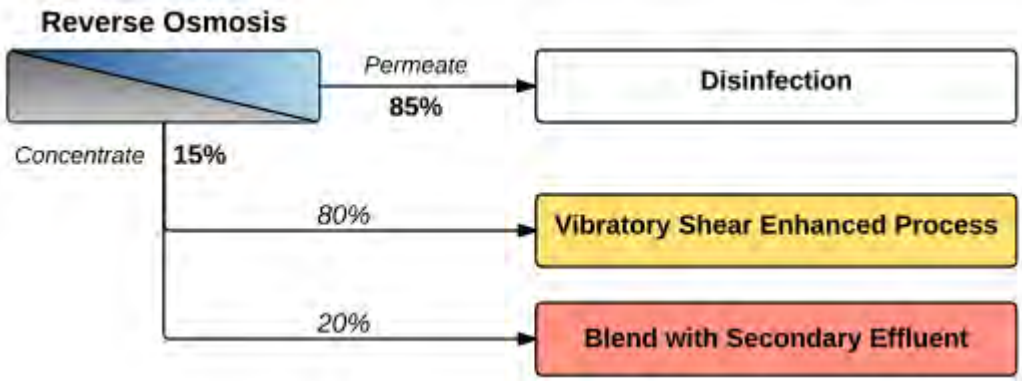
VSEP for Brine Reduction

Vibratory Shear-Enhanced Processing (VSEP), a patented process of New Logic, was developed to reduce polarization of suspended colloids and sparingly soluble salts on the membrane surface by introducing shear to the membrane surface through vibration.

The VSEP consists of four components: driving system than generates vibration, a membrane module, a torsion spring that transfers vibration to the membrane module and a system for controlling vibration. The vibration imparts a shear to the surface of the membrane to mitigate fouling and scaling that would occur in a conventional RO system. The membrane module houses a stack of flat membrane sheets (filter pack) in a plate and- frame type configuration.

Unlike conventional RO systems, VSEP is not limited by the solubility of minerals or the presence of suspended solids. It can be used in the same applications as crystallizers or brine concentrators and is capable of high recoveries (up to 90 percent). The VSEP system can be configured employing either RO or NF membranes in a single-stage or multiple-stage arrangement. The configuration depends upon quality of the wastewater to be treated, water quality goals for the VSEP permeate, and target water recovery, making it a viable option for brine reduction.

Based on the results of this study and pilot testing of brine treatment and disposal alternatives for the BBARWA WWTP, the recommended method of brine disposal was effluent mixing coupled with brine reduction and evaporation ponds (16). Under this scenario, a portion of the brine would be mixed with the secondary effluent that is discharged to the LV Site for irrigation. The portion of brine that is mixed would be limited to ensure that the effluent meets the discharge requirements of the Colorado WDR permit for the LV Site. For the remaining brine, VSEP would be used to reduce the volume of concentrate. The reduced concentrate would then be conveyed to new, lined evaporation ponds on the LV Site. A smaller brine pipeline would be installed inside the existing discharge pipeline to the LV Site. A simplified PFD depicting this scenario is presented below.

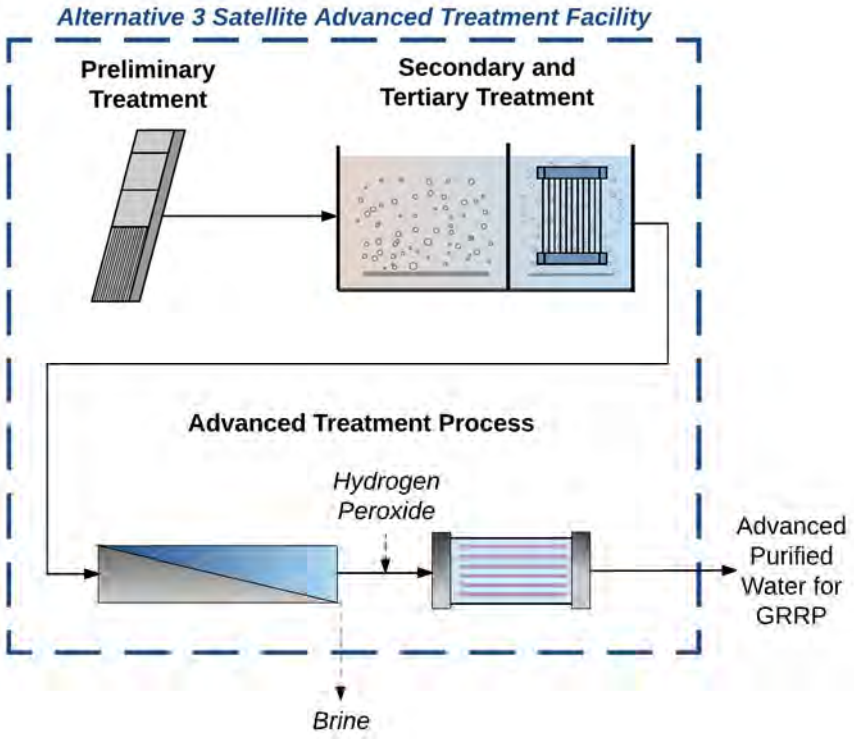


ALTERNATIVE 3: SATELLITE ADVANCED TREATMENT PLANT

For Alternative 3, a new satellite WWTP would be constructed near BBARWA's existing Lake Pump Station. The new treatment processes required for this alternative include:

1. Primary Treatment
2. Secondary and Tertiary Treatment. A Membrane Bioreactor (MBR) process is assumed.
3. Reverse Osmosis (RO)
4. Ultraviolet Advanced Oxidation (UV/AOP)
5. Brine Disposal

The combination of MBR, RO and UV/AOP is considered a conventional indirect potable reuse treatment train. This treatment train meets the criteria in the DDW Regulations Related to Recycled Water (Title 22, Article 5.2). One of the issues with the RO process is that the TDS removed from the feed water is concentrated into a brine stream that needs to be disposed of. A PFD for Alternative 3 is shown below. The new facilities required for this alternative are outlined in blue.



Preliminary Treatment

Preliminary treatment is required to remove debris such as branches and trash, and inert solids such as grit. The removal of these materials is necessary to protect downstream equipment and improve performance of downstream processes. For Alternative 3, it is assumed the preliminary treatment process would consist of a mechanical bar screen, a coarse air grit tank and a fine screen.

Large debris is typically removed using mechanical bar screens that trap objects in front of bars spaced 1-in. to 2-in. apart and remove the material with mechanical rakes. Grit and inorganic solids are removed using either coarse aeration or mechanical vortex grit tanks. The mechanisms for grit removal suspend the organic solids that are finer and lighter, while the coarse, heavy solids settle to the bottom of the tank to be removed through a hopper.

Fine screening is required for MBR treatment applications to remove small abrasive solids that have the potential to damage the membrane fibers. Fine screens are placed immediately upstream of the biological treatment and MBR tanks (secondary and tertiary treatment). The physical straining of fine solids is performed by passing the flow through 0.01-in. to 0.25-in. openings in drum, band, or static screen surfaces. The retained solids are continually washed off or transferred to a solids conveyance belt for processing.

Membrane Bioreactor

MBRs are an established technology for particle removal and pathogen control, intended for application downstream of an activated sludge process. MF modules are submerged in tanks and water is pulled through the membranes by filtrate pumps. Membrane filtration provides a near absolute barrier to suspended solids and microorganisms.

For this analysis, MBRs were assumed because the satellite plant will likely include a pre-constructed secondary process unit equipped with an activated sludge process and MBR unit. As water is filtered through the membranes, the suspended solids and microorganisms are retained on the outside of the membrane. As long as the integrity of the membranes are maintained, MBR effluent turbidities are consistently below 0.1 NTU, independent of feed water quality. Due to high-quality effluent produced, MBRs have been shown to be the preferred pretreatment for RO systems treating wastewater.

However, there are currently no pathogen log reduction credits in place for an MBR with DDW for the purposes of permitting a groundwater recharge project. The lack of credits is attributed to the inability to perform proper membrane integrity testing on the MBR membrane that is commonly performed on tertiary MF or UF membranes. It is anticipated that some level of pathogen log reduction credits will be in place for MBRs in the near future, but additional treatment processes may be required if MBR treatment receives insufficient credits.

Reverse Osmosis

A description of the reverse osmosis process is included in the Treatment Upgrade Details for Alternative 2 earlier in this Appendix.

Ultraviolet Advanced Oxidation Process

A description of the UV/AOP process is included in the Treatment Upgrade Details for Alternative 2 earlier in this Appendix.

Brine Disposal

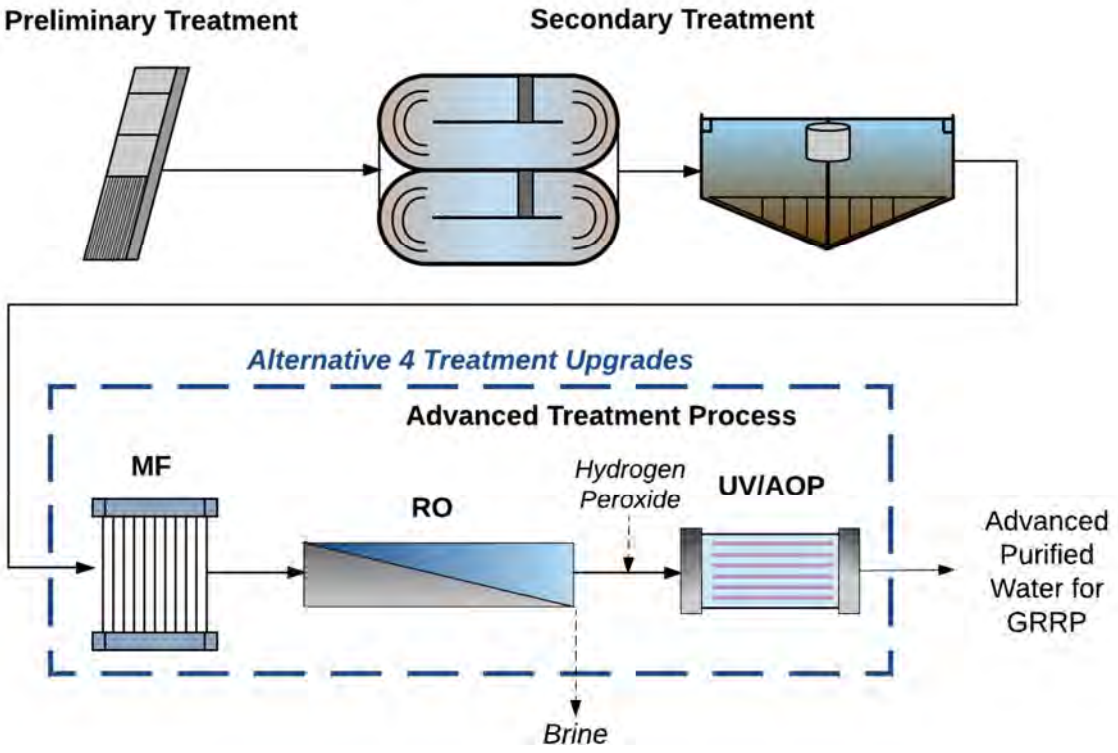
It is assumed the brine stream from the satellite advanced treatment system will be delivered back to the wastewater collection system to be managed at the BBARWA WWTP.

ALTERNATIVE 4: ADVANCED TREATMENT UPGRADES

The treatment upgrades required for implementation of Alternative 4 are identical to Alternative 2, but at a larger scale. The new treatment processes required for Alternative 4 are:

1. Microfiltration/ultrafiltration (MF/UF)
2. Reverse Osmosis (RO)
3. Ultraviolet Advanced Oxidation (UV/AOP)
4. Brine Reduction

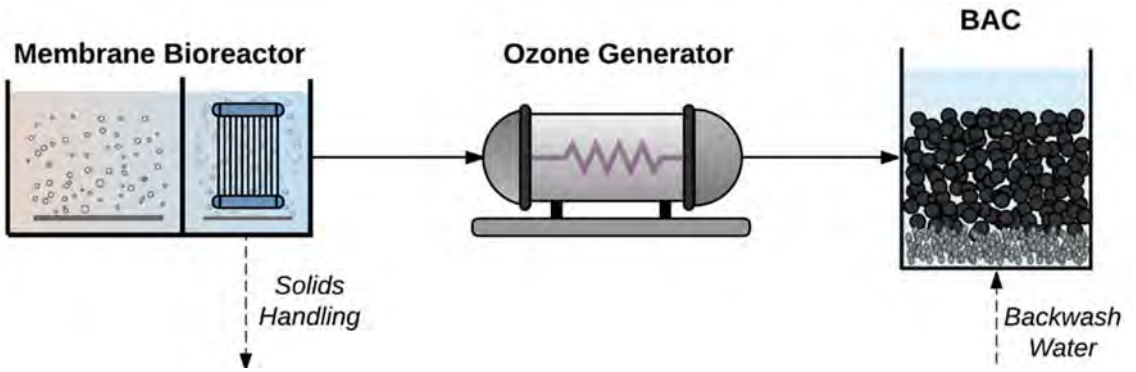
Refer to the Treatment Upgrade Details for Alternative 2 for details of the treatment upgrades required for Alternative 4. A PFD for Alternative 4 is shown below. The new facilities required for this alternative are outlined in blue.



ALTERNATIVE ADVANCED TREATMENT TECHNOLOGIES

As an inland community, the Big Bear Agencies' most significant barrier to implementing an alternative with advanced treatment is the cost of brine management. Unlike coastal communities, the Big Bear Valley does not have the advantage of discharging brine to the ocean. Communities similar to the Big Bear Valley often identify brine management costs as a financial barrier to implementing the project, which highlights the need for alternative advanced treatment technologies for potable reuse applications. Engineering professionals and organizations such as WateReuse have responded to this need by initiating research projects to evaluate alternative advanced treatment train performance compared to the conventional MBR-RO-UV/AOP treatment train.

A potential alternative advanced treatment technology for the BVWSP consists of an MBR or MF, followed by ozone oxidation and biologically activated filtration (BAF), as shown in the figure below.



This alternative advanced treatment process has shown promise for effective TOC, pathogen and synthetic compound removal in cold climates such as Colorado. Despite the performance capabilities of alternative treatment technologies such as the MBR-Ozone-BAF train, without a physical mechanism for removing and separating salts from the effluent stream, the TDS of the RW would likely be too high to be permitted for artificial recharge anywhere in the Big Bear Valley Groundwater Management Zone. It is recommended the Big Bear Agencies investigate local brine management as a means of reducing the brine management costs associated with the advanced treatment alternatives considered for the BVWSP. The SAWPA BMPTF can assist the Bear Valley Agencies in initiating an assimilative capacity study for TDS in the Big Bear Valley Groundwater Management Zone. The results of the assimilative capacity study can be used to quantify the TDS removal requirements of the advanced treatment system and refine the costs of the BVWSP artificial recharge alternatives. Based on the results of the study, it is possible only a sidestream of the RW would need to undergo RO treatment, which would save significant capital and O&M costs.

Appendix G. Cost Detail for Recycled Water Alternatives

Alternative 1
Non Potable Reuse

| **Alternative Information** | | |

Alternative 2

Greenspot Recharge

Alternative Information						
Treatment	Advanced Treatment Upgrade					
Blending Scenario	22% Tertiary, 78% Advanced					
Reuse Demand	0.89	MGD	1000	AFY		
Tertiary Treatment Capacity	1.01	MGD				
Advanced Treatment Capacity	0.82	MGD				
Capital Cost						
	Capacity/Size		Length			
RW Main - 1	12	in	16205	LF	$	3,225,000
Storage	0.9	MG			$	1,209,000
Pump Station	619	gpm			$	472,000
Tertiary Treatment Upgrade	1.01	MGD			$	2,847,000
Advanced Treatment Upgrade	0.82	MGD			$	5,156,000
Brine Management System	0.12	MGD			$	6,088,000
Recharge Basin	7	AC			$	700,000
Extraction Well	6	EA			$	6,624,000
Monitoring Well	2	EA			$	200,000
Construction Subtotal					**$**	**26,521,000**
Construction Contingency					$	5,304,000
Implementation Costs					$	10,608,000
Land Purchase					$	2,100,000
Segment Total Capital Cost					**$**	**44,533,000**
O&M Cost Estimates						
	Capacity/Size		Length			
Pipeline			16205	LF	$	32,000
Storage	0.9	MG			$	12,000
Pump Station	619	gpm				
Maintenance					$	24,000
Power					$	41,600
Tertiary Treatment	1.01	MGD			$	129,000
Advanced Treatment	0.82	MGD			$	568,000
Brine Management System	0.12	MGD			$	636,000
Compliance for Recycled Water					$	61,000
Recharge Basin	7	AC			$	35,000
Total Annual O&M Cost					**$**	**1,539,000**
Annual Capital Payment					$	2,043,000
Year 1 O&M					$	1,539,000
Total Annual Payment					$	3,582,000
Annual Yield (AFY)						1000
Unit Cost ($/AF)					**$**	**3,580**

Alternative 3
Sand Canyon Recharge

Alternative Information											
Treatment	Advanced Treatment Upgrade					Advanced Treatment Upgrade				
Blending Scenario	30% Tertiary, 70% Advanced					55% Tertiary, 45% Advanced				
Reuse Demand	0.45	MGD	500	AFY		0.46	MGD	520	AFY	
Tertiary Treatment Capacity	0.50	MGD				0.50	MGD			
Advanced Treatment Capacity	0.37	MGD				0.25	MGD			
Capital Cost										
	Capacity/Size		Length			Capacity/Size		Length		
RW Main - 1	8	in	17420	LF	$ 1,916,000	8	in	17420	LF	$ 1,916,000
Storage	0.0	MG			$ -	0.0	MG			$ -
Pump Station	310	gpm			$ 268,000	322	gpm			$ 276,000
Tertiary Scalping Plant	0.50	MGD			$ 9,270,000	0.50	MGD			$ 9,264,000
Advanced Treatment Upgrade	0.37	MGD			$ 3,293,000	0.25	MGD			$ 2,628,000
Brine Management System	0.00	MGD			$ -	0.00	MGD			$ -
Recharge Basin	2.5	AC			$ 250,000	2.5	AC			$ 250,000
Monitoring Well	2	EA			$ 200,000	2	EA			$ 200,000
Construction Subtotal					**$ 15,197,000**					**$ 14,534,000**
Construction Contingency					$ 3,039,000					$ 2,907,000
Implementation Costs					$ 6,079,000					$ 5,814,000
Segment Total Capital Cost					**$ 24,315,000**					**$ 23,255,000**
O&M Cost Estimates										
	Capacity/Size		Length			Capacity/Size		Length		
Pipeline			17420	LF	$ 19,000			17420	LF	$ 19,000
Storage	0.0	MG			$ -	0.0	MG			$ -
Pump Station	295	gpm				322	gpm			
Maintenance					$ 13,000					$ 13,000
Power					$ 41,600					$ 41,600
Tertiary Scalping Plant	0.50	MGD			$ 255,000	0.50	MGD			$ 255,000
Advanced Treatment	0.37	MGD			$ 255,000	0.25	MGD			$ 170,000
Brine Management System	0.00	MGD			$ -	0.00	MGD			$ -
New Plant Compliance					$ 662,000					$ 662,000
Recharge Basin	2.5	AC			$ 13,000	2.5	AC			$ 13,000
Total Annual O&M Cost					**$ 1,259,000**					**$ 1,174,000**
Annual Capital Payment					$ 1,116,000					$ 1,067,000
Year 1 O&M					$ 1,259,000					$ 1,174,000
Total Annual Payment					$ 2,375,000					$ 2,241,000
Annual Yield (AFY)					500					520
Unit Cost ($/AF)					**$ 4,750**					**$ 4,310**
Deduct for Shared Lake Pipeline					$ 190					$ 190
Unit Cost with Shared Lake Pipeline ($/AF)					**$ 4,560**					**$ 4,120**

Alternative 4

Combined Greenspot & Sand Canyon

Alternative Information						
Treatment	Advanced Treatment Upgrade					
Blending Scenario	22% Tertiary, 78% Advanced					
Reuse Demand	1.56	MGD	1750	AFY		
Tertiary Treatment Capacity	1.78	MGD				
Advanced Treatment Capacity	1.43	MGD				
Capital Cost						
	Capacity/Size		Length			
RW Main - 1	12	in	50182	LF	$	9,986,000
Storage	1.56	MG			$	2,028,000
Pump Station	1086	gpm			$	747,000
Tertiary Treatment Upgrade	1.78	MGD			$	3,808,000
Advanced Treatment Upgrade	1.43	MGD			$	7,053,000
Brine Management System	0.21	MGD			$	10,654,000
Recharge Basin	9.5	AC			$	950,000
Extraction Well	6	EA			$	6,624,000
Monitoring Well	4	EA			$	400,000
Construction Subtotal					**$**	**42,250,000**
Construction Contingency					$	8,450,000
Implementation Costs					$	16,900,000
Land Purchase					$	2,100,000
Segment Total Capital Cost					**$**	**69,700,000**
O&M Cost Estimates						
	Capacity/Size		Length			
Pipeline			50182	LF	$	100,000
Storage	1.56	MG			$	20,000
Pump Station	1086	gpm				
Maintenance					$	37,000
Power					$	111,300
Tertiary Treatment	1.78	MGD			$	226,000
Advanced Treatment	1.43	MGD			$	994,000
Brine Management System	0.21	MGD			$	1,113,000
Compliance for Recycled Water					$	76,250
Recharge Basin	9.5	AC			$	48,000
Total Annual O&M Cost					**$**	**2,726,000**
Annual Capital Payment					$	3,198,000
Year 1 O&M					$	2,726,000
Total Annual Payment					$	5,924,000
Annual Yield (AFY)						1750
Unit Cost ($/AF)					**$**	**3,390**

Alternative 4

Combined Greenspot & Sand Canyon Phase 1

Alternative Information						
Treatment	Advanced Treatment Upgrade					
Blending Scenario	22% Tertiary, 78% Advanced					
Reuse Demand	0.39	MGD	440	AFY		
Tertiary Treatment Capacity	0.45	MGD				
Advanced Treatment Capacity	0.36	MGD				
Capital Cost						
	Capacity/Size		Length			
RW Main - 1	12	in	16205	LF	$	3,225,000
Storage	0.39	MG			$	507,000
Pump Station	273	gpm			$	241,000
Tertiary Treatment Upgrade	0.45	MGD			$	1,859,000
Advanced Treatment Upgrade	0.36	MGD			$	3,257,000
Brine Management System	0.05	MGD			$	2,679,000
Recharge Basin	3.5	AC			$	350,000
Extraction Well	3	EA			$	3,312,000
Monitoring Well	2	EA			$	200,000
Construction Subtotal					**$**	**15,630,000**
Construction Contingency					$	3,126,000
Implementation Costs					$	6,252,000
Land Purchase					$	1,050,000
Segment Total Capital Cost					**$**	**26,058,000**
O&M Cost Estimates						
	Capacity/Size		Length			
Pipeline			16205	LF	$	32,000
Storage	0.39	MG			$	5,000
Pump Station	273	gpm				
Maintenance					$	12,000
Power					$	15,400
Tertiary Treatment	0.45	MGD			$	57,000
Advanced Treatment	0.36	MGD			$	250,000
Brine Management System	0.05	MGD			$	280,000
Compliance for Recycled Water					$	76,250
Recharge Basin	3.5	AC			$	18,000
Total Annual O&M Cost					**$**	**746,000**
Annual Capital Payment					$	1,196,000
Year 1 O&M					$	746,000
Total Annual Payment					$	1,942,000
Annual Yield (AFY)						440
Unit Cost ($/AF)					**$**	**4,410**

Alternative 4

Demonstration at Greenspot

Alternative Information						
Treatment	Advanced Treatment Upgrade					
Blending Scenario	22% Tertiary, 78% Advanced					
Reuse Demand	0.04	MGD	50	AFY		
Tertiary Treatment Capacity	0.05	MGD				
Advanced Treatment Capacity	0.04	MGD				
Capital Cost						
	Capacity/Size					
Storage	0.04	MG			$	52,000
Pump Station	500	gpm			$	86,000
Tertiary Treatment Upgrade	0.05	MGD			$	601,000
Advanced Treatment Upgrade	0.04	MGD			$	964,000
Recharge Basin	0.7	AC			$	70,000
Extraction Well	1	EA			$	1,104,000
Monitoring Well	2	EA			$	200,000
Construction Subtotal					**$**	**3,077,000**
Construction Contingency					$	615,000
Implementation Costs					$	1,231,000
Land Purchase					$	210,000
Segment Total Capital Cost					**$**	**5,133,000**
O&M Cost Estimates						
	Capacity/Size		Rate			
Water Tank Truck Rental			71	$/hr	$	222,000
Storage	0.04	MG			$	1,000
Pump Station	500	gpm				
Maintenance					$	4,000
Power					$	76,600
Tertiary Treatment	0.05	MGD			$	6,000
Advanced Treatment	0.04	MGD			$	28,000
Compliance for Recycled Water					$	61,000
Recharge Basin	0.7	AC			$	4,000
Labor for Truck Operation	2	EA			$	187,200
Total Annual O&M Cost					**$**	**590,000**
Annual Capital Payment					$	236,000
Year 1 O&M					$	590,000
Total Annual Payment					$	826,000
Annual Yield (AFY)						50
Unit Cost ($/AF)					**$**	**16,520**

Appendix H. Scoring Criteria Definitions

Qualitative & Non-Economic Evaluation Criteria

Definitions for each screening criteria and the corresponding scoring approach is described below.

1. **Promotes Water Supply Resiliency**: This criterion focuses on the benefits for improving water resource management and resiliency of water supply.
   3 = Significantly enhances management of water resources or supply resiliency
   2 = Provides some benefit for the management of water resources or supply resiliency
   1 = Does not affect management of water resources or supply resiliency

2. **O&M Complexity:** Focuses on the complexity of operating the treatment, distribution & administrative aspects of the alternative.
   3 = Simple O&M
   2 = Moderately complex O&M
   1 = Complex O&M

3. **Ease of Implementation:** Focuses on the construction sequencing, constructing phasing, jurisdictional considerations, permit acquisition and the ease of implementing the alternative.
   3 = Few barriers to implementation
   2 = Somewhat difficult to implement
   1 = Difficult to implement

4. **Benefit to Bear Valley Community:** Potential for the project to provide social, environmental, and water supply benefits to the Bear Valley community.
   3 = Significant benefit to the community
   2 = Moderate benefit to the community
   1 = Minimal benefit to the community

Appendix I. Fish Hatchery and Constructed Wetlands Concepts TM

Technical Memorandum

WSC
WATER SYSTEMS CONSULTING, INC.

Date: 6/17/2016

To: Big Bear Area Regional Wastewater Agency

Prepared by: Emily Iskin, EIT

Reviewed by: Joshua Reynolds, P.E. and Laine Carlson, P.E.

Project: Bear Valley Water Sustainability Project

SUBJECT: **DRAFT - FISH HATCHERY AND CONSTRUCTED WETLANDS CONCEPTS**

Purpose

The purpose of the Fish Hatchery and Constructed Wetlands Concepts Technical Memo is to explore the viability of developing a recirculating fish hatchery near the BBARWA WWTP that utilizes recycled water to provide community benefits for the Big Bear Valley and potentially offset project costs for the Bear Valley Water Sustainability Project. Specifically, this memo summarizes the research compiled, sources gathered, and calculations conducted regarding the fish hatchery and treatment wetlands concepts. It should be noted that the results presented here reflect concept level analysis based primarily on empirical formulas. It is recommended that the Project team engage wetlands and fish hatchery experts to advance these concepts into the planning phase.

Fish Hatchery Concept

Existing Hatcheries

While preparing considering elements for the Big Bear hatchery concept, two California Department of Fish and Wildlife (CDFW) hatcheries operating nearby were evaluated for comparison. The data summarized in Table 1 present operation data for the Mojave River Hatchery and the Fillmore Trout Hatchery operate. The data was gathered through conversations with hatchery staff.

Table 1. CDFW Fish Hatchery Summary

Characteristic	Mojave River Hatchery	Fillmore Trout Hatchery
Fish Type	Primarily rainbow trout	Primarily rainbow trout
Annual Fish Production (lbs)	~360,000 to 400,000+	~320,000
Hatchery Flows (gpm)	6,500+	4,500 to 6,500+
Hatchery Configuration	6 raceways, 10’ wide, 1,000’ long	4 raceways, 10’ wide, 1,000’ long
Ponds per Raceway	10, in series	10, in series
Staffing Requirements	7 to 8 FTE plus occasional seasonal workers	6 to 7 FTE plus up to 2 seasonal workers
Source Water	Pumped underflow from Mojave River	Pumped groundwater
Discharge Water Treatment	Settling	None
Discharge Water Uses	Return flow, irrigation, recreation	Irrigation on adjacent farms

Conceptual Big Bear Hatchery and Wetlands

Figure 1 shows the conceptual layout of a potential Big Bear Hatchery at the BBARWA WWTP. It includes a constructed treatment wetland and a flow-through fish hatchery with tertiary treatment and recirculation. Depending on the chosen configuration for the remaining WWTP processes, treatment of blend water using constructed wetlands could potentially reduce size of a microfiltration facility, but there could also be regulatory and public perception challenges.

This analysis is based on a conceptual trout hatchery that produces 150,000 lbs of fish per year. These fish would be mostly 10" long and weigh approximately 0.45 lbs/fish (2.2 fish per lb). To determine the sizing of the wetlands, the hatchery flows are calculated first as fish production is the desired outcome. Figure 2 summarizes general trout hatchery water quality criteria. The water quality criteria affect the amount of treatment required through the wetlands.

Table 5. Water Quality Criteria for Trout Hatchery Water Supplies.

Parameter	Desirable Level
Dissolved oxygen	near saturation
Carbon dioxide	< 2.0 ppm
Temperature	45-65°F
pH	6.5-8.5
Total Alkalinity (as $CaCO_3$)	10-400 ppm
Manganese	<0.01 ppm
Iron	<1.0 ppm
Zinc	<0.05 ppm
copper	<.006 ppm in soft water <0.3 ppm in hard water

Figure 1. Water Quality Parameters (Shelton 5)

It should be noted that even low concentrations of ammonia, although not shown in Figure 2, can be toxic to fish. Unionized ammonia (NH_3) levels depend on water chemistry (pH, alkalinity, and temperature). The rule of thumb is that NH_3 concentrations greater than 0.02 mg/L could be toxic to fish (5. Water Quality: Ammonia). Percent of total ammonia in freshwater based on water chemistry is summarized in Figure 3.

Table 8. Percent of Total Ammonia in the Unionized (NH_3) Form in Freshwater at Varying pH and Water Temperatures.

	TEMPERATURE		
pH	60°F	50°F	68°F
7.0	0.19	0.27	0.4
7.5	0.59	0.85	1.24
8.0	1.83	2.65	3.83
8.5	5.55	7.98	Il.18

Figure 2. Percent of Unionized Ammonia (Shelton 9)

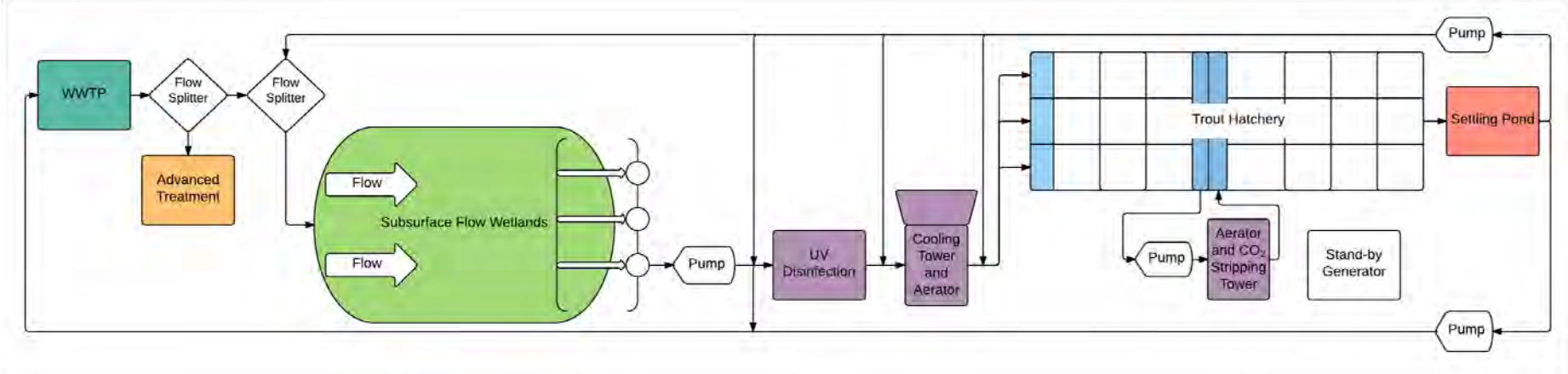


Figure 3. Conceptual Hatchery Process Diagram

Hatchery Calculations

The assumptions used in the conceptual design of the hatchery are summarized in Table 2.

Table 2. Big Bear Hatchery Characteristics

Characteristic	Value
Fish Size	10" long, 2.2 fish per lb
Weight of Fish per Year (lbs)	150,000
Hatchery Flows (gpm)	To be calculated
Hatchery Size	3 raceways, 10' wide, 800' long, 4' deep with 2' freeboard
Ponds per Raceway	8, in series

The calculations below summarize the method used to estimate the flow required to produce the desired 150,000 lb of fish. Equation 1 includes variable F, the Flow Index, "which takes flow rate into consideration when estimating maximum allowable weight of fish that a culture unit can hold," (Shelton 8). The flow is an important consideration because it "determines how rapidly fresh water will replace 'used' water (water in which fish have reduced dissolved oxygen concentrations and excreted waste products)," (Shelton 8). An F value of 0.75 was chosen because it is the middle of the range (0.5 to 1). This equation is empirical and assumes that the water is re-aerated after each pond.

Equation 1. Flow Required for a Trout Hatchery (Shelton 9)

$$Flow\ (gpm) = \frac{Weight\ (lbs\ fish)}{F * Length\ (in)}$$

$$Total\ flow = \frac{150{,}000\ lbs\ fish}{0.75 * 10\ in}$$

Total flow = 20,000 gpm total

Flow per raceway = 20,000 gpm/8 ponds/3 raceways

Flow per raceway = 833 gpm

Total flow required = 2,500 gpm

Conservative flow requirement = 3,000 gpm total

Compared to the Mojave and Fillmore hatcheries (which produce approximately twice as many fish with approximately twice this flow), a flow requirement of 3,000 gpm appears reasonable for the conceptual hatchery.

Wetlands Treatment Concept

Background

Constructed wetlands (CWs) can be used to treat effluent from a variety of processes including industrial wastewater, municipal wastewater, agricultural wastewater, landfill leachate, and stormwater runoff (Vymazal). For fish hatcheries specifically, major contaminants in fish farm effluent are fish food and fish waste (EPA Effluent Guidelines 7-2). CWs are a practical way to treat wastewater, as they require relatively low maintenance and have an approximate lifespan of 10-15 years before experiencing clogging (Cooper 24). Wetlands are great for Biological Oxygen Demand (BOD) reduction, but nitrification-denitrification (NDN) depends on the design of the wetland and pilot testing.

When it comes to types of CWs, there are both surface flow wetlands, where the water surface is above the filter/wetland media, and subsurface flow wetlands, where the water surface is below the media. Subsurface flow wetlands will be discussed here. This type of wetland performs better in cold climates, as the plant material and filter media insulate the subsurface flow (EPA Technology Assessment 2-1), and subsurface flow has a low total suspended solids (TSS) effluent which does not require filtration. There are two main types of subsurface constructed wetlands: horizontal flow (HF) and vertical flow (VF), which will be discussed in the next section.

Subsurface HF and VF CWs

The direction of fluid flow determines the category of CW. The flow in HF CWs flows in one side at the top, and out the other at the bottom as shown in Figure 4.

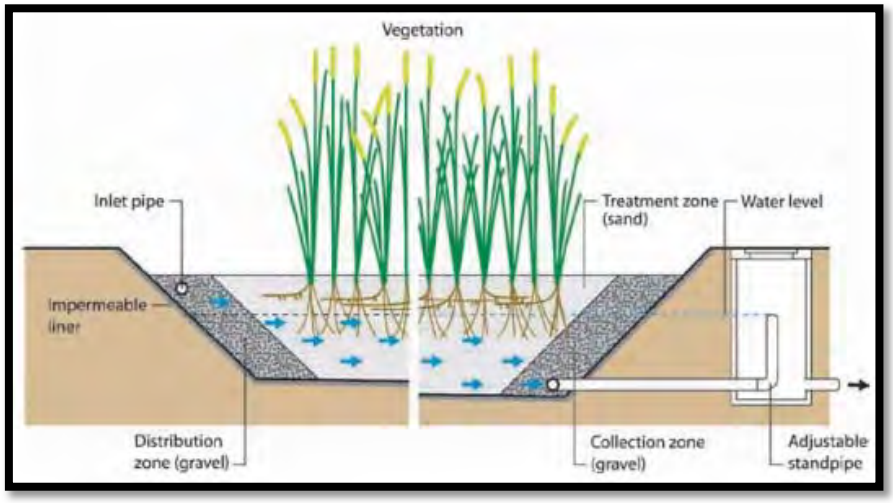


Figure 4. Horizontal Flow Wetland (Source: Greywater Management in Low and Middle-Income Countries)

The overall movement of fluid is horizontal. Because of this flow pattern, HF wetlands have very low oxygen concentrations, resulting in high denitrification ability (Vymazal 11). This is beneficial if the influent to the wetland has high concentrations of nitrates or nitrites. However, ammonia oxidation and removal occurs in an aerobic environment.

The flow to VF CWs enters along the top of the wetland media and exits along the bottom, as shown in Figure 5.

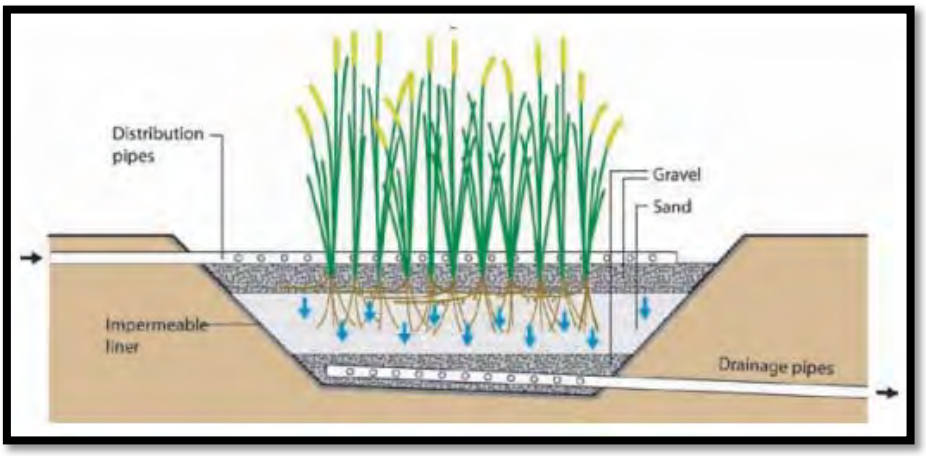


Figure 5. Vertical Flow Wetland (Source: Greywater Management in Low and Middle-Income Countries)

This flow pattern allows for a greater oxygen concentration in the subsurface wetland media, and results in high nitrification and ammonia removal ability (Vymazal 11). HF and VF CWs can be used in series to maximize the pollutant removal from the flow (Vymazal 11). "If the nitrification is achieved in a VF bed, then the nitrate can be removed by biological denitrification in an HF bed, which will be more oxygen stressed than the VF bed. Therefore, if the process design is done [skillfully], the advantages and disadvantages of the two types of beds can be used in a complementary fashion," (Cooper 18). Vymazal cites examples of both VF-HF series systems, and HF-VF series systems. Therefore, one of the main design considerations in wetland design is the properties of the constituents in the effluent from the fish hatchery. The pollutants targeted for removal will determine what types of flow need to be utilized.

Fish Hatchery Flow Constituents

The main pollutants targeted for treatment from agricultural flows are BOD_5, chemical oxygen demand (COD), TSS, Total nitrogen (TN), deionized ammonia (NH_4-N), and Total Phosphorous (TP) (Vymazal 7). Effluents from fish hatcheries differ from other types of runoff because they are very dilute, and contain a large amount of phosphorous (Vymazal 7). Phosphorous can cause eutrophication if introduced to receiving bodies of water, so the concentration of phosphorous after wetland treatment must be taken into consideration. Naylor, et al. presents a solution to the phosphorous issue: "…[T]he use of two sequential units is recommended, a first one consisting of a macrophyte planted basin using a neutral substrate to remove organic matter and N, followed by a second unplanted basin containing only a P-adsorbing substrate," (Naylor 215). This could be considered if phosphorus becomes an issue in hatchery effluent.

To provide context a general idea of the concentrations of pollutants in fish farm effluents, Table 3 summarizes 1998 data from three fish farms in Virginia presented in Chapter 7 of a report by the US EPA entitled "Effluent Guidelines: Aquatic Animal Production Industry: Economic and Environmental Analysis Document".

Table 3. Example Fish Farm Effluent Concentrations

Parameter	Farm 1 Effluent	Farm 2 Effluent	Farm 3 Effluent
Flow (MGD)	1.03-1.54	4.26-9.43	9.74-10.99
BOD_5 (mg/L)	0.96-1.9	0.6-2.4	0.5-1.8
DO (mg/L)	5.7-9.5	6.8-9.6	7.2-9.4
pH	7.3-7.8	6.9	7.8
Temperature (°C)	11-15.5	5-16.5	8.5-14
TSS (mg/L)	0.8-6	1.5-7.5	4.1-62
Settleable Solids (mg/L)	0-0.04	0.01-0.08	0.04-0.08
NH_3-N (mg/L)	0.5-0.6	0.45	0.02-0.17
Dissolved Organic Carbon (mg/L)	1.5-2.4	1.2-3.1	1.5-3.8

Governing Equations and Design Considerations

The Technology Assessment(Assessment) conducted by the Environmental Protection Agency in July 1993 describes certain equations that can be used to estimate size for CW design purposes. Darcy's Law has been used in practice to calculate either the flow rate into the CW or the cross-sectional area perpendicular to the flow:

Equation 2. Darcy's Law (EPA Technology Assessment 4-3)

$$Q = k_s A S \qquad (2)$$

Where:

- Q = flow per unit time, m^3/d (ft^3/d), or (gal/d), etc.
- k_s = hydraulic conductivity of a unit area of the medium perpendicular to the flow direction, $m^3/m^2/d$ ($ft^3/ft^2/d$), or (gal/d), etc.
- A = total cross-sectional area, perpendicular to flow, m^2 (ft^2).
- S = hydraulic gradient of the water surface in the flow system dh/dL, m/m, (ft/ft).
  (All units must be consistent)

The Assessment provides the following analysis of using Darcy's Law to approximate flow or shape: "Darcy's Law is not strictly applicable to subsurface flow wetlands because of physical limitations in the actual system. It assumes laminar flow conditions, which may not be the case when large rock or very coarse gravel are used as the media. Turbulent flow will occur in these coarse media when the hydraulic design is based on a high hydraulic gradient. Darcy's Law also assumes that the flow (Q) in the system is constant and uniform, but in the actual case in a SF wetland the input versus output Q may vary due to precipitation, evaporation, and seepage; and short circuiting of flow may occur due to unequal porosity or poor construction. **[All] of these factors limit the theoretical applicability of Darcy's Law, but it remains as the only reasonably accessible model for design of these SF systems**," (EPA Technology Assessment 4-3).

To determine BOD_5 removal, the model of a first order plug flow reactor has been used, given be Equation 3.

Equation 3. First-order Plug Flow Model (EPA Technology Assessment 3-7)

$$\frac{C_e}{C_o} = e^{(-K_T t)}$$

(4)

Where:
C_e = Effluent BOD_5 (mg/L)
C_o = Influent BOD_5 (mg/L)
K_T = temperature dependent rate constant (d^{-1})
t = hydraulic residence time (d)
$K_T = K_{20}(1.06)^{(T-20)}$
K_{20} = rate constant at 20o C, (d^{-1})
= 1.104 d^{-1}
T = temperature of liquid in the system (°C)

The surface area (length * width) can be calculated using Equation 4.

Equation 4. Surface Area to Achieve Needed BOD_5 Removal (EPA Technology Assessment 4-12)

$$A_s = (L)(W) = \frac{Q[\ln(C_o/C_e)]}{K_T dn}$$

Where:
A_s = bed surface area, m^2 (ft^2)
Other terms defined previously

For an in-depth discussion of aspect ratio, bed slope, media types, vegetation selection, and inlet and outlet structures, see the EPA's Technology Assessment.

The design process for BOD_5 removal given by the EPA is as follows:

1. Determine the media type, vegetation, and depth of bed to be used.
2. Determine by field or laboratory testing the porosity (n) and "effective" hydraulic conductivity (k_s) of the media to be used.
3. Determine the required surface area of the bed, for the desired level of BOD_5 removal [with equation 4]
4. Depending on site topography, select a preliminary aspect ratio (L:W); 0.4:1 up to 3: 1 are generally acceptable.
5. Determine bed length (L) and width (W) from the previously assumed aspect ratio, and results of step 2.
6. Using Darcy's Law [equation 2] with the previously recommended limits (k_s < 1/3 "effective" value, hydraulic gradient S < 10% of maximum potential), determine the flow (Q) which can pass through the

bed in a subsurface mode. If this Q is less than the actual design flow, then surface flow is possible. In that case it is necessary to adjust the L and W values until the Darcy's Q is equal to the design flow.

7. It is not valid to use [equation 2] with effluent BOD_5 (C_e) values below 5 mg/l. As previously discussed, these wetland systems export a BOD_5 residual due to decomposition of the natural organic detritus in the system.
8. In cold climates it is necessary to assume a design temperature for BOD_5 to first determine the required surface area. Thermal calculations are then necessary to determine the winter heat losses and bed temperature conditions during the design HRT. Further iterations of this procedure are necessary until the assumed temperature and the temperature determined by the heat loss calculations converge. (EPA Technology Assessment 4-13)

For a more detailed discussion of the caveats of using the above design steps, see the EPA's Technology Assessment by Sherwood C. Reed, cited in Works Cited.

Sample Calculation

Below is a sample design calculation for a subsurface flow constructed wetland. Table 4 lists the values used in the sample calculation.

Table 4. Values Used in Sample Calculation

Characteristic	Value	Source
Flow Rate, Q (gpm; MGD)	1,000; 1.44	Assumed
Media Type	Medium gravel	Chosen from EPA Table 5 (4-6)
Porosity, n (%)	40	Table 5
Effective Hydraulic Conductivity, k_s (m^3/m^2d)	10,000	Table 5
Vegetation Type	Reeds, *Phragmites*	Chosen from EPA Table 6 (4-12)
Root Depth (m)	0.6	Table 6
Bed Depth (ft)	3.0	Estimated
Aspect Ratio, L:W	0.4:1	Estimated
Water Surface Hydraulic Gradient, S (ft/ft)	0.01	Estimated
BOD_5 of Influent, C_o (mg/L)	10	Estimated
BOD_5 of Effluent, C_e (mg/L)	5	Estimated
Average Depth of Liquid in Bed, d (ft)	2.5	Estimated
Temperature of Fluid in System, T (°C)	10	Estimated
Rate Constant at 20°C, K_{20} (d^{-1})	1.104	EPA Tech Assessment (4-11)

a. Calculate K_T value, rate constant at temperature T:

$$K_T = K_{20}*(1.06)^{(T-20)}$$

$$K_T = (1.104)*(1.06)^{(10-20)}$$

$$K_T = 0.616\ d^{-1}$$

b. Calculate the bed surface area, A_s:

$$A_s = L*W = (Q*[\ln(C_o/C_e)]) / (K_T*d*n)$$

A_s = 216,444.84 ft^2 for a 50% BOD_5 reduction ≈ 5.0 acres

c. Calculate L and W using A_s and chosen aspect ratio:

L:W = 0.4:1 (from Table 2)

$0.4x^2 = A_s$

x = 735.60 ft

d. Check theoretical flow, Q_o against assumed flow, Q using Darcy's Equation:

$Q_o = (1/3)*k_s*A*S$ with $A = W*d$

Q_o = 1044.76 gpm

Check: $Q_o > Q$, flow will be below the surface

Note: if an S value of 0.001 is used, then Q_o = 104.48 gpm, which makes $Q_o < Q$, and surface flow is very likely to occur. Adjust inputs, such as d, S, and L:W to ensure that $Q_o > Q$ in the final design.

e. Calculate the hydraulic residence time factor, t, from plug flow model:

$t = (n*L*W*d) / Q$

$t = (0.4*A_s*2.5) / Q$

t = 1.12 days

f. Final wetland dimensions:

A_s = 216,444.84 ft^2 ≈ 5.0 acres

L = 294.24 ft

W = 735.60 ft

Conceptual Wetland Sizing for Big Bear Hatchery

The flow rate required through the wetland will depend on the recirculation rate to the hatchery and amount of makeup water used. For this analysis, it was assumed that 50% of the 3,000 gpm flow would be recirculated in the hatchery, requiring 1,500 gpm from the wetlands. Table 5 shows the values used to estimate the size for treatment wetlands.

Table 5. Values Used in Big Bear Calculation

Characteristic	Value
Flow Rate, Q (gpm)	1,500
Bed Depth (ft)	3.0
Aspect Ratio, L:W	0.52:1
BOD_5 of Influent, C_o (mg/L)	15
BOD_5 of Effluent, C_e (mg/L)	5
Average Depth of Liquid in Bed, d (ft)	2.5
Temperature of Fluid in System, T (°F)	50

A first order plug flow reactor model with maintenance of subsurface flow using Darcy's Law was used to estimate wetland size. Based on an assumed 3 day hydraulic retention time (HRT) for full NDN, 18 to 24 acres of land would be required for this wetland, as shown in Figure 6. Note that this wetland could require flood protection.

Figure 6. Conceptual Wetland Size

Potential Refinements

Alternative Treatment Options

In addition to a wetlands treatment concept, an alternative treatment option was identified.

A package wastewater treatment plant could be installed instead of a wetlands treatment system. This would include the following:

1. Headworks
    a. 1,500 gpm fine screen (50 micron or less)
    b. pH correction/nutrient addition if required
    c. Flow meter and flow control box
2. Treatment
    a. 3 trickling filter trains each capable of receiving 500 gpm
    b. Each train will have a recirculation pump, distribution header, air supply system etc.
3. Effluent Screening
    a. Final effluent will be screened prior to disposal to a polishing pond and back to the hatchery

Community Benefits

In addition to the recreational benefits that a local hatchery would provide, the following list provides a few ideas for additional elements could be incorporated to provide added community benefits:

- university research opportunities
- interactive community component that provides public tours and education for the hatchery
- interactive community component that provides public tours and education for the wetlands treatment system

Opinion of Preliminary Cost

A concept level opinion of preliminary cost was developed to provide an order of magnitude estimate for the hatchery and wetlands treatment concept to help guide decisions on next steps for this project component.

It is estimated the hatchery would cost between $8.3M and $13.2M, and the wetlands would cost between $8.0M and $11.3M, not including the cost of the plants. This gives a total of between $16.3M and $24.5M. An alternative mechanical treatment plant could cost between $6.2M and $7.5M. These costs include implementation and contingency allowance and conservative and intended for an order of magnitude analysis. Annual operating costs could be between $400,000 and $700,000, based on FTE per CDFW hatcheries and CDFW hatchery budgets.

Using an annualized cost method and assuming the capital costs are financed with a 30-year loan at 2.2% (to be consistent with the financial assumptions for the other components in the Recycled Water Facilities Planning Study), the unit cost of the fish produced would be in the range of $8 to $12 per pound.

Next Steps

The key assumptions, unknowns, and potential next steps are outlined below.

Key Assumptions and Unknowns

- A pilot study is required to understand nitrogen removal and water quality
- Evapotranspiration has not been accounted for in either the raceways or in the wetlands
    - Makeup water is available from the BBARWA WWTP
- Increased solids handling from cleaning of hatchery raceways could impact the WWTP
- Unionized ammonia ratio needs more research
    - Impacted by alkalinity, pH, temperature of water, and actual gravel source
- A pilot study is needed to assess the ability of a subsurface wetland to consistently reduce ammonia below 1 mg/L
- HRT of ~3 days to meet ammonia target
    - A reduction in HRT would reduce wetland size

Potential Next Steps

- Visits to Mojave River Hatchery
- Prepare bio-programming and hatchery feasibility study by hatchery expert
- Study feasibility of wetlands treatment for hatchery recirculation
- Investigate regulatory considerations
    - EPA, USDA, CDFW, RWQCB, etc.
- Pilot study with small-scale wetland and hatchery

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Appendix J. Fort Erwin Tank Cost Evaluation Memorandum

Memorandum

WSC
WATER SYSTEMS CONSULTING, INC.

Date: 2/27/2015

To: Reggie Lamson
Big Bear Lake Department of Water and Power
41972 Garstin Dr
Big Bear Lake, CA 92315

Phone: (909) 866-5050

Prepared by: Christy Stevens, PE and Kaylie Ashton, EIT

Reviewed by: Josh Reynolds, PE

SUBJECT: **COST ESTIMATE FOR BBARWA TANK COST**

Big Bear Lake Department of Water and Power (BBLDWP) asked Water Systems Consulting, Inc (WSC) to prepare a comparative cost opinion for construction of a 500,000 gallon modular precast concrete tank supplied by the U.S. Army Corps of Engineers (COE) and a custom cast-in place concrete tank. The COE has offered a 100' x 50' x 20' precast concrete tank (nominally 500,000 gallons storage) for use by BBLDWP/ Big Bear Area Regional Wastewater Agency (BBARWA). The tank panels are currently stored at the manufacturer's yard (Structure Cast) in Bakersfield. The precast tank will be stored at BBARWA's site until it is installed. WSC also prepared a cost opinion for a more traditional cast-in-place concrete tank in order to compare the relative value of accepting the modular precast tank from COE.

Precast Concrete Tank

The precast concrete tank has been designed and fabricated by Structure Cast to the COE project specifications. The modular tank is composed of 80 precast concrete panels as follows:

1. Thirty (30) 10' x 20' exterior wall panels
2. Twelve (12) 8.5' x 20' interior wall panels
3. Thirty-eight (38) roof panels with variable dimensions

The tank will be partially buried up to a depth of 10' and will be fabricated on a cast-in-place concrete slab foundation. Fabrication requires placing the wall panels onto rebar dowels cast into the foundation followed by installation of 1" diameter steel horizontal tie-rods which are post tensioned to pull the panels together. The tank is waterproofed with a combination of joint mastic, grout, and waterproof caulking at locations where the panels join each other or the foundation. The roof panels are set on rebar cast into the wall panels, protruding approximately 30" from the end of the wall panel which aligns with sleeves cast into the roof panels.

Work involved includes the following items:

1. Delivery and storage of the panels until ready for use
2. Design and construction of a concrete slab foundation
3. Excavation and backfill of the tank
4. Fabrication and testing of the tank

The comparative cost does not include site piping, level sensing, valves, hatches, ladders, or other work that would be comparable between the two tank options and will depend on the final selected use and layout of the tank and project site.

Precast Concrete Tank	
Work Item	**Cost ($)**
Delivery from Bakersfield to BVWSP[1]	197,000
Delivery Credit from COE[1]	(197,000)
Storage materials	5,000
Installation	
Construct concrete foundation	175,000
Excavation & backfill for half buried tank[2]	110,000
Fabricate and test tank	220,000
Subtotal	**510,000**
Confirm structural design of tank for new location[3]	5,000
Design foundation - structural and geotechnical engineering	24,000
Construction management	25,000
Subtotal	**564,000**
20% Contingency	**113,000**
Comparative Project Total	**677,000**

[1]WSC understands that the COE will over the cost of delivery to Big Bear Lake assuming the actual delivered cost is less than the budgeted delivery line item in the Fort Irwin Hospital project bid of $535,000.
[2]Excavation & backfill of completely buried tank is estimated at an additional $70,000.
[3]Structural evaluation of tank should be completed prior to accepting delivery of the tank.

Cast-in-place Concrete Tank

As a point of comparison, BBLDWP requested a cost opinion for an equivalent cast-in-place concrete tank. The cast-in-place tank would have similar dimensions to the precast tank (100' x 50' x20'). The cast-in-place concrete tank is anticipated to be a traditional steel reinforced concrete tank, comprised of a poured reinforced concrete foundation slab with reinforced walls formed and poured in place on the foundation. This option will require complete design engineering, and will be delivered by the traditional design-bid-build contract method.

Cast-in Place Concrete Tank	
Work Item	**Cost ($)**
Construct concrete foundation	175,000
Excavation and backfill for half buried tank	110,000
Cast-in-place walls	310,000
Pre-fabricated roof system	125,000
Subtotal	**710,000**
Design (includes structural, geotechnical and civil engineering)	80,000
Construction management, materials testing, office engineering	85,000
Subtotal	**875,000**
20% Contingency	175,000
Comparative Project Total	**1,050,000**

Comparison

Comparing the two project totals the precast tank is less expensive to implement with a potential savings to BBLDWP in excess of $300,000. However, this cost savings has some potential risk associated with it. The risk should be considered to increase the effective cost of the precast tank. Here are a few of the areas of concern with the precast tank:

1. The precast concrete panels have exposed steel rebar and cast sleeves that could be subject to corrosion when stored for an extended period outdoors. The corrosion, if not inhibited, could decrease the useful life of the tank. Mitigation could include coating the rebar prior to storing, and/or cleaning rust from steel prior to fabrication.
2. The tank requires long steel rods to tension the panels together, which requires alignment of the sleeves in the panels. There is +/- 1" of tolerance on the alignment of the sleeves. However, if the tank sits for an extended period it may be costly to correct any misalignment inherent in the panels. There may not be a contractual/binding obligation back to StructureCast in the future.
3. The tank design requires extensive water sealing of tank panel joints. The joints could be a potential source of leaks. If the tank doesn't pass testing for leaks and water tightness it could result in a protracted fight with the fabricator regarding the source of the leaks/defects (i.e. contractor, manufacturer, or storage defects).
4. Panels, sleeves, or rebar could be damaged during storage leading to installation/tank fabrication issues. This could require re-casting panels.
5. The design of the panels may restrict coring openings for new pipe penetrations in the interior and exterior panels to accommodate the required pipe connections and to create openings between the three storage bays. If adequate openings cannot be cored, new panels would need to be cast.

Appendix L. Question & Answer Letter

WSC
WATER SYSTEMS CONSULTING, INC.

8/30/2016

Steve Schindler
Big Bear Area Regional Wastewater Agency
121 Palomino Drive
Big Bear City, CA 92314

SUBJECT: RESPONSES TO QUESTIONS ON THE DRAFT BEAR VALLEY WATER SUSTAINABILITY PROJECT REPORT

Dear Steve,

This letter presents a summary of questions and comments received from the BBARWA Board of Directors following their review of the Draft Bear Valley Water Sustainability Project Report (Report), along with responses.

1. *Can secondary effluent and/or tertiary water be utilized for snowmaking at the local resort?*

   Yes, the State Water Resources Control Board (State Water Board) permits the use of disinfected tertiary recycled water for artificial snowmaking purposes. In late 2015, Donner Summit Public Utilities District partnered with Soda Springs Mountain Resort to become the first ski area in California to make snow using recycled water.

   This beneficial use alternative was considered as a potential refinement to Alternative 3, as described in Section 5.1.3.6 of report. Key challenges to implementation of this beneficial use in Big Bear include potential negative public perception, the cost of the recycled water, and the additional operational considerations for the Bear Mountain Resorts; therefore, it was concluded that the use of recycled water for artificial snowmaking in Big Bear is not a highly favorable opportunity. Despite these challenges, if the Big Bear Valley agencies would like to further evaluate this opportunity, the next step would be to meet with the resort owners to discuss the potential project and gauge their interest in using recycled water for snowmaking.

   Potential public perception issues can be evaluated with public surveys and addressed through focused community outreach. The cost of delivering recycled water for snowmaking could be reduced if the existing pipeline running from Lake Pump Station to Big Bear Mountain Resorts, which is currently used to deliver water for firefighting and snowmaking, was used to distribute the recycled water. Regulatory and operational considerations for shared use of the pipeline would need to be evaluated. Also, the amount of water used for snow making is minimal and seasonal, which adds to this not being a viable option.

2. *Can we "over" irrigate a crop within the Valley and utilize the incidental percolation concept to achieve recharge?*

   No, the State Water Board strictly regulates irrigation sites that use recycled water and requires that recycled water application is limited to rates required to grow the crop to minimize the potential for runoff, ponding, and incidental percolation. Regional Boards are becoming more active in enforcing this restriction. BBARWA's Waste Discharge Requirements (WDR) permit for the Lucerne Valley

irrigation site was recently updated by the Colorado River Regional Board to require an Irrigation Management Plan that includes a water balance and nutrient balance to assure that recycled water is applied at appropriate rates.

3. *What is the feasibility of using reclaimed water for release to Bear Creek?*

Bear Creek is designated as a Municipal and Domestic Water Supply in the Santa Ana River Basin Plan (Basin Plan); therefore, discharge to Bear Creek may be regulated as a potable reuse project, which would require advanced treatment. Discharge to Bear Creek under a potable reuse scheme would require an analysis to demonstrate that there would be sufficient environmental buffer before downstream water purveyors divert the water to their surface water treatment facilities. The potential negative public perceptions from the downstream users would be a key challenge to this scenario. If the Department of Drinking Water determined that the discharge to Bear Creek was not a potable reuse project, it may be possible to discharge tertiary treated recycled water to Bear Creek. However, the Basin Plan Water Quality Objective for total dissolved solids (TDS) for Bear Creek is 175 mg/L, so the recycled water would require treatment with reverse osmosis (RO) to reduce salts, increasing the cost of producing the recycled water. The pipeline from the BBARWA WWTP to Bear Creek would be approximately 12.5 miles in length and cost approximately $20 million to construct.

State Water Board Order No. 95-4 mandates a minimum flow to be released from the lake to maintain a minimum average daily flow of 1.0 cfs in Bear Creek to provide fishery protection. Potential effects to the fish and their habitat would need to be evaluated to ensure the recycled water release to Bear Creek would not result in habitat degradation.

Although this option may provide an alternative to releases from the lake, it does not provide a water supply benefit to the Big Bear Valley.

4. *What is the feasibility of implementing a small reclamation effort to get our foot in the door while planning for future expansion?*

One potential option for implementing a small reclamation effort to initiate the Bear Valley Water Sustainability Project is to construct a small-scale advanced treatment unit at the BBARWA WWTP and recharge the purified water at the Greenspot recharge site. Prior reports have demonstrated that permitting and constructing the Greenspot site for groundwater recharge is feasible. A skid-mounted advanced treatment facility could be installed at BBARWA's WWTP and tanker trucks can haul a small portion of recycled water to a demonstration recharge basin at the Greenspot site. Deferring the construction of the pipeline to the Greenspot site would reduce the initial capital investment by approximately $5 million.

Although the unit cost of small scale projects is high due to economies of scale, a small demonstration project provides opportunities for community education, proof of concept and local buy-in of the project. The small-scale project would allow the Big Bear Agencies to minimize risk of implementing a large recycled water program and reduce the initial capital expenditure necessary to initiate the program. WSC can perform a cost analysis of this alternative and include the results and a general description of the project in the Final Draft of the Report.

To make a small reclamation effort more financially feasible for the Big Bear Valley, BBARWA can pursue low interest loans or grants to help fund a recycled water program. It is common for funding agencies to solicit applications for small recycled water demonstration projects that provide habitat enhancement, social benefits, water supply benefits or educational opportunities. For example, the United States Bureau of Reclamation (USBR) recently began a Drought Response Program to fund Contingency Planning and Drought Resiliency Projects aimed at building long-term resiliency to drought. The conditions of the Drought Response Program closely align with the objective of the Bear Valley Water Sustainability Project; therefore, if the USBR Drought Response Program receives federal funding allocations for the next fiscal year, the program can be evaluated in early 2017 as a potential funding source.

5. *What is the feasibility of establishing a coalition consisting of Federal, State, County, City, CSD, DWP, MWD, BBARWA and the MWA to fund a reclamation effort?*

BBARWA, DWP, CSD and MWD have demonstrated their commitment to working together toward common benefits by partnering to develop this Report as a first step. There is an opportunity for elected representatives of these agencies to foster relationships with other elected officials to develop further support and collaborative teaming agreements to further advance a reclamation effort in the Big Bear Valley. Each agency would likely need to gain a clear understanding of the short and long term benefits to their citizens to justify a shared funding effort.

Competitive Federal and State funding programs solicit grant and low-interest loan funding for recycled water projects, and sometimes provide opportunities to combine both Federal and State funding sources to further benefit the community.

6. *The capital cost of a Brine Management System is $9,742,000 and the O&M cost is $1,018,000 or about 40% of the total annual O&M? Please provide additional details regarding components of this cost.*

The brine management system component of this Report was developed based on the findings from the CH2M and BBARWA report, *Evaluating Traditional and Innovative Concentrate Treatment and Disposal Methods for Water Recycling at Big Bear Valley, California*, completed in 2007. This study evaluated seven alternative technologies based on detailed site-specific considerations and pilot testing of some equipment. The study identified the most favorable alternative as a system consisting of a vibratory shear enhanced process (VSEP) to reduce brine volume, a blending system, a small pipeline inside the existing Lucerne Valley discharge pipeline, and new evaporation ponds in the Lucerne Valley. The 2007 study provided only total capital and O&M costs and did not provide a breakdown of costs by component. These total values were escalated to 2015 costs and scaled to match the flows used in the Report.

Due to the significant cost of brine management, one of the recommended next steps in development of a Bear Valley Water Sustainability Project is to target optimization of brine management at the existing BBARWA WWTP by evaluating:

- new and emerging technologies since the 2007 study that could reduce brine disposal costs
- local brine evaporation scenarios and sites
- alternative treatment technologies for a portion of the advanced treatment to minimize brine produced

7. *Is the useful life of equipment in this Report assumed to be 20 years? Except for pipelines, is that reasonable?*

   The useful life of equipment assumed for this Report was 20 years, except pipelines, which are designed for a useful life of 60 years or more. A useful life of 20 years for the equipment is a conservative assumption. BBARWA staff has practiced an aggressive preventive maintenance schedule to maximize the useful life of the equipment and mitigate equipment failures. For example, the bar screens at the wastewater treatment plant were installed in 1974 with an expected useful life of 15 years, but preventative maintenance activities enabled the bar screens to operate until 1993 before a major overhaul was performed. The bar screens are still in operation and have far exceeded their expected useful life of 15 years due to BBARWA's preventative maintenance practices.

8. *Is it possible to arrange a tour of Orange County's Groundwater Replenishment System?*

   Yes, the Orange County Water District frequently offers tours of their facility. WSC would be glad to coordinate with Orange County Water District to schedule a tour for the agencies that participated in this study.

9. *What is the possibility of using Big Bear Lake water to help with the 20-80% blend for groundwater recharge dilution credits?*

   The Groundwater Recharge Regulations require the diluent water source to meet drinking water standards for primary and secondary Maximum Contaminant Levels (MCLs) and notification levels. As a surface water, the existing lake water quality would not meet these drinking water standards and would require additional treatment through a surface water treatment plant.

10. *Is it correct that tertiary treated water cannot be used to augment the water supply in Big Bear Lake?*

    Disinfected tertiary recycled water could potentially be used to augment the lake levels in Big Bear Lake; however, there are currently restrictions in place that prohibit that practice. Currently, BBARWA operates under a Waste Discharge Requirement (WDR), which does not permit discharge to waters of the United States (i.e., Big Bear Lake). To enable this practice, the WDR would need to be changed to a National Pollutant Discharge Elimination System (NPDES) permit which would impose stricter discharge limits on the wastewater treatment plant effluent stream. Additionally, MWD has a resolution in place that prohibits discharge of recycled water to Big Bear Lake. This resolution would need to be rescinded by MWD to enable this practice.

    Based on discussions with regulatory agencies, using disinfected tertiary recycled water to augment the lake levels is possible, provided the necessary permits and resolutions are changed and sufficient technical analysis is performed. The analysis would have to demonstrate that the introduction of recycled water to Big Bear Lake would not degrade the water quality of the lake. The Basin Plan Water Quality Objectives for Big Bear Lake are very low for nitrogen, phosphorus, and TDS. In addition to tertiary treatment upgrades, RO treatment would need to be added to reduce the salt in the recycled water to meet the lake TDS objective of 175 mg/l.

Public perception could be a significant barrier to implementation of this practice and would need to be addresses through a community outreach program.

11. *Would a lower cost alternative be to put RO treated recycled water into Big Bear Lake?*

Yes, an alternative that delivers RO treated recycled water to the lake would have a lower cost than those presented in the report due to a lower level of treatment and a shorter pipeline. This option was not evaluated in the report because it was not found to provide a water supply benefit to the Big Bear Valley, which is a key objective of the report. Without a water supply benefit, opportunities for grants and low-interest loans would be very limited and would place more of the financial responsibility on the local community.

However, based on discussions with regulators, this is expected to be a feasible option to augment lake levels. One risk to this use of recycled water is that it may create a long term water dependency and make it difficult to change the discharge point in the future, due to political and/or environmental challenges. For example, if a water supply benefit becomes more critical and the agencies decide to transition to groundwater recharge, there could be opposition to removing the water from the lake by the community or environmental groups if the water has supported habitat in the Stanfield Marsh.

12. *Is it feasible to provide RO treated recycled water to discharge to Stanfield Marsh or Baldwin Lake?*

Prior studies of groundwater recharge potential in the Big Bear Valley have not identified Stanfield Marsh or Baldwin Lake as viable locations for groundwater recharge. In previous reports, it was concluded that Stanfield Marsh would not be conducive to percolation due to an underlying clay layer and would not provide a water supply benefit. Additionally, since the Stanfield Marsh is hydraulically connected to the Lake, the TDS objective for Stanfield Marsh would be the same as the Lake, which is 175 mg/L. Treating to this TDS level would require a significant portion of the discharge to receive RO treatment to reduce TDS.

13. *What is the feasibility of developing an initial project to include tertiary treated recycled water for irrigation and construction purposes?*

The report evaluated numerous pipe segments and customer groups for providing recycled water for irrigation and construction. Of these, Segment 1.1, which provides irrigation water for schools and parks in Sugarloaf, is the lowest cost segment. The total capital cost would be $3.3 million to serve approximately 54 AFY of recycled water. This system is a standalone system due to the higher elevation in Sugarloaf so it can be implemented independent of all other options. As a result, it would not be expandable in the future to serve additional customer or integrate with a groundwater recharge project. Although the initial capital investment for this segment would be lower, the unit cost is nearly $4,000/AF and it does not build a foundation that can be expanded upon for future reuse projects.

14. *The Report should address "gray water." I believe the County actually has a gray water ordinance, but I do not think many are aware of it.*

The Report will be edited to address gray water in Section 6.4, Water Conservation / Reduction Analysis. Implementation of private gray water systems would decrease wastewater generation, as

well as water consumption. While gray water systems provide an opportunity to increase the sustainable use of resources, widespread implementation in the Big Bear Valley would have an impact on the volume and strength of wastewater available for future reuse projects.

15. *Comment on digging deeper into Point of Use (POU) conservation measures other than the easy ones (toilets and low flow fixtures).*

    Section 6.4 of the Report, which discussed Water Conservation / Reduction Analysis will be edited to include an expanded discussion of current and proposed conservation measures being implemented by the DWP and CSD. Additional water conservation would have an impact on the volume and strength of wastewater available for future reuse projects.

16. *Look at what other arid communities/countries (Israel) do.*

    The development of water reuse in the United States has been greatly influenced by the research, experiences and treatment technologies employed in arid countries who have been pioneers in water reuse, including Israel, Singapore, and Australia. In the United States, the WateReuse Association has partnered with agencies in Singapore and Australia to share expertise and knowledge to benefit the research community and the water industry as a whole. Through conferences, research projects, and toolsets, the WateReuse Association provides its members with the newest ideas, information, and tools for evaluating and implementing water reuse projects. As an active member of the WateReuse Association, WSC regularly utilizes these state-of-the-industry resources and leveraged this information as appropriate in the development and evaluation of water reuse alternatives in the Big Bear Valley.

Please don't hesitate to reach out with any additional questions or if clarification is required for any responses contained in this letter.

Sincerely,

Water Systems Consulting, Inc.

Laine E. Carlson, PE
Project Manager

Replenish Big Bear

NOISE IMPACT ANALYSIS

COUNTY OF SAN BERNARDINO

PREPARED BY:

William Maddux
bmaddux@urbanxroads.com
(619) 778-1971

OCTOBER 2, 2023

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LIST OF ABBREVIATED TERMS

•	Reference
ANSI	American National Standards Institute
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibels
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
INCE	Institute of Noise Control Engineering
L_{eq}	Equivalent continuous (average) sound level
L_{max}	Maximum level measured over the time interval
L_{min}	Minimum level measured over the time interval
mph	Miles per hour
OSHA	Occupational Safety and Health Administration
PPV	Peak Particle Velocity
Project	Replenish Big Bear
RMS	Root-mean-square
VdB	Vibration Decibels

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EXECUTIVE SUMMARY

Urban Crossroads, Inc. has prepared this construction noise study to determine the potential noise impacts due to the proposed Replenish Big Bear development ("Project"). The Project site is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are located in the middle of this Basin. The overall Project area consists of the Valley, in the County of San Bernardino. The Project is not noise sensitive and would not be impacted by aircraft noise. Therefore, the focus of this analysis is on the potential construction related noise and vibration impacts. This noise study has been prepared to satisfy applicable County of San Bernardino construction noise standards and significance criteria based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1)

SUMMARY OF SIGNIFICANCE FINDINGS

The results of this Replenish Big Bear Noise Impact Analysis are summarized below based on the significance criteria in Section 4 of this report. Table ES-1 shows the findings of significance for each potential noise and/or vibration impact with applicable Project standard practices described in this study.

TABLE ES-1: SUMMARY OF SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
Off-Site Traffic Noise	6	*Less Than Significant*	-
Operational Noise	7	*Less Than Significant*	-
Construction Noise	8	*Significant*	*Less Than Significant*
Construction Vibration		*Less Than Significant*	-

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1 INTRODUCTION

This noise analysis has been completed to determine the construction noise impacts associated with the development of the proposed Replenish Big Bear ("Project"). This noise study briefly describes the proposed Project, provides information regarding noise fundamentals, sets out the local regulatory setting, presents the study methods and procedures for short-term construction noise and vibration impacts.

1.1 SITE LOCATION

The Project site is located within the Big Bear Valley Groundwater Management Zone (GMZ or Basin). Big Bear Lake and Baldwin Lake are located in the middle of this Basin. The overall Project area consists of the Valley, in the County of San Bernardino as shown on Exhibit 1-A.

1.2 PROJECT DESCRIPTION

The proposed Project includes upgrades and additions to Big Bear Area Regional Wastewater Agency's (BBARWA) wastewater treatment plant (WWTP) to produce purified water through full advanced treatment to protect the receiving waters and their beneficial uses. The Replenish Big Bear Program would upgrade BBARWA's WWTP to produce full advanced treated water that would be retained within the Big Bear Valley watershed to be used to increase the sustainability of local water supplies, consequently, wastewater currently delivered to Lucerne Valley will be modified. The proposed Project consists of construction and operation of the various facilities which are separated into five project categories: 1) Replenish Big Bear Component 1: Lake Discharge Pipeline Alignment; 2) Replenish Big Bear Component 2: Shay Pond; 3) Replenish Big Bear Component 3: Evaporation Pond; 4) Replenish Big Bear Component 4: BBARWA WWTP Upgrades; and 5) Replenish Big Bear Component 5: Sand Canyon.

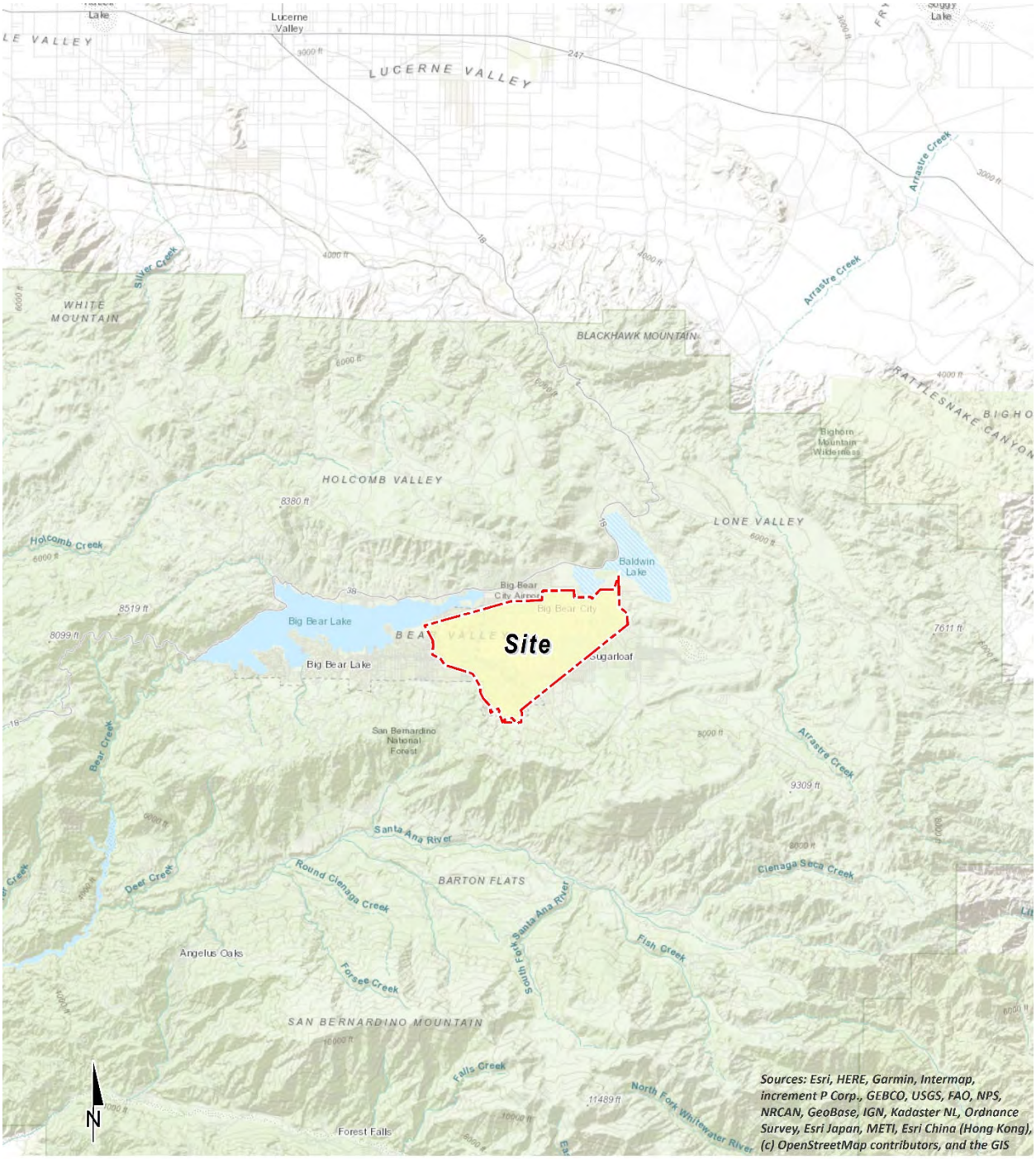
REPLENISH BIG BEAR COMPONENT 1: BBARWA WWTP UPGRADES

This Replenish Big Bear Component includes upgrades to the BBARWA WWTP, to include 2.2 MGD of full advanced treatment, producing up to 2,210 AFY of purified water. The upgrades include the construction of a 40,000 SF building which would provide the following upgrades and new construction in order of process flow:

- Upgrades to the Oxidation Ditches
- New Denitrification Filter
- New UF and RO filtration membranes
- New UV Disinfection
- New AOP
- New Pellet Reactor: 0.22 MGD

The BBARWA WWTP Treatment Upgrades also includes the installation of about 1,350 LF of brine pipeline anticipated to be sized between 8" to 10" from the pellet reactor to the solar evaporation ponds. Additionally, the BBARWA WWTP Treatment Upgrades also includes installation of a 50 gpm brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

EXHIBIT 1-A: LOCATION MAP



REPLENISH BIG BEAR COMPONENT 2: LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12" in diameter.

REPLENISH BIG BEAR COMPONENT 3: SHAY POND

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

REPLENISH BIG BEAR COMPONENT 4: EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells..

REPLENISH BIG BEAR COMPONENT 5: SAND CANYON

The Sand Canyon groundwater recharge project involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and pipeline.

As part of the Replenish Big Bear Program, the following will be constructed:

- A new 471 gpm pump station near the snowmaking pond, at the BBLDWP Sand Canyon Well site, to convey water to Sand Canyon.
- A new 8-inch pipeline that will discharge into Sand Canyon and will be approximately 7,200 feet in length.
- Two monitoring wells for groundwater recharge at Sand Canyon, as required by the future discharge permit.
- Installation of erosion control using rip rap or similar erosion control methods, at Sand Canyon.

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2 FUNDAMENTALS

Noise is simply defined as "unwanted sound." Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health. Noise is measured on a logarithmic scale of sound pressure level known as a decibel (dB). A-weighted decibels (dBA) approximate the subjective response of the human ear to broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear. Exhibit 2-A presents a summary of the typical noise levels and their subjective loudness and effects that are described in more detail below.

EXHIBIT 2-A: TYPICAL NOISE LEVELS

COMMON OUTDOOR ACTIVITIES	COMMON INDOOR ACTIVITIES	A - WEIGHTED SOUND LEVEL dBA	SUBJECTIVE LOUDNESS	EFFECTS OF NOISE
THRESHOLD OF PAIN		140	INTOLERABLE OR DEAFENING	HEARING LOSS
NEAR JET ENGINE		130		
		120		
JET FLY-OVER AT 300m (1000 ft)	ROCK BAND	110		
LOUD AUTO HORN		100	VERY NOISY	
GAS LAWN MOWER AT 1m (3 ft)		90		
DIESEL TRUCK AT 15m (50 ft), at 80 km/hr (50 mph)	FOOD BLENDER AT 1m (3 ft)	80		SPEECH INTERFERENCE
NOISY URBAN AREA, DAYTIME	VACUUM CLEANER AT 3m (10 ft)	70	LOUD	
HEAVY TRAFFIC AT 90m (300 ft)	NORMAL SPEECH AT 1m (3 ft)	60		
QUIET URBAN DAYTIME	LARGE BUSINESS OFFICE	50	MODERATE	SLEEP DISTURBANCE
QUIET URBAN NIGHTTIME	THEATER, LARGE CONFERENCE ROOM (BACKGROUND)	40		
QUIET SUBURBAN NIGHTTIME	LIBRARY	30	FAINT	NO EFFECT
QUIET RURAL NIGHTTIME	BEDROOM AT NIGHT, CONCERT HALL (BACKGROUND)	20		
	BROADCAST/RECORDING STUDIO	10	VERY FAINT	
LOWEST THRESHOLD OF HUMAN HEARING	LOWEST THRESHOLD OF HUMAN HEARING	0		

Source: Environmental Protection Agency Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004) March 1974.

2.1 RANGE OF NOISE

Since the range of intensities that the human ear can detect is so large, the scale frequently used to measure intensity is a scale based on multiples of 10, the logarithmic scale. The scale for measuring intensity is the decibel scale. Each interval of 10 decibels indicates a sound energy ten times greater than before, which is perceived by the human ear as being roughly twice as loud. (2) The most common sounds vary between 40 dBA (very quiet) to 100 dBA (very loud). Normal conversation at three feet is roughly at 60 dBA, while loud jet engine noises equate to 110 dBA

at approximately 100 feet, which can cause serious discomfort. (3) Another important aspect of noise is the duration of the sound and the way it is described and distributed in time.

2.2 NOISE DESCRIPTORS

Environmental noise descriptors are generally based on averages, rather than instantaneous, noise levels. The most commonly used figure is the equivalent level (L_{eq}). Equivalent sound levels are not measured directly but are calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period (typically one hour) and is commonly used to describe the "average" noise levels within the environment.

Peak hour or average noise levels, while useful, do not completely describe a given noise environment. Noise levels lower than peak hour may be disturbing if they occur during times when quiet is most desirable, namely evening and nighttime (sleeping) hours. To account for this, the Day-Night Average Noise Level (LDN) and the Community Noise Equivalent Level (CNEL), representing a composite 24-hour noise level is utilized. The LDN and CNEL are weighted averages of the intensity of a sound, with corrections for time of day, and averaged over 24 hours. The LDN time of day corrections include the addition of 10 decibels to dBA Leq sound levels at night between 10:00 p.m. and 7:00 a.m. The CNEL time of day corrections require the addition of 5 decibels to dBA Leq sound levels in the evening from 7:00 p.m. to 10:00 p.m., in addition to the corrections for the LDN. These additions are made to account for the noise sensitive time periods during the evening and night hours when sound appears louder. LDN and CNEL do not represent the actual sound level heard at any time, but rather represent the total sound exposure. The County of San Bernardino relies on the 24-hour CNEL level to assess land use compatibility with transportation related noise sources.

2.3 SOUND PROPAGATION

When sound propagates over a distance, it changes in level and frequency content. The way noise reduces with distance depends on the following factors.

2.3.1 GEOMETRIC SPREADING

Sound from a localized source (i.e., a stationary point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source. (2)

2.3.2 GROUND ABSORPTION

The propagation path of noise from a highway to a receiver is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation

associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 ft. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receiver such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance from a line source. (4)

2.3.3 ATMOSPHERIC EFFECTS

Receivers located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects. (2)

2.3.4 SHIELDING

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Shielding by trees and other such vegetation typically only has an “out of sight, out of mind” effect. That is, the perception of noise impact tends to decrease when vegetation blocks the line-of-sight to nearby residents. However, for vegetation to provide a substantial, or even noticeable, noise reduction, the vegetation area must be at least 15 feet in height, 100 feet wide and dense enough to completely obstruct the line-of sight between the source and the receiver. This size of vegetation may provide up to 5 dBA of noise reduction. The FHWA does not consider the planting of vegetation to be a noise abatement measure. (4)

2.4 NOISE CONTROL

Noise control is the process of obtaining an acceptable noise environment for an observation point or receiver by controlling the noise source, transmission path, receiver, or all three. This concept is known as the source-path-receiver concept. In general, noise control measures can be applied to these three elements.

2.5 NOISE BARRIER ATTENUATION

Effective noise barriers can reduce noise levels by up to 10 to 15 dBA, cutting the loudness of traffic noise in half. A noise barrier is most effective when placed close to the noise source or receiver. Noise barriers, however, do have limitations. For a noise barrier to work, it must be high enough and long enough to block the path of the noise source. (4)

2.6 LAND USE COMPATIBILITY WITH NOISE

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than are commercial or industrial developments and related activities. As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design process. The FHWA encourages State and Local government to regulate land development in such a way that noise-sensitive land uses are either prohibited from being located adjacent to a highway, or that the developments are planned, designed, and constructed in such a way that noise impacts are minimized. (5)

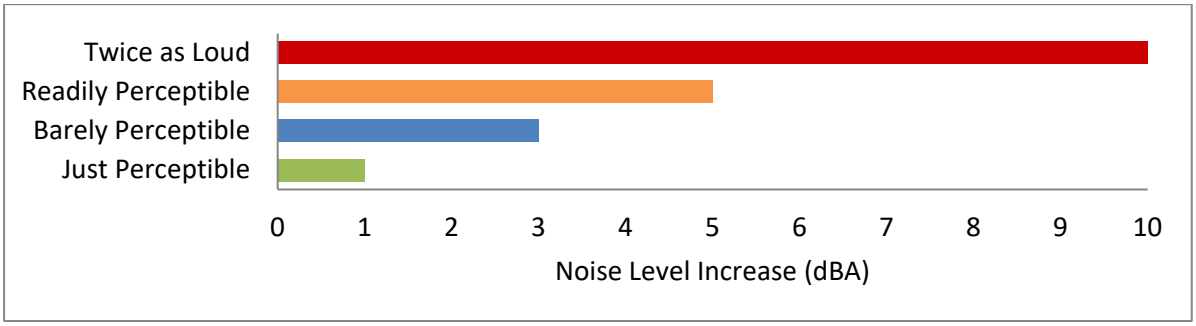
2.7 COMMUNITY RESPONSE TO NOISE

Community responses to noise may range from registering a complaint by telephone or letter, to initiating court action, depending upon everyone's susceptibility to noise and personal attitudes about noise. Several factors are related to the level of community annoyance including:

- Fear associated with noise producing activities;
- Socio-economic status and educational level;
- Perception that those affected are being unfairly treated;
- Attitudes regarding the usefulness of the noise-producing activity;
- Belief that the noise source can be controlled.

Approximately ten percent of the population has a very low tolerance for noise and will object to any noise not of their making. Consequently, even in the quietest environment, some complaints will occur. Twenty-five percent of the population will not complain even in very severe noise environments. Thus, a variety of reactions can be expected from people exposed to any given noise environment. (6) Surveys have shown that about ten percent of the people exposed to traffic noise of 60 dBA will report being highly annoyed with the noise, and each increase of one dBA is associated with approximately two percent more people being highly annoyed. When traffic noise exceeds 60 dBA or aircraft noise exceeds 55 dBA, people may begin to complain. (6) Despite this variability in behavior on an individual level, the population can be expected to exhibit the following responses to changes in noise levels as shown on Exhibit 2-B. A change of 3 dBA are considered *barely perceptible*, and changes of 5 dBA are considered *readily perceptible*. (4)

EXHIBIT 2-B: NOISE LEVEL INCREASE PERCEPTION



2.8 VIBRATION

Per the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual*, vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structure-borne noise. Sources of ground-borne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, ground-borne vibrations may be described by amplitude and frequency.

Additionally, in contrast to airborne noise, ground-borne vibration outdoors is not a common environmental problem and annoyance from ground-borne vibration is almost exclusively an indoor phenomenon (7). Therefore, the effects of vibrations should only be evaluated at a structure and the effects of the building structure on the vibration should be considered. Wood-frame buildings, such as typical residential structures, are more easily excited by ground vibration than heavier buildings. In contrast, large masonry buildings with spread footings have a low response to ground vibration (7). In general, the heavier a building is, the lower the response will be to the incident vibration energy. However, all structurers reduce vibration levels due to the coupling of the building to the soil.

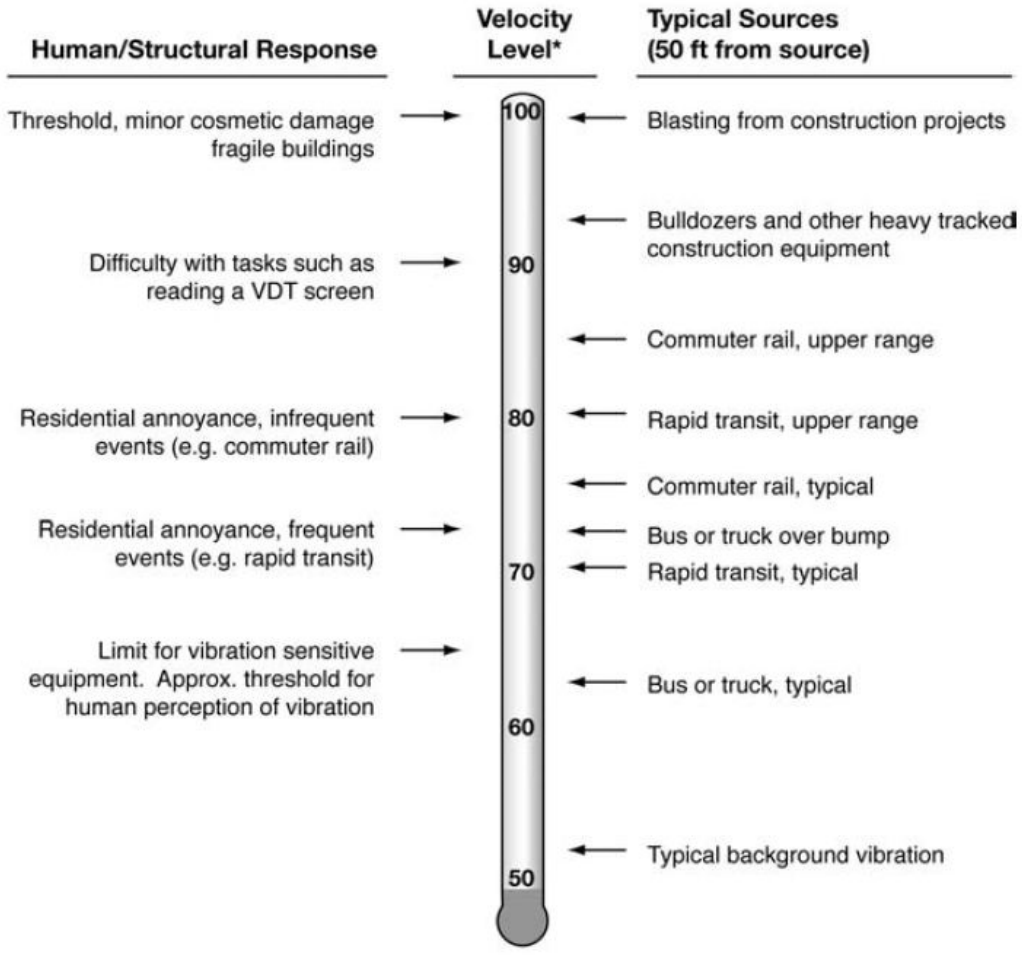
There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal (7). The PPV is most frequently used to describe vibration impacts to buildings but is not always suitable for evaluating human response (annoyance) because it takes some time for the human body to respond to vibration signals. Instead, the human body responds to average vibration amplitude often described as the root mean square (RMS). The RMS amplitude is defined as the average of the squared amplitude of the signal and is most frequently used to describe the effect of vibration on the human body (7). However, the RMS amplitude and PPV are related mathematically, and the RMS amplitude of equipment is typically calculated from the PPV reference level. The RMS amplitude is approximately 70% of the PPV (8). Thus, either can be used on the description of vibration impacts.

While not universally accepted, vibration decibel notation (VdB) is another vibration notation developed and used by the FTA in their guidance manual to describe vibration levels and provide

a background of common vibration levels and set vibration limits (9). Decibel notation (VdB) serves to reduce the range of numbers used to describe vibration levels and is used in this report to describe vibration levels.

As stated in the FTA guidance manual, the background vibration-velocity level in residential areas is generally 50 VdB. Ground-borne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground-borne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Exhibit 2-C illustrates common vibration sources and the human and structural response to ground-borne vibration.

EXHIBIT 2-C: TYPICAL LEVELS OF GROUND-BORNE VIBRATION



** RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second*

Source: Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual.

3 REGULATORY SETTING

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state have established standards and ordinances to control noise. In most areas, automobile and truck traffic is the major source of environmental noise. Traffic activity generally produces an average sound level that remains constant with time. Air and rail traffic, and commercial and industrial activities are also major sources of noise in some areas. Federal, state, and local agencies regulate different aspects of environmental noise. Federal and state agencies generally set noise standards for mobile sources such as aircraft and motor vehicles, while regulation of stationary sources is left to local agencies.

3.1 STATE OF CALIFORNIA NOISE REQUIREMENTS

The State of California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires that each county and city adopt a General Plan that includes a Noise Element which is to be prepared per guidelines adopted by the Governor's Office of Planning and Research (OPR). (10) The purpose of the Noise Element is to *limit the exposure of the community to excessive noise levels*. In addition, the California Environmental Quality Act (CEQA) requires that all known environmental effects of a project be analyzed, including environmental noise impacts.

3.2 BIG BEAR AREA REGIONAL WASTEWATER AGENCY'S

The BBARWA does not have specific noise ordinances or standards and while the BBARWA is not subject to local noise standards under CEQA, for purposes of this project the BBAQWA considers the County of San Bernardino noise standards in the determination of impacts. The County noise standards and ordinances are summarized in the following discussion.

3.2 COUNTY OF SAN BERNARDINO COUNTYWIDE PLAN

The County of San Bernardino has adopted a Countywide Plan Hazards Element, in part, to limit the exposure of the community to excessive noise levels. In most cases, no single goal, policy, or implementation program is expected to completely avoid or reduce an identified potential environmental impact. However, the collective, cumulative mitigating benefits of the polices listed below are intended to reduce noise-related impacts. Specific goals and policies are discussed in Section 5.12.4, Environmental Impacts, to demonstrate how the policy would avoid or reduce the impact. (11)

HZ-2 Human Generated Hazards: People and the natural environment protected from exposure to hazardous materials, excessive noise, and other human-generated hazards.

HZ-2.6 Coordination with Transportation Authorities: We collaborate with airport owners, FAA, Caltrans, SBCTA, SCAG, neighboring jurisdictions, and other transportation providers in the preparation and maintenance of, and updates to transportation-related plans and projects to minimize noise impacts and provide appropriate mitigation measures.

HZ-2.7 Truck Delivery Areas: We encourage truck delivery areas to be located away from residential properties and require associated noise impacts to be mitigated.

HZ-2.8 Proximity to Noise Generating Uses: We limit to restrict new noise sensitive land uses in proximity to existing conforming noise generating uses and planned industrial areas.

HZ-2.9 Control Sound at the Source: We prioritize noise mitigation measures that control sound at the source before buffers, soundwalls and other perimeter measures.

HZ-2.10 Agricultural Operations: We require new development adjacent to existing conforming agricultural operations to provide adequate buffers to reduce the exposure of new development to operational noise, odor, and the storage or application of pesticides or other hazardous materials.

3.3 COUNTY OF SAN BERNARDINO DEVELOPMENT CODE

While the County of San Bernardino Hazards Element provides guidelines and criteria to assess transportation noise on sensitive land uses, the County Code, Title 8 Development Code contains the noise level limits for mobile, stationary, and construction-related noise sources. (12)

3.3.1 TRANSPORTATION NOISE STANDARDS

Section 83.01.080(d), Table 83-3, contains the County of San Bernardino's mobile noise source-related standards, shown on Exhibit 3-A. Based on the County's mobile noise source standards, there are no exterior noise level standards for the Project commercial land use. Exterior transportation (mobile) noise level standards for residential land uses in the Project study area are shown to be 60 dBA CNEL, while non-noise-sensitive land uses, such as office uses, require exterior noise levels of 65 dBA CNEL per the County's Table 83-3 mobile noise source standards.

EXHIBIT 3-A: COUNTY OF SAN BERNARDINO MOBILE NOISE LEVEL STANDARDS

Noise Standards for Adjacent Mobile Noise Sources			
Land Use		*Ldn (or CNEL) dB(A)*	
Categories	*Uses*	*Interior (1)*	*Exterior (2)*
Residential	Single and multi-family, duplex, mobile homes	45	60(3)
Commercial	Hotel, motel, transient housing	45	60(3)
	Commercial retail, bank, restaurant	50	N/A
	Office building, research and development, professional offices	45	65
	Amphitheater, concert hall, auditorium, movie theater	45	N/A
Institutional/Public	Hospital, nursing home, school classroom, religious institution, library	45	65
Open Space	Park	N/A	65

Notes:

(1) The indoor environment shall exclude bathrooms, kitchens, toilets, closets and corridors.

(2) The outdoor environment shall be limited to:

- Hospital/office building patios
- Hotel and motel recreation areas
- Mobile home parks
- Multi-family private patios or balconies
- Park picnic areas
- Private yard of single-family dwellings
- School playgrounds

(3) An exterior noise level of up to 65 dB(A) (or CNEL) shall be allowed provided exterior noise levels have been substantially mitigated through a reasonable application of the best available noise reduction technology, and interior noise exposure does not exceed 45 dB(A) (or CNEL) with windows and doors closed. Requiring that windows and doors remain closed to achieve an acceptable interior noise level shall necessitate the use of air conditioning or mechanical ventilation.

CNEL = (Community Noise Equivalent Level). The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night from 10:00 p.m. to 7:00 a.m.

Source: County of San Bernardino County Code, Title 8 Development Code, Table 83-3.

3.3.2 OPERATIONAL NOISE STANDARDS

To analyze noise impacts originating from a designated fixed location or private property such as the Replenish Big Bear Project, stationary-source (operational) noise such as the expected pumps, compressors, and the drilling rig are typically evaluated against standards established under a jurisdiction's Municipal Code. The County of San Bernardino County Code, Title 8 Development Code, Section 83.01.080(c) establishes the noise level standards for stationary noise sources. Since the Project's land use will potentially impact adjacent noise-sensitive uses in the Project study area, this noise study relies on the more conservative residential noise level standards to describe potential operational noise impacts.

For residential properties, the exterior noise level shall not exceed 55 dBA L_{eq} during the daytime hours (7:00 a.m. to 10:00 p.m.) and 45 dBA L_{eq} during the nighttime hours (10:00 p.m. to 7:00 a.m.) for both the whole hour, and for not more than 30 minutes in any hour. (12) The exterior noise level standards shall apply for a cumulative period of 30 minutes in any hour, as well as the standard plus 5 dBA cannot be exceeded for a cumulative period of more than 15 minutes in any hour, or the standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour, or the standard plus 15 dBA for a cumulative period of more than 1 minute in any hour, or the

standard plus 20 dBA for any period of time. Further, Section 83.01.080(e) indicates that if the existing ambient noise level already exceeds any of the exterior noise level limit categories, then the standard shall be adjusted to reflect the ambient conditions. The County of San Bernardino operational noise level standards are shown on Table 3-1 and included in Appendix 3.1.

TABLE 3-1: OPERATIONAL NOISE LEVEL STANDARDS

Affected Land Uses (Receiving Noise)	7:00 a.m. - 10:00 p.m. (dBA L_{eq})	10:00 p.m. - 7:00 a.m. (dBA L_{eq})
Residential	55	45
Professional Services	55	55
Other Commercial	60	60
Industrial	70	70

L_{eq} = (Equivalent Energy Level). The sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period, typically one, eight or 24 hours.
dB(A) = (A-weighted Sound Pressure Level). The sound pressure level, in decibels, as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound, placing greater emphasis on those frequencies within the sensitivity range of the human ear.

The percentile noise descriptors are provided to ensure that the duration of the noise source is fully considered. However, due to the relatively constant intensity of the Project operational activities, the L_{50} or average L_{eq} noise level metrics best describe the pumps, compressors, and the drilling rig. In addition, the L_{eq} noise level metric accounts for noise fluctuations over time by averaging the louder and quieter events and giving more weight to the louder events. In addition, due to the mathematical relationship between the median (L_{50}) and the mean (L_{eq}), the L_{eq} will always be larger than or equal to the L_{50}. The more variable the noise becomes, the larger the L_{eq} becomes in comparison to the L_{50}. Therefore, this noise study conservatively relies on the average L_{eq} sound level limits to describe the Project operational noise levels.

3.4 CONSTRUCTION NOISE STANDARDS

Section 83.01.080(g)(3) of the County of San Bernardino Development Code, provided in Appendix 3.1, indicates that construction activity is considered exempt from the noise level standards between the hours of 7:00 a.m. to 7:00 p.m. except on Sundays and Federal holidays. (12) However, neither the County of San Bernardino General Plan or Municipal Code establish numeric maximum acceptable construction source noise levels at potentially affected receivers, which would allow for a quantified determination of what CEQA constitutes a *substantial temporary or periodic noise increase*. Therefore, a numerical construction threshold based on Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* is used for analysis of daytime construction impacts, as discussed below.

According to the FTA, local noise ordinances are typically not very useful in evaluating construction noise. They usually relate to nuisance and hours of allowed activity, and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the impact of a construction project. Project construction noise criteria should account for the existing noise

environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use. Due to the lack of standardized construction noise thresholds, the FTA provides guidelines that can be considered reasonable criteria for construction noise assessment. The FTA considers a daytime exterior construction noise level of 80 dBA L_{eq} as a threshold for noise sensitive residential land use, a noise level of 85 dBA L_{eq} for commercial locations, and 90 dBA L_{eq} for industrial locations. (7)

3.5 CONSTRUCTION VIBRATION STANDARDS

Construction activity can result in varying degrees of ground-borne vibration, depending on the equipment and methods used, distance to the affected structures and soil type. Construction vibration is generally associated with pile driving and rock blasting. Other construction equipment such as air compressors, light trucks, hydraulic loaders, etc., generates little or no ground vibration. (7)

The County of San Bernardino Development Code, Section 83.01.090(a) states that vibration shall be no *greater than or equal to two-tenths inches per second measured at or beyond the lot line*. (12) Therefore, to determine if the vibration levels due to the operation and construction of the Project, the peak particle velocity (PPV) vibration level standard of 0.2 inches per second is used.

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4 SIGNIFICANCE CRITERIA

The following significance criteria are based on currently adopted guidance provided by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (13) For the purposes of this report, impacts would be potentially significant if the Project results in or causes:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

B. Generation of excessive ground-borne vibration or ground-borne noise levels?

C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

While the County of San Bernardino General Plan Guidelines provide direction on noise compatibility and establish noise standards by land use type that are sufficient to assess the significance of noise impacts, they do not define the levels at which increases are considered substantial for use under Guideline A. CEQA Appendix G Guideline C applies to nearby public and private airports, if any, and the Project's land use compatibility..

4.1 CEQA GUIDELINES NOT FURTHER ANALYZED

The Project site is located adjacent Big Bear Airport and one option would locate a pipeline within the Big Bear Airport. However, the project would not erect any structures near the airport and would not locate any incompatible land uses within the airport influence area (14). The Project is a water infrastructure development and would not place people within the airport land use plan area. As such, the Project site would not be exposed to excessive noise levels from airport operations and would not conflict with the airport land use plan, and therefore, impacts are considered *less than significant,* and no further noise analysis is conducted in relation to Guideline C.

The Project site will not include any residential or commercial office space and thus does not conflict with any interior noise level requirements. Similarly, the project would not result in substantial new trips on local roadways, rather future maintenance activities at new facilities would be carried out by the existing maintenance crews and the BBARWA WWTP upgrades would not require substantial new staff. Therefore, the Project would not result in a substantial off-site traffic increase.

4.2 SIGNIFICANCE CRITERIA SUMMARY

Noise impacts shall be considered significant if any of the following occur as a direct result of the proposed development. Table 4-1 shows the significance criteria summary matrix that includes the allowable criteria used to identify potentially significant incremental noise level increases.

TABLE 4-1: SIGNIFICANCE CRITERIA SUMMARY

Analysis	Land Use	Condition(s)	Significance Criteria	
			Daytime	**Nighttime**
Construction	Noise-Sensitive	Permitted between 7:00 a.m. to 7:00 p.m.; except Sundays and Federal holidays.[3]		
		Noise Level Threshold[1]	80 dBA L_{eq}	n/a
		Vibration Level Threshold[4]	0.2 PPV in/sec	n/a

[1] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual.
[2] County of San Bernardino Development Code, Title 8, Section 83.01.080 (Appendix 3.1)
[3] Section 83.01.080(g)(3) of the County of San Bernardino County Code.
[4] Section 83.01.090(a) of the County of San Bernardino County Code.
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m. "n/a" = construction activities are not planned during the nighttime hours; "PPV" = peak particle velocity.

5 EXISTING NOISE LEVEL MEASUREMENTS

To assess the existing noise level environment, 24-hour noise level measurements were taken at six locations in the Project study area. The receiver locations were selected to describe and document the existing noise environment within the Project study area. Exhibits 5-A and 5-B provide the noise level measurement locations. To fully describe the existing noise conditions, noise level measurements were collected by Urban Crossroads, Inc. on Wednesday, July 12, 2023. Appendix 5.1 includes study area photos.

5.1 MEASUREMENT PROCEDURE AND CRITERIA

To describe the existing noise environment, the hourly noise levels were measured during typical weekday conditions over a 24-hour period. By collecting individual hourly noise level measurements, it is possible to describe the equivalent daytime and nighttime hourly noise levels. The long-term noise readings were recorded using Piccolo Type 2 integrating sound level meter and dataloggers. The Piccolo sound level meters were calibrated using a Larson-Davis calibrator, Model CAL 150. All noise meters were programmed in "slow" mode to record noise levels in "A" weighted form. The sound level meters and microphones were equipped with a windscreen during all measurements. All noise level measurement equipment satisfies the American National Standards Institute (ANSI) standard specifications for sound level meters ANSI S1.4-2014/IEC 61672-1:2013. (15)

5.2 NOISE MEASUREMENT LOCATIONS

The long-term noise level measurements were positioned as close to the nearest sensitive receiver locations as possible to assess the existing ambient hourly noise levels surrounding the Project site. Both Caltrans and the FTA recognize that it is not reasonable to collect noise level measurements that can fully represent every part of a private yard, patio, deck, or balcony normally used for human activity when estimating impacts for new development projects. This is demonstrated in the Caltrans general site location guidelines which indicate that, *sites must be free of noise contamination by sources other than sources of interest. Avoid sites located near sources such as barking dogs, lawnmowers, pool pumps, and air conditioners unless it is the express intent of the analyst to measure these sources*. (2) Further, FTA guidance states, t*hat it is not necessary nor recommended that existing noise exposure be determined by measuring at every noise-sensitive location in the project area. Rather, the recommended approach is to characterize the noise environment for clusters of sites based on measurements or estimates at representative locations in the community*. (16)

Based on recommendations of Caltrans and the FTA, it is not necessary to collect measurements at each individual building or residence, because each receiver measurement represents a group of buildings that share acoustical equivalence. (16) Collecting reference ambient noise level measurements at the nearest sensitive receiver locations allows for a comparison of the before and after Project noise levels and is necessary to assess potential noise impacts due to the Project's contribution to the ambient noise levels.

EXHIBIT 5-A: NOISE MEASUREMENT LOCATIONS 1 TO 3

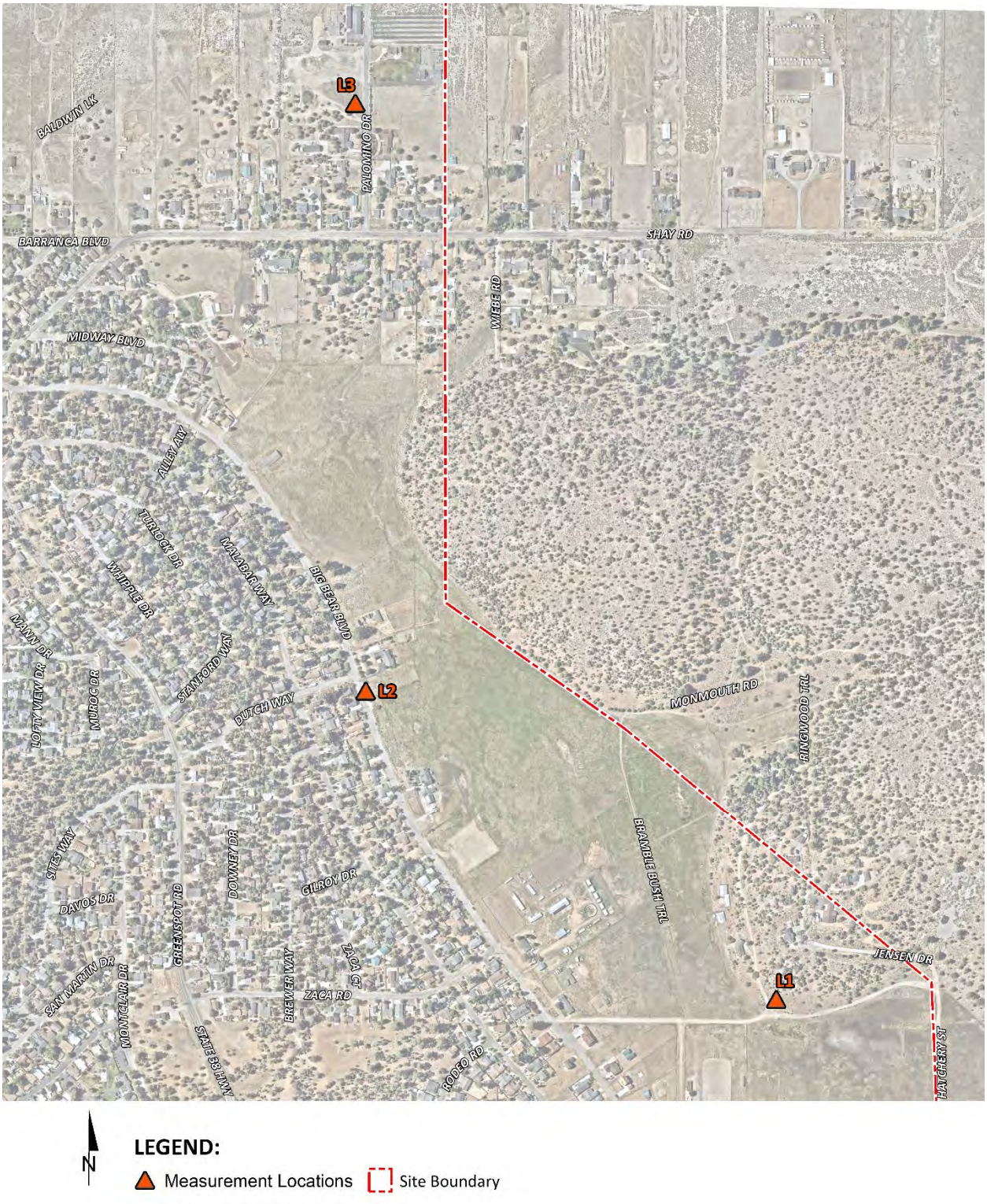

EXHIBIT 5-B: NOISE MEASUREMENT LOCATIONS 4 TO 6

5.3 NOISE MEASUREMENT RESULTS

The noise measurements presented below focus on the average or equivalent sound levels (L_{eq}). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period. Table 5-1 identifies the hourly daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) noise levels at each noise level measurement location during typical weekday Friday conditions and weekend Saturday conditions. Appendix 5.2 provides a summary of the existing hourly ambient noise levels described below:

TABLE 5-1: 24-HOUR AMBIENT NOISE LEVEL MEASUREMENTS

Location[1]	Description	Energy Average Noise Level (dBA L_{eq})[2]	
		Daytime	Nighttime
L1	Northwest of Shay Pond near 2025 Garnet Street	46.7	42.7
L2	Located near 1485 E Big Bear Blvd	51.6	43.0
L3	Located near 109 Palomino Drive	46.9	44.3
L4	Located near 1467 Lassen Drive	42.1	46.9
L5	Located near 43652 Sand Canyon Road	48.3	38.3
L6	Located near 43485 Colusa Drive	42.9	40.5

[1] See Exhibit 5-A and B for the noise level measurement locations.
[2] Energy (logarithmic) equivalent levels. The long-term 24-hour measurement worksheets are included in Appendix 5.2. "Daytime" = 8:00 a.m. to 10:00 p.m.; "Nighttime" = 10:01 p.m. to 7:59 a.m.

Table 5-1 provides the (energy average) noise levels used to describe the daytime and nighttime ambient conditions. These daytime and nighttime energy average noise levels represent the average of all hourly noise levels observed during these time periods expressed as a single number. Appendix 5.2 provides summary worksheets of the noise levels for each hour as well as the minimum, maximum, L_1, L_2, L_5, L_8, L_{25}, L_{50}, L_{90}, L_{95}, and L_{99} percentile noise levels observed during the daytime and nighttime periods. The background ambient noise levels in the Project study area are dominated by the transportation-related noise associated with surface streets.

6 RECEIVER LOCATIONS

To assess the potential for operational and construction noise impacts, the following receiver locations, as shown on Exhibit 6-A, were identified as representative locations for analysis. Sensitive receivers are generally defined as locations where people reside or where the presence of unwanted sound could otherwise adversely affect the use of the land. The County of San Bernardino General Plan Noise Element defines noise-sensitive uses as residences, hospitals, convalescent and day care facilities, schools, and libraries. (17) Moderately noise-sensitive land uses typically include multi-family dwellings, hotels, motels, dormitories, out-patient clinics, cemeteries, golf courses, country clubs, athletic/tennis clubs, and equestrian clubs. Land uses that are considered relatively insensitive to noise include business, commercial, and professional developments. Land uses that are typically not affected by noise include: industrial, manufacturing, utilities, agriculture, undeveloped land, parking lots, warehousing, liquid and solid waste facilities, salvage yards, and transit terminals.

To describe the potential off-site Project noise levels, seven receiver locations in the vicinity of the Project site were identified. All distances are measured from the Project site boundary to the outdoor living areas (e.g., private backyards), Project boundary line, or at the building façade, whichever is closer to the Project site. The selection of receiver locations is based on FHWA guidelines and is consistent with additional guidance provided by Caltrans and the FTA, as previously described in Section 5.2. Other sensitive land uses in the Project study area that are located at greater distances than those identified in this noise study will experience lower noise levels than those presented in this report due to the additional attenuation from distance and the shielding of intervening structures. Distance is measured in a straight line from the project boundary to each receiver location.

R1: Location R1 represents the backyard of existing noise sensitive residence located at 109 Palomino Drive located south of the BBARWA WWTP. R1 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L3, to describe existing ambient noise level.

R2: Location R2 represents the backyard existing noise sensitive residence located at 116 Palomino Drive, south of the BBARWA WWTP. R2 is placed in the private outdoor living areas (backyard) facing the Project site.

R3: Location R3 represents an existing noise sensitive residence located at 1458 Shay Road. This residence is located east of the Shay Pond Pipeline alignment. Since there are no private outdoor living areas (e.g. backyards) facing the Project site, receiver R3 is placed at the building façade.

R4: Location R4 represents an existing noise sensitive residence located at 1485 E Big Bear Boulevard west of the Shay Pond Pipeline alignment. R4 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L2, to describe existing ambient noise level.

R5: Location R5 represents an existing noise sensitive residence located at 2025 Garnet Street east of the Shay Pond Pipeline alignment and west of Shay Pond. Receiver R5 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L1, to describe existing ambient noise level.

R6: Location R6 represents an existing noise sensitive residence located at 1467 Lassen Drive northeast of the Sand Canyon Conveyance Pipeline and Pump Station of the Project site. Receiver R6 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L4, to describe existing ambient noise level.

R7: Location R7 represents an existing noise sensitive residence located at 43861 Mendocino Drive northeast of the Sand Canyon Recharge Area. Receiver R7 is placed in the private outdoor living areas (backyard) facing the Project site.

R8: Location R8 represents an existing noise sensitive residence located at 43817 Sand Canyon Road southwest of the Sand Canyon Recharge Area. Receiver R8 is placed in the private outdoor living areas facing the Project site.

R9: Location R9 represents an existing noise sensitive residence located at 43652 Sand Canyon Road south of the Sand Canyon Recharge Area. Receiver R9 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L5, to describe existing ambient noise level.

R10: Location R10 represents an existing noise sensitive residence located at 43485 Colusa Drive northeast of the Sand Canyon Recharge Area. Receiver R10 is placed in the private outdoor living areas (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L6, to describe existing ambient noise level.

Pipeline Receivers: Receivers located along pipeline routes occur along nearly all off-site pipeline alignments. For purposes of analysis, and based on a survey of project alignments, the majority of roadways and potential rights-of-way are the width of 2 lane roadways (approximately 24 feet), thus receivers (e.g. residential buildings) are evaluated as close as 20 feet from the centerline of the pipeline construction activities.

EXHIBIT 6-A: BBARWA WWTP, SHAY POND, AND PIPELINE RECEIVER LOCATIONS

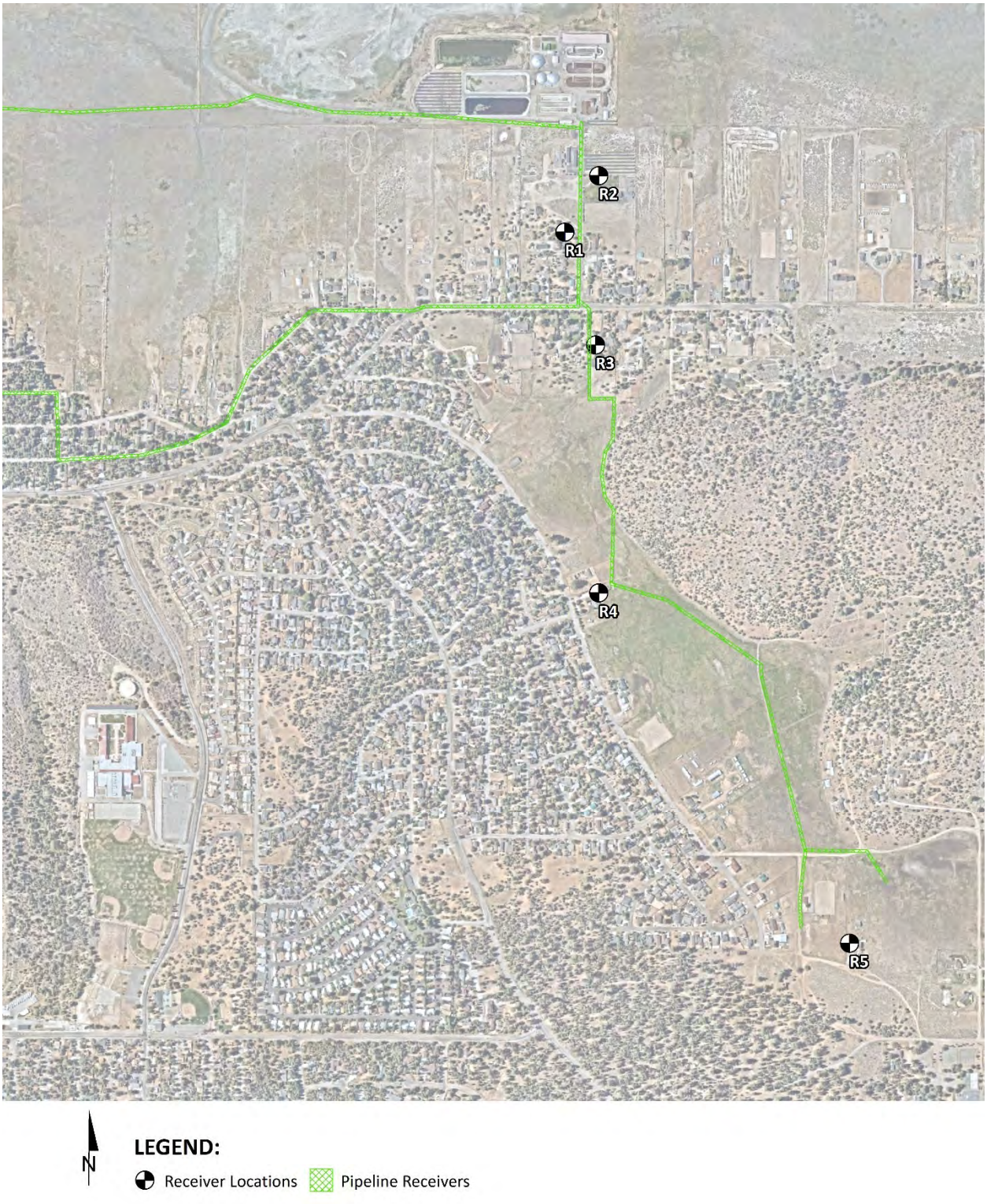

EXHIBIT 6-B: PIPELINE RECEIVER LOCATIONS - EAST

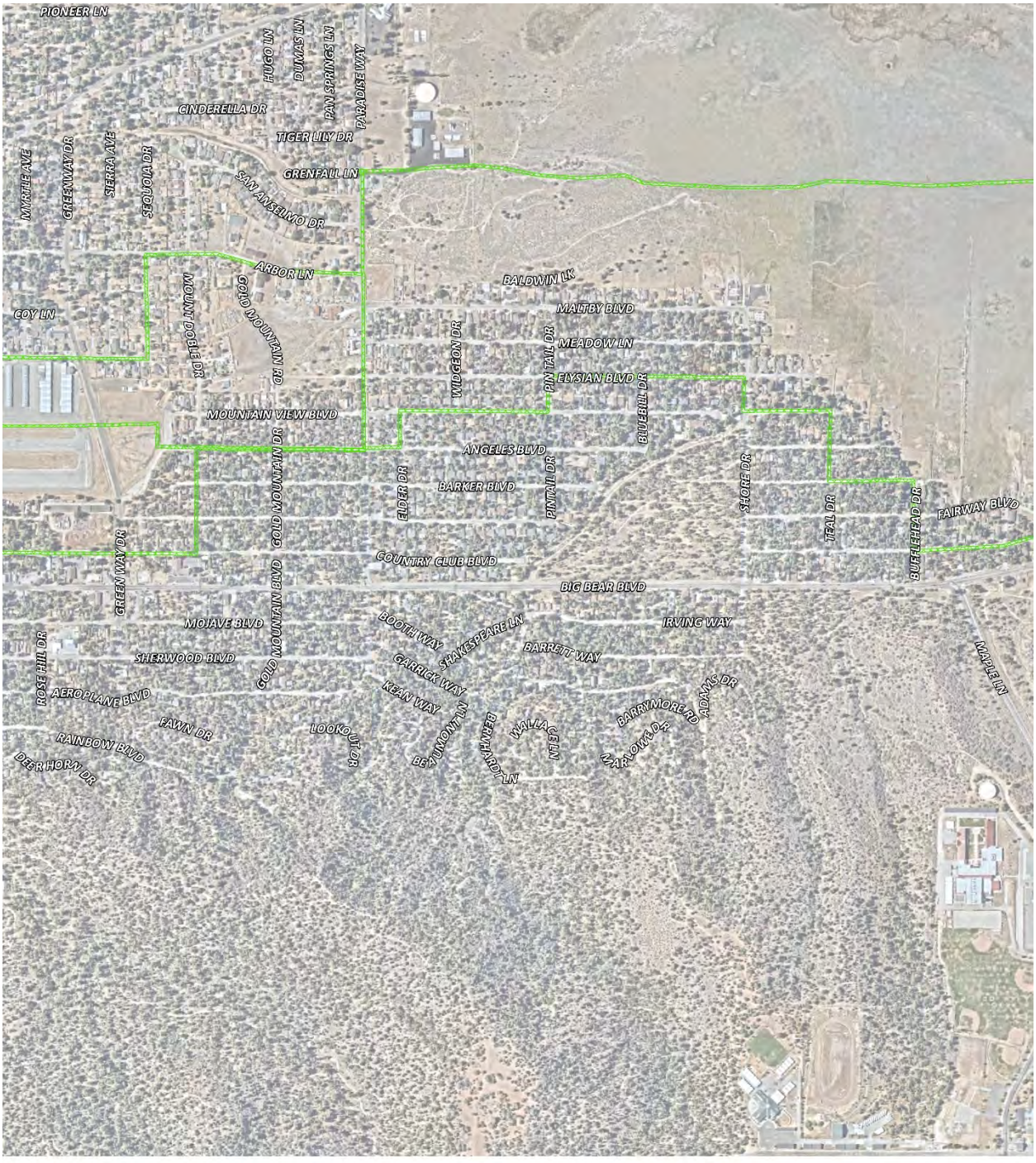

EXHIBIT 6-C: PIPELINE RECEIVER LOCATIONS - WEST

EXHIBIT 6-D: SAND CANYON RECEIVER LOCATIONS

7 OPERATIONAL NOISE IMPACTS

The Project will include several improvements at the BBARWA WWTP, however, all new noise sources would be housed inside the new building and the two pumps at the BBARWA WWTP would be housed in concrete masonry unit (CMU) buildings. Similarly, the proposed Sand Canyon pump station would be housed in a CMU building. The proposed structures would achieve between 40 and 50 dBA in noise reduction from pump noise to exterior locations. The proposed pumps are anticipated to generate up to 60 dBA at 32 feet. Based on the anticipated reduction, pump noise would be 30 dBA L_{eq} less outside the building. Therefore, operational noise sources would be well controlled and are not anticipated to result in substantial noise level increases.

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8 CONSTRUCTION IMPACTS

This section analyzes potential impacts resulting from the construction noise and vibration activities associated with the development of the Project.

8.1 CONSTRUCTION NOISE SOURCES

Noise generated by the Project construction equipment will include a combination of trucks, power tools, concrete mixers, and portable generators that when combined can reach high levels. The Project is construction noise sources are expected to include a combination of loaders, cranes, welders, drill rigs, diesel generators, concrete pumps and mixture of other construction equipment.

As discussed under the Project description, Project construction activities are expected to occur in the following phases:

- Component 1: BBARWA WWTP Upgrades
- Component 2: Lake Discharge Pipeline Alignment
- Component 3: Shay Pond Conveyance Pipeline
- Component 4: Evaporation Pond
- Component 5: Sand Canyon

BBARWA WWTP UPGRADES

The upgrades include the construction of a 40,000 SF building, upgrades to the oxidation ditches, a denitrification filter, ultrafiltration (UF) and reverse osmosis (RO) filtration membranes, ultraviolet disinfection with advanced oxidation process (UV -AOP), and a 0.22 million gallons per day (MGD) Pellet Reactor. The BBARWA WWTP Treatment Upgrades includes the installation of about 1,350 linear feet (LF) of brine pipeline anticipated to be sized between 8” to 10” from the pellet reactor to the solar evaporation ponds within the existing facility boundaries.

Additionally, the BBARWA WWTP Treatment Upgrades include the installation of a 50 gallon per minute (gpm) brine pump station and a 1,520 gpm pump station at the BBARWA WWTP to pump purified water to Shay Pond and Stanfield Marsh.

Construction of the BBARWA WWTP Upgrades would include typical demolition, site preparation, grading, building construction, and architectural coatings activities. It is anticipated that BBARWA WWTP Upgrades could be constructed while the evaporation ponds are being constructed and have been modeled as simultaneous construction. Exhibit 8-A shows the construction noise source locations and receiver locations used to assess the construction noise levels from the BBARWA WWTP Upgrades.

EXHIBIT 8-A: BBARWA WWTP AND EVAPORATION POND CONSTRUCTION NOISE SOURCES AND RECEIVER LOCATIONS

LAKE DISCHARGE PIPELINE ALIGNMENT

The Replenish Big Bear Program would ultimately install a pipeline utilizing one of three alignments from the WWTP to Stanfield Marsh in the amount of about 19,940 LF sized at 12" in diameter. Construction of the Lake Discharge Pipelines would include roadway demolition, pipeline installation, roadbed backfilling, grading, and paving activities. It is anticipated that Lake Discharge Pipelines would be constructed with multiple teams, however, pipeline construction would not physically overlap, rather improvements would occur in multiple locations along the alignment and represent individual events at multiple locations. For locations within existing paved right-of-way, pipeline construction is anticipated to extend 200-300 LF per day, while construction along unpaved areas would extend 400-500 LF per day. Pipeline construction is modeled as a single 200 foot long moving point source along the alignment

Receiver locations used to assess the construction noise levels from the Lake Discharge Pipelines component would occur at various locations all along the pipeline alignment, with receivers as close as 30 feet from potential construction locations. The potential pipeline alignments are Shown in Exhibit 8-B. Receivers are assumed to occur approximately 30 feet from the center of all alignments in public rights-of-way.

SHAY POND CONVEYANCE PIPELINE

The Replenish Big Bear Program would ultimately install about 710 LF of 4" pipeline to reach Shay Pond from either an existing pipeline or a new 6" pipeline that would be 5,600 LF. As such, this Replenish Big Bear Component includes the installation of up to 6,310 LF of conveyance pipeline.

Construction of the Shay Pond Conveyance Pipeline and monitoring wells would include roadway demolition, pipeline installation, backfilling, and grading, activities along Shay Road. It is anticipated that Shay Pond Conveyance Pipeline would be constructed with multiple teams. Construction along unpaved areas pipeline construction activities would extend 400-500 LF per day. Exhibit 8-C shows the construction noise source locations and receiver locations used to assess the construction noise levels from the Shay Pond Conveyance Pipeline.

EVAPORATION POND

The Replenish Big Bear Program would include between 23 and 57 acres of evaporation ponds at the BBARWA WWTP site. The ponds would be segmented into different storage basins to allow for evaporation of the brine stream in a cycle of filling with brine, allowing the brine to evaporate, and then removing remaining brine. This Replenish Big Bear Component includes the installation of up to 2 monitoring wells.

EXHIBIT 8-B: LAKE DISCHARGE PIPELINE CONSTRUCTION NOISE SOURCES

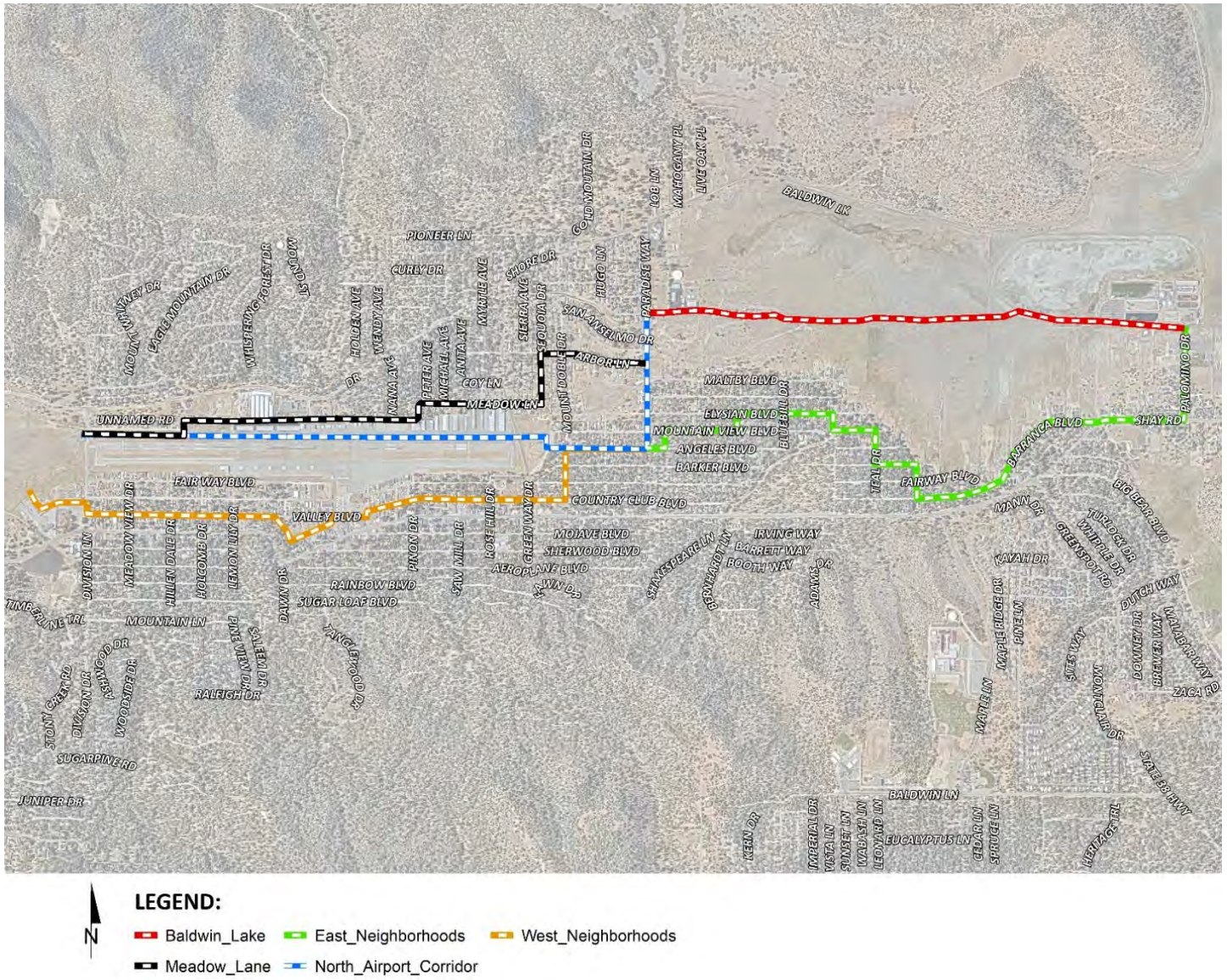
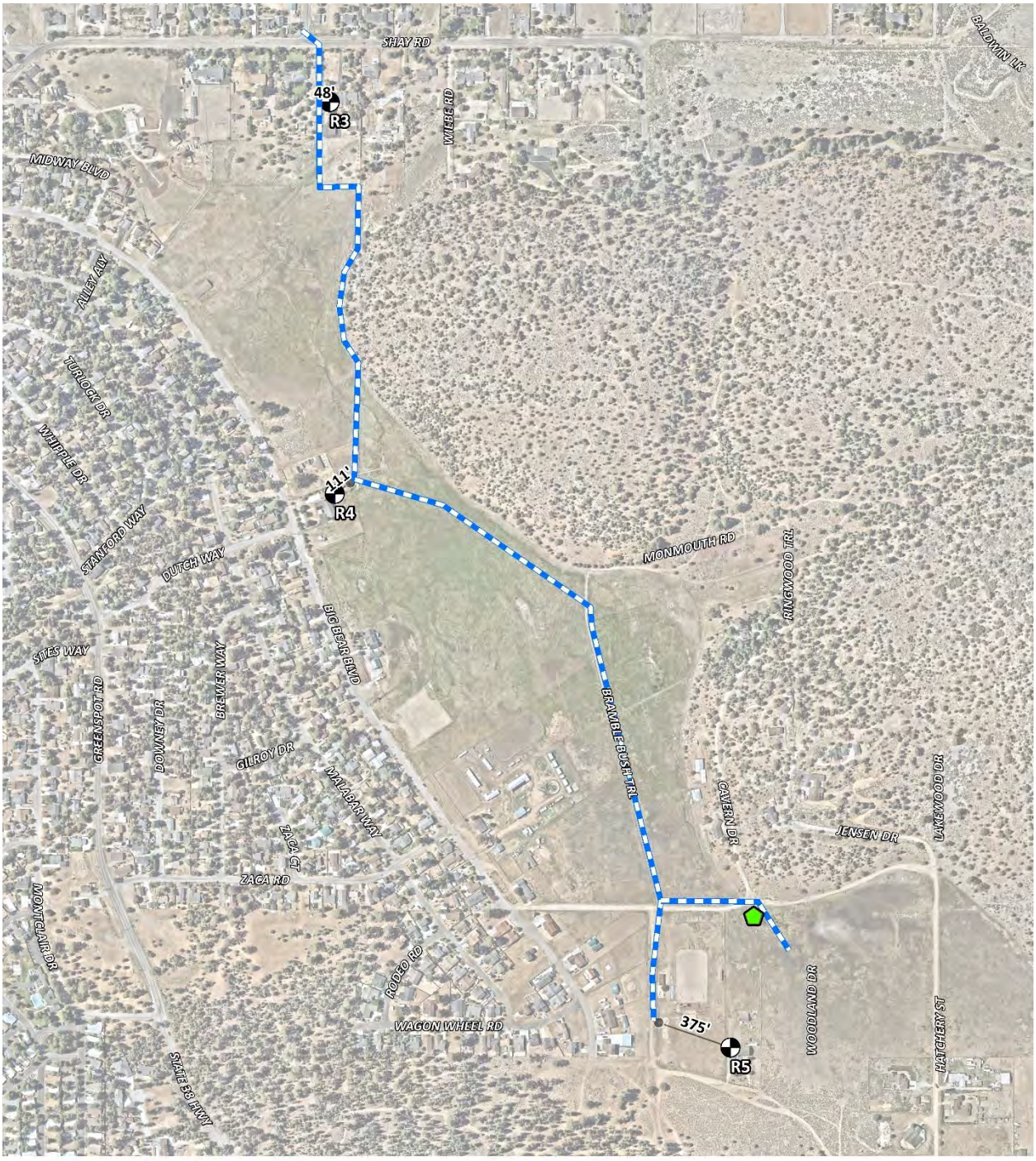


EXHIBIT 8-C: SHAY POND CONSTRUCTION NOISE SOURCES AND RECEIVER LOCATIONS



Construction of the Evaporation Pond improvements would include typical site preparation, grading, and well drilling activities. It is anticipated that Evaporation Pond improvements could be constructed while the BBARWA WWTP Upgrades are being constructed and both these activities have been modeled as simultaneous construction. Exhibit 8-A shows the construction noise source locations and receiver locations used to assess the construction noise levels from the Evaporation Pond improvements.

SAND CANYON GROUNDWATER RECHARGE

The Sand Canyon Groundwater Recharge component involves extracting Project water stored in the Lake to a temporary storage pond using existing infrastructure owned by a local resort. The Project water will then be pumped and conveyed to the Sand Canyon recharge area using a new pump station and 7,210 LF of pipeline. This Sand Canyon Groundwater Recharge improvements include the construction of a new pump station and installation of up to 2 monitoring wells at Sand Canyon.

Construction of the Sand Canyon Groundwater Recharge component would include roadway demolition, pipeline installation, roadbed backfilling, grading, paving activities, and well drilling activities. It is anticipated that Sand Canyon Groundwater Recharge improvements would be constructed with multiple teams. For locations within existing paved right-of-way, pipeline construction is anticipated to extend 200-300 LF per day, while construction along unpaved areas would extend 400-500 LF per day. Exhibit 8-D shows the pipeline locations and receiver locations used to assess the construction noise levels from the Sand Canyon Groundwater Recharge improvements.

8.2 REFERENCE CONSTRUCTION NOISE LEVELS

This construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels. (18) The RCNM equipment database, provides a comprehensive list of the noise generating characteristics for specific types of construction equipment. In addition, the database provides an acoustical usage factor to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation. The usage factor is a key input variable of the RCNM noise prediction model that is used to calculate the average L_{eq} noise levels using the reference L_{max} noise levels measured at 50 feet. Table 8-1 provides a summary of the reference average L_{eq} noise levels used to describe each stage of construction.

Because few details are known at this time regarding construction of specific components of the Project, it is assumed that construction of any Project component may occur simultaneously. As a conservative measure, and in order to identify a reasonable worst-case scenario, this analysis assumes that the Project would construct the certain features simultaneously as discussed in Section 8.1.

EXHIBIT 8-D: SAND CANYON CONSTRUCTION NOISE SOURCE AND RECEIVER LOCATIONS

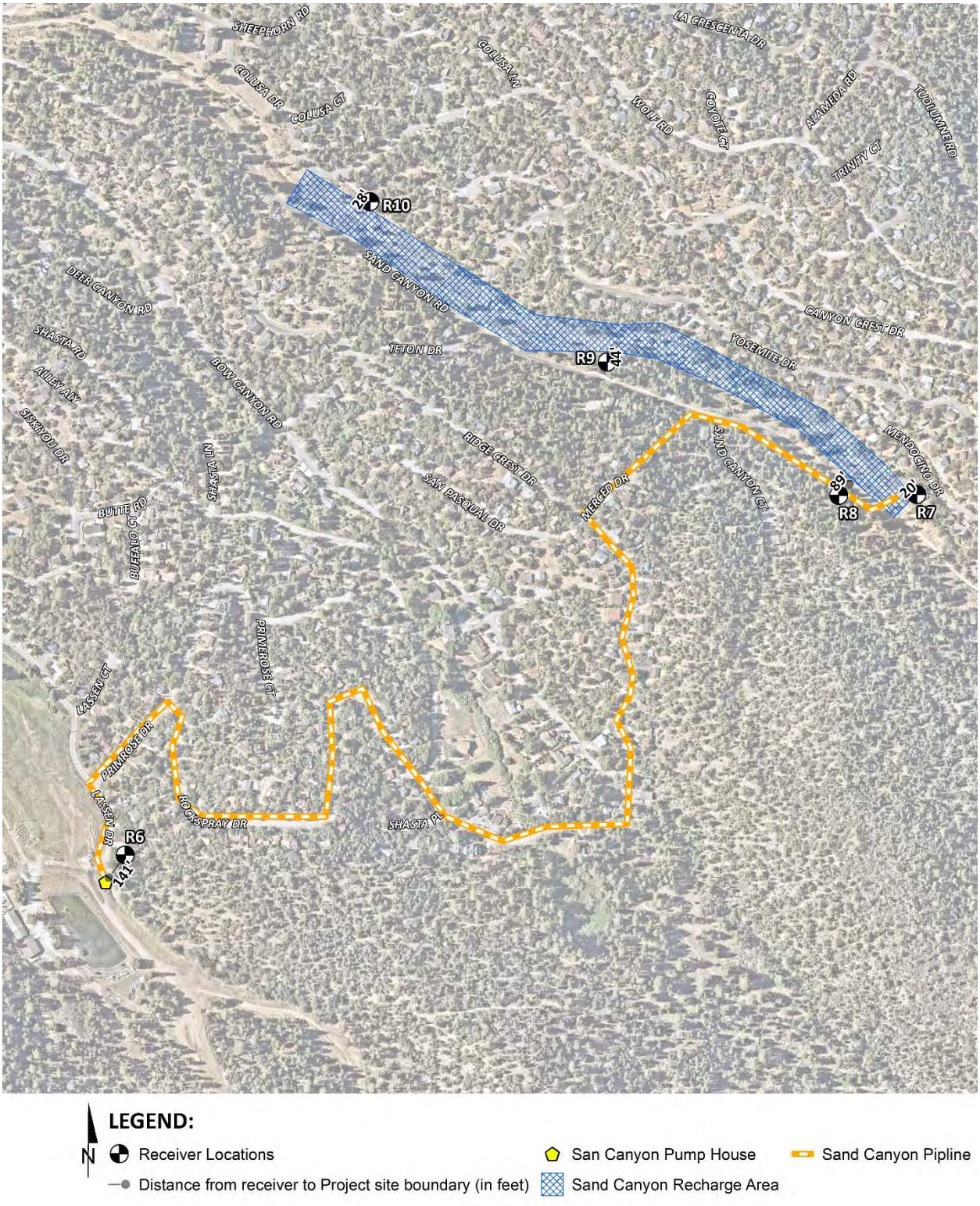


TABLE 8-1: CONSTRUCTION REFERENCE NOISE LEVELS

Construction Stage	Reference Construction Equipmnet[1]	Reference Noise Level @ 50 Feet (dBA L_{eq})	Composite Reference Noise Level (dBA L_{eq})	Reference Power Level (dBA L_w)
Demolition	Concrete Saw	83	86.3	118.0
	Impact Hammer (hoe ram)	83		
	Front End Loader	75		
Site Preparation	Tractor	80	84.0	115.6
	Backhoe	74		
	Grader	81		
Grading	Scraper	80	83.3	114.9
	Excavator	77		
	Dozer	78		
Building Construction	Crane	73	80.6	112.2
	Generator	78		
	Front End Loader	75		
Paving	Paver	74	77.8	109.5
	Dump Truck	72		
	Roller	73		
Architectural Coating	Man Lift	68	76.2	107.8
	Compressor (air)	74		
	Generator (<25kVA)	70		
Pipeline Construction	Excavator	77	79.6	111.3
	Front End Loader	75		
	Welder/Torch	70		
Monitoring Well Drilling	Auger Drill Rig	77	81.6	113.3
	Generator	78		
	Front End Loader	75		

[1] FHWA Road Construction Noise Model.

Noise levels generated by heavy construction equipment can range from approximately 68 dBA to more than 80 dBA when measured at 50 feet. However, these noise levels diminish with distance from the construction site at a rate of 6 dBA per doubling of distance. For example, a noise level of 80 dBA measured at 50 feet from the noise source to the receiver would be reduced to 74 dBA at 100 feet from the source to the receiver and would be further reduced to 68 dBA at 200 feet from the source to the receiver. A default ground attenuation factor of 0.0 was used in the CadnaA noise prediction model to account for hard site conditions.

8.3 CONSTRUCTION NOISE LEVELS

Using the reference construction equipment noise levels and the CadnaA noise prediction model, calculations of the Project construction noise level impacts at the nearby sensitive receiver

locations were completed for the BBARWA WWTP and Evaporation Pond construction, the Shay Pond Pipeline construction and the pump station and monitoring well installation at Sand Canyon. All other pipeline activities were modeled based on 200 foot and 400 foot pipeline activities, but due to the distances associated with the pipelines and the number of receiver locations, noise levels are predicted at a common distance of 30 feet from these activities for the Lake Discharge and Sand Canyon pipelines. To assess a reasonable worst-case construction scenario and account for the dynamic nature of construction activities, the Project construction noise analysis models the equipment combination with the highest reference level as a moving point source within the construction area (Project site boundary or alignment). As shown on Table 8-2, the highest construction noise levels during the BBARWA WWTP and Evaporation Pond construction activities noise levels are expected to range from 60.5 to 63.5 dBA L_{eq} at the nearest receiver locations. Appendix 8.1 includes the detailed CadnaA construction noise model inputs. These noise levels would not exceed the applicable daytime noise level limit of 80 dBA L_{eq}. Therefore, no mitigation is required for daytime construction activities at the BBARWA WWTP and Evaporation Pond.

As shown on Table 8-3, the highest construction noise levels during the Shay Pond Conveyance Pipeline construction activities noise levels are expected to range from 62.6 to 68.3 dBA L_{eq} at the nearest receiver locations. Appendix 8.2 includes the detailed CadnaA construction noise model inputs. These noise levels would not exceed the applicable daytime noise level limit of 80 dBA L_{eq}. Therefore, no mitigation is required for daytime construction activities along the Shay Pond Conveyance Pipeline.

As shown on Table 8-4, simultaneous construction of the pipeline improvements, the Sand Canyon Pump station, and improvements at the recharge location, the highest construction noise levels are expected to be 65.5 to 72.8 dBA L_{eq} at the nearest receiver locations. Appendix 8.3 includes the detailed CadnaA construction noise model inputs. These noise levels would not exceed the applicable daytime noise level limit of 80 dBA L_{eq}. Therefore, no mitigation is required for daytime construction activities at the Sand Canyon pump station or recharge area.

As indicated pipeline construction would occur within 30 feet of noise sensitive residential receivers along the majority of the Lake Discharge Pipeline and Sand Canyon alignments, at 30 feet pipeline construction activity is estimated to generate noise levels up to 79.1 dBA L_{eq} for segments with paving and 75.6 dBA L_{eq} for the segments without paving. Appendix 8.4 includes the CadnaA construction noise model inputs. These noise levels would not exceed the applicable daytime noise level limit of 80 dBA L_{eq}. Therefore, no mitigation is required for daytime construction activities at the Sand Canyon recharge site.

TABLE 8-2: BBARWA WWTP UPGRADES AND EVAPORATION POND – CONSTRUCTION EQUIPMENT NOISE LEVELS

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})						
	Demolition	Site Preparation	Grading	Building Construction	Paving	Architectural Coating	Highest Levels[2]
R1	58.9	56.6	55.8	54.4	50.4	55.0	58.9
R2	62.5	60.2	59.4	58.0	54.0	58.6	62.5

[1] Noise receiver locations are shown on Exhibit 8-A.
[2] CadnaA construction noise model inputs are included in Appendix 8.1.

TABLE 8-3: SHAY POND CONVEYANCE PIPELINE –CONSTRUCTION EQUIPMENT NOISE LEVELS

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})			
	Site Preparation	Grading	Pipeline Construction	Highest Levels[2]
R1	68.3	67.6	63.9	68.3
R2	62.6	61.9	58.2	62.6
R3	63.1	62.4	58.7	63.1

[1] Noise receiver locations are shown on Exhibit 8-C.
[2] CadnaA construction noise model inputs are included in Appendix 8.2.

TABLE 8-4: SAND CANYON –CONSTRUCTION EQUIPMENT NOISE LEVELS

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})					
	Site Preparation	Grading	Building Construction	Paving	Pipeline Construction	Highest Levels[2]
R6	72.8	72.1	70.6	66.7	68.4	72.8
R7	65.5	64.8	--	--	61.1	65.5
R8	71.9	71.2	--	--	67.5	71.9
R9	65.5	64.8	--	--	61.1	65.5
R10	66.0	65.3	--	--	61.6	66.0

-- Recharge area would not include any building or paving activities.
[1] Noise receiver locations are shown on Exhibit 8-D.
[2] CadnaA construction noise model inputs are included in Appendix 8.3.

MONITORING WELL DRILLING ACTIVITIES

The highest construction noise levels during the Evaporation Pond and Shay Pond monitoring well drilling activities noise levels are expected to exceed the daytime and nighttime noise level limit at the nearest receiver locations within 125 feet and 325 feet, respectively. Since the exact locations of these activities are unknown, and these activities would occur for 24 hours a day for up to two weeks, thus without mitigation these activities will exceed the applicable noise level limit during the nighttime if located within 325 feet of residences. This would be considered a significant impact. Therefore, mitigation is required for nighttime monitoring well drilling activities at the Sand Canyon recharge site.

N-1 Monitoring Well Drilling:

To comply with the nighttime noise level limit during the nighttime hours noise, noise barriers with a minimum height of 14 feet shall be erected surrounding the drilling rig monitoring well locations such that the pumps, compressors, and the drilling rig are completely shielded from nearby residential areas. An effective barrier requires a weight of at least 2 pounds per square foot of face area with no decorative cutouts, perforations, or line-of-sight openings between shielded areas and the source. Examples of temporary barrier material includes 5/8-inch plywood, 5/8-inch oriented-strand board, or sound blankets capable of providing a minimum sound transmission loss (STC) of 27 or a Noise Reduction Coefficient (NRC) of 0.85.

With implementation of the barrier noise levels would be reduced to a maximum noise level of 69 dBA L_{eq} at 50 feet. None of the potential monitoring well locations are located within 50 feet of residences. Therefore, with implementation of mitigation measure N-1, impacts would be less than significant.

8.4 CONSTRUCTION NOISE LEVEL COMPLIANCE

To evaluate whether the Project will generate potentially significant short-term noise levels at nearby receiver locations, a construction related daytime noise level limit of 80 dBA L_{eq}, a nighttime noise level limit of 70 dBA L_{eq} (FTA Transit Noise and Vibration Impact Assessment Manual, 2018). The construction noise analysis shows that with mitigation measure N-1, the nearby receiver locations will satisfy the daytime and nighttime significance thresholds during Project construction activities. Therefore, the noise impacts due to Project construction noise is considered *less than significant* at all receiver locations.

8.5 CONSTRUCTION VIBRATION ASSESSMENT

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods employed. Operation of construction equipment causes ground vibrations that spread through the ground and diminish in strength with distance. Ground vibration levels associated with various types of construction equipment are summarized on Table 8-5. Based on the representative vibration levels presented for various construction equipment types, it is possible to estimate the potential for human response (annoyance) and

building damage using the following vibration assessment methods defined by the Caltrans. To describe the vibration impacts Caltrans provides the following equation: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$

TABLE 8-5: VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	PPV (in/sec) at 25 feet
Small bulldozer	0.003
Jackhammer	0.035
Loaded trucks	0.076
Large bulldozer/Caisson drilling	0.089

Federal Transit Administration, Transit Noise and Vibration Impact Assessment, September 2018, p. 184.

8.6 CONSTRUCTION VIBRATION LEVELS

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type. It is expected that ground-borne vibration from typical Project construction activities would cause only intermittent or transient, localized intrusion. The proposed Project's construction activities most likely to cause vibration impacts are:

- Heavy Construction Equipment: Although all heavy mobile construction equipment has the potential of causing at least some perceptible vibration while operating close to building, the vibration is usually short-term (transient) and is not of enough magnitude to cause building damage.
- Trucks: Trucks hauling building materials to construction sites can be sources of transient vibration intrusion if the haul routes pass through residential neighborhoods on streets with bumps or potholes. Repairing the bumps and potholes generally eliminates the problem.

To assess the Project construction vibration levels, this analysis describes both the transient vibration levels associated with typical construction equipment activities and the continuous vibration levels associated with the well drilling activities.

8.6.1 TYPICAL CONSTRUCTION ACTIVITY VIBRATION LEVELS

Table 8-6 presents the expected Project related typical construction activity vibration levels at each of the receiver locations. At distances ranging from 20 to 871 feet from Project construction activity, including well drilling, the continuous construction vibration velocity levels are estimated to range from less than 0.00 to 0.124 PPV (in/sec), as shown on Table 8-6. Based on the vibration standards outlined in Table 4-1, the typical Project construction vibration levels will satisfy the transient human annoyance and building damage thresholds. Therefore, the vibration impacts due to Project typical construction activities are considered *less than significant*.

TABLE 8-6: CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Receiver Location[1]	Distance to Const. Activity (Feet)[2]	Typical Construction Vibration Levels PPV (in/sec)[3]					Thresholds PPV (in/sec)[4]	Thresholds Exceeded?[5]
		Small bulldozer	Jack-hammer	Loaded Trucks	Large Bulldozer	Highest Vibration Level		
R1	817'	0.00	0.00	0.00	0.00	0.00	0.30	No
R2	433'	0.00	0.00	0.00	0.00	0.00	0.30	No
R3	48'	0.00	0.01	0.03	0.03	0.03	0.30	No
R4	111'	0.00	0.00	0.01	0.01	0.01	0.30	No
R5	375'	0.00	0.00	0.00	0.00	0.00	0.30	No
R6	141'	0.00	0.00	0.01	0.01	0.01	0.30	No
R7	20'	0.00	0.05	0.11	0.12	0.12	0.30	No
R8	89'	0.00	0.01	0.01	0.01	0.01	0.30	No
R9	44'	0.00	0.01	0.03	0.04	0.04	0.30	No
R10	28'	0.00	0.03	0.06	0.08	0.08	0.30	No
Pipeline	20'	0.00	0.05	0.11	0.12	0.12	0.30	No

[1] Construction receiver locations are shown on Exhibits 8-A through 8-D.
[2] Distance from receiver location to Project construction boundary.
[3] Based on the Vibration Source Levels of Construction Equipment (Table 8-4).
[4] Caltrans, Transportation and Construction Vibration Guidance Manual, 2020.
[5] Does the peak vibration exceed the acceptable vibration thresholds?
"PPV" = Peak Particle Velocity

9 REFERENCES

1. **State of California.** *California Environmental Quality Act, Appendix G.* 2018.
2. **California Department of Transportation Environmental Program.** *Technical Noise Supplement - A Technical Supplement to the Traffic Noise Analysis Protocol.* Sacramento, CA : s.n., September 2013.
3. **Environmental Protection Agency Office of Noise Abatement and Control.** *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* March 1974. EPA/ONAC 550/9/74-004.
4. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch.** *Highway Traffic Noise Analysis and Abatement Policy and Guidance.* December 2011.
5. **U.S. Department of Transportation, Federal Highway Administration.** *Highway Traffic Noise in the United States, Problem and Response.* April 2000. p. 3.
6. **U.S. Environmental Protection Agency Office of Noise Abatement and Control.** *Noise Effects Handbook-A Desk Reference to Health and Welfare Effects of Noise.* October 1979 (revised July 1981). EPA 550/9/82/106.
7. **U.S. Department of Transportation, Federal Transit Administration.** *Transit Noise and Vibration Impact Assessment Manual, FTA Report No. 0123.* September 2018.
8. **California Department of Transportation.** *Transportation and Construction Vibration Guidance Manual.* April 2020.
9. **U.S. Department of Transportation, Federal Transit Administration.** *Transit Noise and Vibration Impact Assessment Manual, FTA-VA-90-1003-06.* May 2006.
10. **Office of Planning and Research.** *State of California General Plan Guidelines.* October 2017.
11. **San Bernardino County.** *Countywide Plan.* 2023.
12. **County of San Bernardino.** *Code of Ordinances, Title 8 Development Code, Chapter 83.01 General Performance Standards.*
13. **State of California.** *California Environmental Quality Act, Appendix G.* 2019.
14. **County of San Bernardino Planning Department.** *Airport Comprehensive Land Use Plan, Big Bear City Airport.* 1992.
15. **American National Standards Institute (ANSI).** *Specification for Sound Level Meters ANSI S1.4-2014/IEC 61672-1:2013.*
16. **U.S. Department of Transportation, Federal Transit Administration.** *Transit Noise and Vibration Impact Assessment Manual.* September 2018.
17. **Couty of San Bernardino.** *General Plan.* March 2010.
18. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning.** *FHWA Roadway Construction Noise Model.* January, 2006.

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10 CERTIFICATION

The contents of this noise study report represent an accurate depiction of the noise environment and impacts associated with the proposed Replenish Big Bear Project. The information contained in this noise study report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at (619) 788-1971.

William Maddux
Senior Associate
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EDUCATION

Bachelor of Science in Urban and Regional Planning
California Polytechnic State University, Pomona • June 2000

PROFESSIONAL AFFILIATIONS

ASA – Acoustical Society of America
APA – American Planning Association
AWMA – Air and Waste Management Association

PROFESSIONAL CERTIFICATIONS

Approved Acoustical Consultant • County of San Diego
FHWA Traffic Noise Model of Training • November 2004
CadnaA Basic and Advanced Training Certificate • October 2008

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APPENDIX 3.1:

COUNTY OF SAN BERNARDINO MUNICIPAL CODE

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§ 83.01.080. Noise.

Latest version.

This Section establishes standards concerning acceptable noise levels for both noise-sensitive land uses and for noise-generating land uses.

(a) *Noise Measurement.* Noise shall be measured:

(1) At the property line of the nearest site that is occupied by, and/or zoned or designated to allow the development of noise-sensitive land uses;

(2) With a sound level meter that meets the standards of the American National Standards Institute (ANSI § SI4 1979, Type 1 or Type 2);

(3) Using the "A" weighted sound pressure level scale in decibels (ref. pressure = 20 micronewtons per meter squared). The unit of measure shall be designated as dB(A).

(b) *Noise Impacted Areas.* Areas within the County shall be designated as "noise-impacted" if exposed to existing or projected future exterior noise levels from mobile or stationary sources exceeding the standards listed in Subdivision (d) (Noise Standards for Stationary Noise Sources) and Subdivision (e) (Noise Standards for Adjacent Mobile Noise Sources), below. New development of residential or other noise-sensitive land uses shall not be allowed in noise-impacted areas unless effective mitigation measures are incorporated into the project design to reduce noise levels to these standards. Noise-sensitive land uses shall include residential uses, schools, hospitals, nursing homes, religious institutions, libraries, and similar uses.

(c) *Noise Standards for Stationary Noise Sources.*

(1) *Noise Standards.* Table 83-2 (Noise Standards for Stationary Noise Sources) describes the noise standard for emanations from a stationary noise source, as it affects adjacent properties:

Table 83-2		
Noise Standards for Stationary Noise Sources		
Affected Land Uses (Receiving Noise)	7:00 a.m. - 10:00 p.m. Leq	10:00 p.m. - 7:
Residential	55 dB(A)	45

Professional Services	55 dB(A)	55
Other Commercial	60 dB(A)	60
Industrial	70 dB(A)	70

Leq = (Equivalent Energy Level). The sound level corresponding to a steady-state sound level co same total energy as a time-varying signal over a given sample period, typically one, eight or 24

dB(A) = (A-weighted Sound Pressure Level). The sound pressure level, in decibels, as measured level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very lo high frequency components of the sound, placing greater emphasis on those frequencies within range of the human ear.

Ldn = (Day-Night Noise Level). The average equivalent A-weighted sound level during a 24-hour by adding 10 decibels to the hourly noise levels measured during the night (from 10:00 p.m. to 7 this way Ldn takes into account the lower tolerance of people for noise during nighttime periods.

(2) *Noise Limit Categories.* No person shall operate or cause to be operated a source of sound at a location or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by the person, which causes the noise level, when measured on another property, either incorporated or unincorporated, to exceed any one of the following:

(A) The noise standard for the receiving land use as specified in Subdivision (b) (Noise-Impacted Areas), above, for a cumulative period of more than 30 minutes in any hour.

(B) The noise standard plus five dB(A) for a cumulative period of more than 15 minutes in any hour.

(C) The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour.

(D) The noise standard plus 15 dB(A) for a cumulative period of more than one minute in any hour.

(E) The noise standard plus 20 dB(A) for any period of time.

(d) *Noise Standards for Adjacent Mobile Noise Sources.* Noise from mobile sources may affect adjacent properties adversely. When it does, the noise shall be mitigated for any new development to a level that shall not exceed the standards described in the following Table 83-3 (Noise Standards for Adjacent Mobile Noise Sources).

Table 83-3

Noise Standards for Adjacent Mobile Noise Sources

Land Use		Ldn (or CNEL) dB(A)	
Categories	Uses	Interior (1)	Exteri
Residential	Single and multi-family, duplex, mobile homes		
Commercial	Hotel, motel, transient housing		
Commercial retail, bank, restaurant	50		
Office building, research and development,	45		

professional offices	
Amphitheater, concert hall, auditorium, movie theater	45
Institutional/Public	Hospital, nursing home, school classroom, religious institution, library
Open Space	Park
Notes:	
(1) The indoor environment shall exclude bathrooms, kitchens, toilets, closets and corridors.	
(2) The outdoor environment shall be limited to: · Hospital/office building patios · Hotel and motel recreation areas · Mobile home parks · Multi-family private patios or balconies · Park picnic areas · Private yard of single-family dwellings · School playgrounds	
(3) An exterior noise level of up to 65 dB(A) (or CNEL) shall be allowed provided exterior noise le been substantially mitigated through a reasonable application of the best available noise reductio and interior noise exposure does not exceed 45 dB(A) (or CNEL) with windows and doors closed that windows and doors remain closed to achieve an acceptable interior noise level shall necess of air conditioning or mechanical ventilation.	
CNEL = (Community Noise Equivalent Level). The average equivalent A-weighted so during a 24-hour day, obtained after addition of approximately five decibels to sound evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night fro p.m. to 7:00 a.m.	

(e) *Increases in Allowable Noise Levels.* If the measured ambient level exceeds any of the first four noise limit categories in Subdivision (d)(2), above, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category in Subdivision (d)(2), above, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.

(f) *Reductions in Allowable Noise Levels.* If the alleged offense consists entirely of impact noise or simple tone noise, each of the noise levels in Table 83-2 (Noise Standards for Stationary Noise Sources) shall be reduced by five dB(A).

(g) *Exempt Noise.* The following sources of noise shall be exempt from the regulations of this Section:

(1) Motor vehicles not under the control of the commercial or industrial use.

(2) Emergency equipment, vehicles, and devices.

(3) Temporary construction, maintenance, repair, or demolition activities between 7:00 a.m. and 7:00 p.m., except Sundays and Federal holidays.

(h) *Noise Standards for Other Structures.* All other structures shall be sound attenuated against the combined input of all present and projected exterior noise to not exceed the criteria.

Table 83-4	
Noise Standards for Other Structures	
Typical Uses	12-Hour Equivalent Sound Leve dBA Ldn
Educational, institutions, libraries, meeting facilities, etc.	45
General office, reception, etc.	50
Retail stores, restaurants, etc.	55
Other areas for manufacturing, assembly, testing, warehousing, etc.	65

In addition, the average of the maximum levels on the loudest of intrusive sounds occurring during a 24-hour period shall not exceed 65 dBA interior.

(Ord. 4011, passed - -2007; Am. Ord. 4245, passed - -2014)

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APPENDIX 5.1:

STUDY AREA PHOTOS

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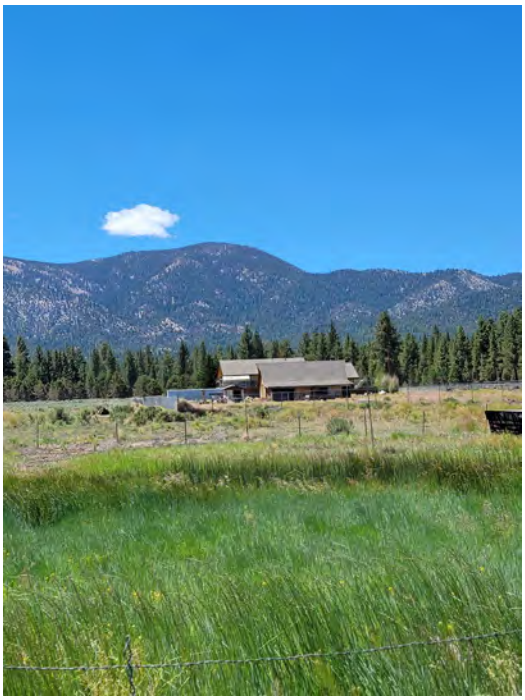
15309 - Replenish Big Bear Program

15309_L1_East
34, 15' 30.942720"116, 48' 53.729279"

15309_L1_North
34, 15' 15.205679"116, 48' 28.463400"

15309_L1_South
34, 15' 15.166439"116, 48' 28.460520"

15309_L1_West
34, 15' 15.176879"116, 48' 28.466999"



15309 - Replenish Big Bear Program

15309_L2_East
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15309_L2_North
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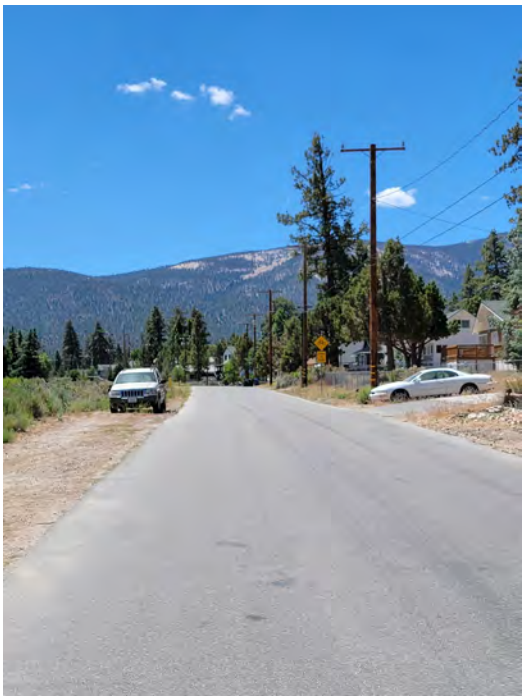
15309_L2_South
34, 15' 30.965759"116, 48' 53.729279"



15309_L2_West
34, 15' 30.963959"116, 48' 53.744039"

15309 - Replenish Big Bear Program

15309_L3_East
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15309_L3_North
34, 15' 31.659839"116, 48' 53.963280"

15309_L3_South
34, 16' 0.540840"116, 48' 54.409680"

15309_L3_West
34, 16' 0.587999"116, 48' 54.475919"

15309 - Replenish Big Bear Program

15309_L4_East
34, 13' 33.218759"116, 51' 24.072119"

15309_L4_North
34, 16' 0.526799"116, 48' 54.366479"

15309_L4_South
34, 16' 0.526799"116, 48' 54.366479"

15309_L4_West
34, 16' 0.526799"116, 48' 54.366479"

15309 - Replenish Big Bear Program

15309_L5_East
34, 13' 31.554480"116, 51' 12.374640"

15309_L5_North
34, 13' 33.179879"116, 51' 24.118919"

15309_L5_South
34, 13' 33.144599"116, 51' 24.117839"

15309_L5_West
34, 13' 33.144599"116, 51' 24.117839"

15309 - Replenish Big Bear Program

15309_L6_East
34, 13' 48.648359"116, 50' 53.243159"

15309_L6_North
34, 13' 31.519919"116, 51' 12.187800"

15309_L6_South
34, 13' 48.697320"116, 50' 53.206440"

15309_L6_West
34, 13' 48.896400"116, 50' 53.116080"

APPENDIX 5.2:

NOISE LEVEL MEASUREMENT WORKSHEETS

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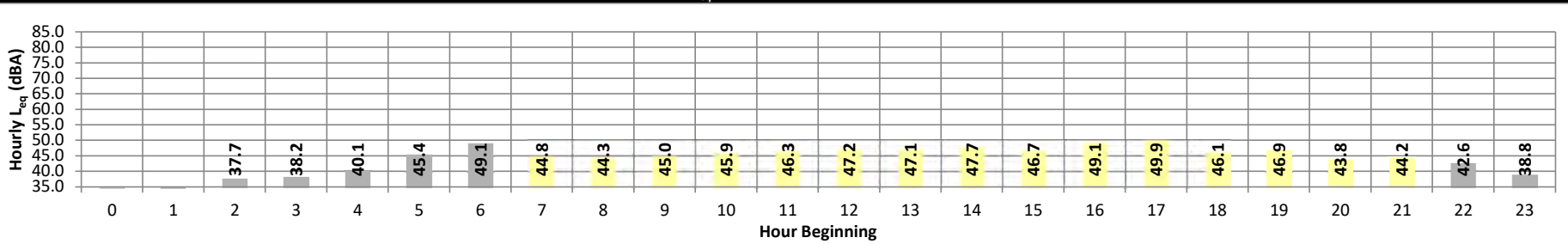
24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 | *Location:* L1 - Northwest of Shay Pond near 2025 Garnet Street | *Meter:* Piccolo II | *JN:* 15309

Project: Big Bear Replenishment Program | *Source:* | *Analyst:* B. Maddux

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*	*L_{eq}*	*Adj.*	*Adj. L_{eq}*
Night	0	34.8	39.5	31.8	39.2	38.9	38.1	37.6	35.5	33.8	32.3	32.1	31.8	34.8	10.0	44.8
	1	34.6	41.3	30.9	40.8	40.4	39.4	38.3	34.6	32.9	31.4	31.2	31.0	34.6	10.0	44.6
	2	37.7	45.8	31.3	45.2	44.8	43.6	42.8	38.0	33.6	31.7	31.5	31.3	37.7	10.0	47.7
	3	38.2	44.9	31.7	44.5	44.1	43.3	42.7	39.1	35.6	32.4	32.1	31.8	38.2	10.0	48.2
	4	40.1	46.5	34.1	46.0	45.5	44.6	43.8	41.4	38.3	35.3	34.8	34.3	40.1	10.0	50.1
	5	45.4	51.5	39.6	50.8	50.3	49.4	48.7	46.4	44.1	41.0	40.5	39.8	45.4	10.0	55.4
	6	49.1	55.3	43.9	54.7	54.3	53.3	52.7	49.7	47.5	45.1	44.6	44.1	49.1	10.0	59.1
Day	7	44.8	50.7	41.1	50.0	49.6	48.8	48.1	45.1	43.8	42.1	41.7	41.3	44.8	0.0	44.8
	8	44.3	51.2	40.6	50.4	49.7	48.6	47.6	44.4	43.0	41.4	41.0	40.7	44.3	0.0	44.3
	9	45.0	52.2	40.5	51.4	50.7	49.4	48.4	45.5	43.3	41.3	41.0	40.6	45.0	0.0	45.0
	10	45.9	52.9	41.4	52.1	51.5	50.1	49.0	46.5	44.7	42.4	41.9	41.5	45.9	0.0	45.9
	11	46.3	54.4	41.3	53.6	52.7	51.3	50.4	46.6	44.2	42.2	41.9	41.5	46.3	0.0	46.3
	12	47.2	54.1	41.9	53.5	53.0	51.8	50.8	47.9	45.7	42.9	42.5	42.0	47.2	0.0	47.2
	13	47.1	53.8	41.5	53.3	52.8	51.6	50.8	47.9	45.4	42.5	42.1	41.6	47.1	0.0	47.1
	14	47.7	55.7	41.5	55.1	54.5	52.9	52.0	48.0	45.2	42.5	42.1	41.6	47.7	0.0	47.7
	15	46.7	55.4	41.1	54.8	54.0	51.9	50.3	46.8	44.6	42.1	41.7	41.2	46.7	0.0	46.7
	16	49.1	57.2	42.1	56.6	56.1	55.1	54.3	48.8	45.4	43.1	42.7	42.2	49.1	0.0	49.1
	17	49.9	57.4	42.7	56.9	56.5	55.6	54.9	50.1	46.3	43.6	43.2	42.8	49.9	0.0	49.9
	18	46.1	55.2	40.3	54.4	53.7	52.6	50.7	45.4	43.0	41.2	40.8	40.5	46.1	0.0	46.1
	19	46.9	54.7	38.9	54.2	53.9	52.4	51.5	47.9	43.0	39.9	39.5	39.0	46.9	5.0	51.9
	20	43.8	50.2	39.8	49.3	48.6	47.5	46.8	44.5	42.8	40.8	40.4	40.0	43.8	5.0	48.8
	21	44.2	51.9	38.2	51.1	50.5	49.5	48.6	45.1	41.7	39.0	38.7	38.3	44.2	5.0	49.2
Night	22	42.6	51.7	36.4	50.9	50.2	48.5	47.0	42.4	39.8	37.4	37.0	36.6	42.6	10.0	52.6
	23	38.8	44.9	34.7	44.4	43.8	42.5	42.0	39.4	37.7	35.7	35.3	34.9	38.8	10.0	48.8

Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*
Day	Min	43.8	50.2	38.2	49.3	48.6	47.5	46.8	44.4	41.7	39.0	38.7	38.3
	Max	49.9	57.4	42.7	56.9	56.5	55.6	54.9	50.1	46.3	43.6	43.2	42.8
Energy Average		46.7	Average:		53.1	52.5	51.3	50.3	46.7	44.1	41.8	41.4	41.0
Night	Min	34.6	39.5	30.9	39.2	38.9	38.1	37.6	34.6	32.9	31.4	31.2	31.0
	Max	49.1	55.3	43.9	54.7	54.3	53.3	52.7	49.7	47.5	45.1	44.6	44.1
Energy Average		42.7	Average:		46.3	45.8	44.7	44.0	40.7	38.1	35.8	35.5	35.1

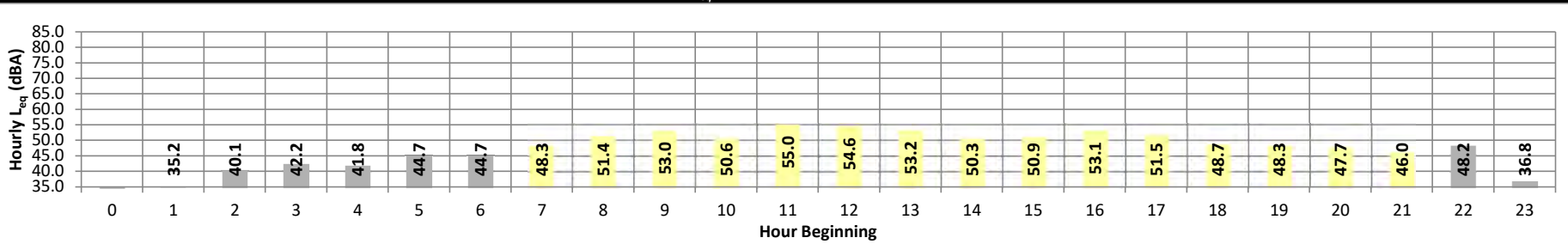
24-Hour CNEL	*Leq (dBA) Daytime (7am-10pm)*	*Leq (dBA) Nighttime (10pm-7am)*
50.4	**46.7**	**42.7**

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 | *Location:* L2 - Loacted near 1485 E Big Bear Blvd | *Meter:* Piccolo II | *JN:* 15309

Project: Big Bear Replenishment Program | *Source:* | *Analyst:* B. Maddux

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	34.3	40.8	31.6	40.4	39.8	38.2	37.1	34.4	33.0	32.0	31.8	31.6	34.3	10.0	44.3
	1	35.2	42.9	31.6	41.8	41.1	39.9	38.8	35.4	33.3	32.0	31.8	31.7	35.2	10.0	45.2
	2	40.1	52.2	31.7	52.0	51.4	47.8	44.3	35.1	33.2	32.1	32.0	31.8	40.1	10.0	50.1
	3	42.2	55.0	31.5	54.7	53.8	50.0	46.5	36.4	33.5	31.7	31.6	31.5	42.2	10.0	52.2
	4	41.8	53.8	31.9	53.6	53.1	49.7	46.5	37.5	34.4	32.4	32.1	31.9	41.8	10.0	51.8
	5	44.7	56.3	35.5	55.9	55.1	52.0	48.9	42.3	39.7	36.9	36.4	35.8	44.7	10.0	54.7
	6	44.7	55.2	39.0	54.9	54.0	50.7	48.1	43.5	41.9	39.9	39.6	39.2	44.7	10.0	54.7
Day	7	48.3	60.1	37.7	59.7	59.0	56.0	53.3	44.8	41.5	38.8	38.4	37.9	48.3	0.0	48.3
	8	51.4	63.0	38.5	62.6	62.0	59.2	57.0	48.1	44.1	40.1	39.4	38.7	51.4	0.0	51.4
	9	53.0	65.2	38.2	64.8	64.1	60.7	57.8	49.8	44.9	39.6	39.0	38.4	53.0	0.0	53.0
	10	50.6	61.9	39.6	61.6	60.9	57.8	55.1	48.9	44.7	40.9	40.4	39.8	50.6	0.0	50.6
	11	55.0	67.1	46.7	66.7	65.8	62.4	59.2	51.2	49.1	47.4	47.1	46.8	55.0	0.0	55.0
	12	54.6	63.0	50.6	62.7	62.2	59.6	57.9	54.0	52.5	51.3	51.0	50.8	54.6	0.0	54.6
	13	53.2	64.1	44.5	63.8	63.1	60.1	57.7	51.7	48.1	45.2	44.9	44.6	53.2	0.0	53.2
	14	50.3	61.2	39.2	60.9	60.4	57.7	55.4	48.8	44.2	40.5	40.0	39.3	50.3	0.0	50.3
	15	50.9	61.9	39.4	61.5	60.9	58.3	55.9	49.0	45.3	40.7	40.1	39.6	50.9	0.0	50.9
	16	53.1	65.6	39.7	65.2	64.6	60.9	57.5	49.5	45.0	40.7	40.2	39.8	53.1	0.0	53.1
	17	51.5	63.1	40.3	62.8	62.2	59.3	56.5	48.6	44.6	41.3	40.9	40.4	51.5	0.0	51.5
	18	48.7	60.4	37.0	60.1	59.6	56.6	53.4	45.7	42.1	38.3	37.7	37.2	48.7	0.0	48.7
	19	48.3	59.9	35.4	59.6	59.0	55.9	53.5	45.4	40.3	36.4	36.1	35.6	48.3	5.0	53.3
	20	47.7	59.5	36.3	59.0	58.2	55.1	52.2	45.6	41.5	37.1	36.7	36.4	47.7	5.0	52.7
	21	46.0	57.2	36.5	56.9	56.4	53.6	50.7	43.4	40.0	37.2	36.9	36.6	46.0	5.0	51.0
Night	22	48.2	60.9	35.6	60.4	59.7	56.5	53.1	42.1	38.8	36.3	36.0	35.7	48.2	10.0	58.2
	23	36.8	42.0	33.3	41.8	41.5	40.7	39.8	37.5	35.6	33.9	33.6	33.4	36.8	10.0	46.8

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	46.0	57.2	35.4	56.9	56.4	53.6	50.7	43.4	40.0	36.4	36.1	35.6
	Max	55.0	67.1	50.6	66.7	65.8	62.4	59.2	54.0	52.5	51.3	51.0	50.8
Energy Average		51.6	Average:		61.9	61.2	58.2	55.5	48.3	44.5	41.0	40.6	40.1
Night	Min	34.3	40.8	31.5	40.4	39.8	38.2	37.1	34.4	33.0	31.7	31.6	31.5
	Max	48.2	60.9	39.0	60.4	59.7	56.5	53.1	43.5	41.9	39.9	39.6	39.2
Energy Average		43.0	Average:		50.6	49.9	47.3	44.8	38.2	35.9	34.1	33.9	33.6

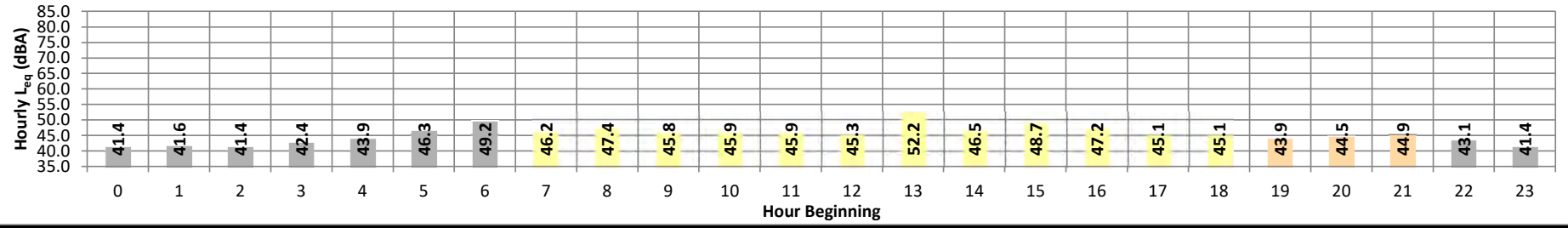
24-Hour CNEL	Leq (dBA) Daytime (7am-10pm)	Leq (dBA) Nighttime (10pm-7am)
52.5	**51.6**	**43.0**

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 *Location:* L3 - Located near 109 Palomino Drive *Meter:* Piccolo II *JN:* 12640

Project: *Analyst:* P. Mara

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	41.4	42.5	40.8	42.3	42.3	42.2	42.0	41.5	41.1	40.8	40.7	40.7	41.4	10.0	51.4
	1	41.6	42.4	41.2	42.3	42.2	42.1	42.1	41.7	41.4	41.1	41.1	41.1	41.6	10.0	51.6
	2	41.4	41.8	41.0	41.7	41.6	41.6	41.5	41.4	41.2	41.0	41.0	40.9	41.4	10.0	51.4
	3	42.4	43.3	41.8	43.2	43.2	43.1	43.0	42.6	42.2	41.8	41.7	41.7	42.4	10.0	52.4
	4	43.9	44.7	43.2	44.6	44.6	44.5	44.4	44.1	43.7	43.3	43.2	43.1	43.9	10.0	53.9
	5	46.3	50.9	44.2	50.7	50.4	49.9	49.3	46.9	45.2	44.3	44.2	44.1	46.3	10.0	56.3
	6	49.2	53.2	44.9	53.1	52.9	52.5	52.1	50.5	48.5	45.6	45.2	44.9	49.2	10.0	59.2
Day	7	46.2	49.4	43.3	49.3	49.2	49.0	48.8	47.3	45.4	43.5	43.4	43.3	46.2	0.0	46.2
	8	47.4	53.0	43.6	52.9	52.8	52.1	51.5	48.0	45.5	43.9	43.7	43.5	47.4	0.0	47.4
	9	45.8	49.1	43.1	49.0	48.9	48.6	48.3	46.9	45.2	43.3	43.2	43.0	45.8	0.0	45.8
	10	45.9	50.3	43.0	49.9	49.7	49.3	48.9	47.0	44.7	43.1	43.0	42.9	45.9	0.0	45.9
	11	45.9	49.3	43.1	49.2	49.1	48.7	48.4	46.8	45.3	43.3	43.2	43.1	45.9	0.0	45.9
	12	45.3	48.1	43.0	48.0	48.0	47.7	47.5	46.3	44.8	43.1	43.0	42.9	45.3	0.0	45.3
	13	52.2	56.2	48.1	56.1	56.0	55.6	55.3	53.5	51.5	48.6	48.4	48.1	52.2	0.0	52.2
	14	46.5	49.5	44.0	49.4	49.4	49.2	48.9	47.4	45.8	44.2	44.1	44.0	46.5	0.0	46.5
	15	48.7	52.2	43.7	52.1	52.0	51.8	51.6	50.3	48.3	44.3	43.9	43.7	48.7	0.0	48.7
	16	47.2	50.8	43.7	50.7	50.6	50.3	50.0	48.5	46.5	44.0	43.8	43.7	47.2	0.0	47.2
	17	45.1	47.3	43.4	47.2	47.1	46.9	46.7	45.8	44.6	43.5	43.4	43.3	45.1	0.0	45.1
	18	45.1	49.2	42.6	49.2	49.1	48.6	47.9	45.9	44.1	42.8	42.6	42.6	45.1	0.0	45.1
Evening	19	43.9	46.3	42.4	46.2	46.1	45.9	45.6	44.5	43.3	42.5	42.4	42.3	43.9	5.0	48.9
	20	44.5	46.8	42.8	46.7	46.7	46.4	46.1	45.1	44.0	43.0	42.8	42.7	44.5	5.0	49.5
	21	44.9	47.1	42.8	47.0	47.0	46.8	46.6	45.7	44.6	43.0	42.9	42.7	44.9	5.0	49.9
Night	22	43.1	45.0	41.8	44.9	44.9	44.7	44.6	43.7	42.7	41.9	41.8	41.7	43.1	10.0	53.1
	23	41.4	42.3	40.8	42.2	42.2	42.1	41.9	41.5	41.2	40.8	40.7	40.7	41.4	10.0	51.4

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	45.1	47.3	42.6	47.2	47.1	46.9	46.7	45.8	44.1	42.8	42.6	42.6
(7am-7pm)	Max	52.2	56.2	48.1	56.1	56.0	55.6	55.3	53.5	51.5	48.6	48.4	48.1
Energy Average		47.3	Average:		50.3	50.2	49.8	49.5	47.8	46.0	44.0	43.8	43.7
Evening	Min	43.9	46.3	42.4	46.2	46.1	45.9	45.6	44.5	43.3	42.5	42.4	42.3
(7pm-10pm)	Max	44.9	47.1	42.8	47.0	47.0	46.8	46.6	45.7	44.6	43.0	42.9	42.7
Energy Average		44.4	Average:		46.6	46.6	46.4	46.1	45.1	44.0	42.8	42.7	42.6
Night	Min	41.4	41.8	40.8	41.7	41.6	41.6	41.5	41.4	41.1	40.8	40.7	40.7
(10pm-7am)	Max	49.2	53.2	44.9	53.1	52.9	52.5	52.1	50.5	48.5	45.6	45.2	44.9
Energy Average		44.3	Average:		45.0	44.9	44.7	44.5	43.8	43.0	42.3	42.2	42.1

L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
46.1	46.9	44.3

24-Hour CNEL (dBA)

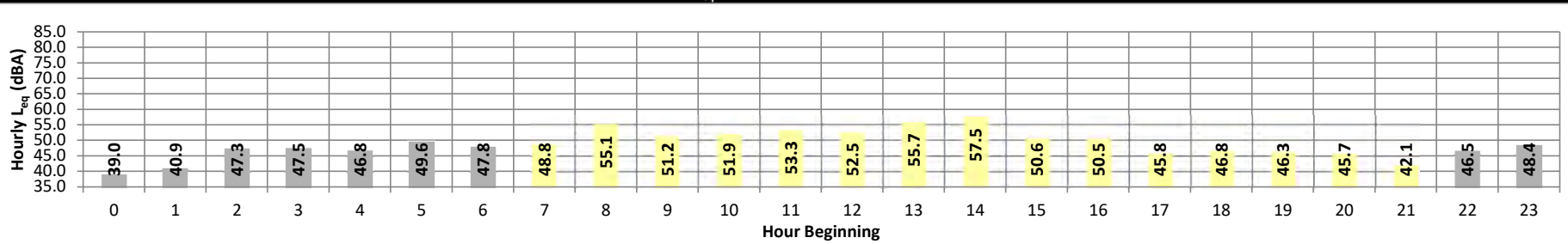
51.5

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 *Location:* L4 -Located near 1467 Lassen Drive *Meter:* Piccolo II *JN:* 15309

Project: Big Bear Replenishment Program *Source:* *Analyst:* B. Maddux

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	39.0	40.6	38.5	39.6	39.5	39.3	39.2	38.9	38.8	38.6	38.5	38.5	39.0	10.0	49.0
	1	40.9	44.9	39.2	43.4	43.1	42.5	42.2	41.4	40.5	39.5	39.4	39.3	40.9	10.0	50.9
	2	47.3	57.0	41.5	55.7	54.9	52.8	51.2	47.3	44.7	42.3	42.0	41.7	47.3	10.0	57.3
	3	47.5	57.5	41.3	55.7	54.5	52.6	51.0	47.7	45.6	42.2	41.9	41.5	47.5	10.0	57.5
	4	46.8	55.1	41.9	53.7	52.9	51.2	50.1	47.2	45.2	42.7	42.3	42.0	46.8	10.0	56.8
	5	49.6	62.2	40.0	61.6	61.0	57.5	53.6	44.8	42.4	40.5	40.3	40.0	49.6	10.0	59.6
	6	47.8	60.2	39.5	59.4	58.6	55.8	52.4	43.3	41.2	40.0	39.8	39.6	47.8	10.0	57.8
Day	7	48.8	60.0	39.8	59.2	58.8	57.4	55.3	43.8	41.2	40.2	40.1	39.9	48.8	0.0	48.8
	8	55.1	66.6	40.8	66.0	65.4	62.9	60.6	53.9	44.0	41.5	41.3	40.9	55.1	0.0	55.1
	9	51.2	63.2	42.5	61.3	60.0	57.4	55.6	50.4	47.6	44.4	43.9	43.2	51.2	0.0	51.2
	10	51.9	64.2	42.5	63.1	62.4	59.1	56.9	49.0	46.0	43.4	43.1	42.7	51.9	0.0	51.9
	11	53.3	65.1	44.3	63.9	62.9	59.5	57.2	51.9	49.0	45.6	45.1	44.6	53.3	0.0	53.3
	12	52.5	62.6	44.5	61.3	60.8	58.9	57.2	52.1	49.0	45.7	45.3	44.8	52.5	0.0	52.5
	13	55.7	69.5	43.9	68.1	66.9	63.4	58.3	51.6	48.5	45.2	44.7	44.2	55.7	0.0	55.7
	14	57.5	74.9	44.0	70.3	68.0	64.1	61.1	52.3	48.4	45.3	44.8	44.3	57.5	0.0	57.5
	15	50.6	61.2	42.7	59.9	59.2	57.1	55.3	50.0	46.7	43.8	43.4	43.0	50.6	0.0	50.6
	16	50.5	61.5	42.3	60.3	59.3	56.7	54.4	49.9	47.1	43.6	43.1	42.6	50.5	0.0	50.5
	17	45.8	57.3	39.8	55.8	54.9	52.5	50.0	44.2	42.2	40.4	40.2	39.9	45.8	0.0	45.8
	18	46.8	58.0	40.4	57.1	56.0	53.2	51.0	44.8	42.8	41.1	40.9	40.6	46.8	0.0	46.8
	19	46.3	56.8	41.3	55.2	54.0	51.8	49.9	45.6	44.0	42.1	41.8	41.4	46.3	5.0	51.3
	20	45.7	58.7	39.7	56.9	55.7	51.6	48.7	43.3	41.6	40.2	40.0	39.7	45.7	5.0	50.7
	21	42.1	50.0	39.4	48.2	47.6	46.0	44.6	42.0	40.8	39.7	39.6	39.5	42.1	5.0	47.1
Night	22	46.5	55.1	41.9	53.3	52.2	50.8	49.8	47.0	45.1	42.7	42.4	42.0	46.5	10.0	56.5
	23	48.4	57.6	42.8	55.8	54.8	53.2	52.1	48.8	46.4	43.9	43.4	43.0	48.4	10.0	58.4

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	42.1	50.0	39.4	48.2	47.6	46.0	44.6	42.0	40.8	39.7	39.6	39.5
	Max	57.5	74.9	44.5	70.3	68.0	64.1	61.1	53.9	49.0	45.7	45.3	44.8
Energy Average		52.1	Average:		60.4	59.5	56.8	54.4	48.3	45.3	42.8	42.5	42.1
Night	Min	39.0	40.6	38.5	39.6	39.5	39.3	39.2	38.9	38.8	38.6	38.5	38.5
	Max	49.6	62.2	42.8	61.6	61.0	57.5	53.6	48.8	46.4	43.9	43.4	43.0
Energy Average		46.9	Average:		53.1	52.4	50.6	49.1	45.2	43.3	41.4	41.1	40.8

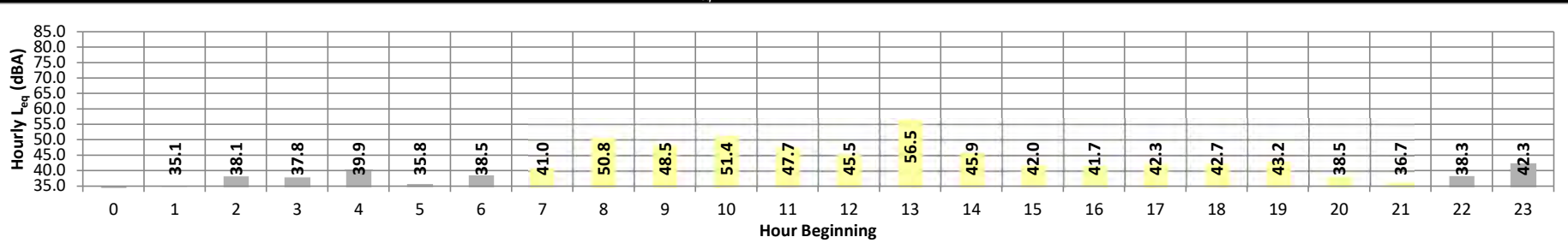
24-Hour CNEL	Leq (dBA) Daytime (7am-10pm)	Leq (dBA) Nighttime (10pm-7am)
54.7	**52.1**	**46.9**

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 *Location:* L5 - Located near 43652 Sand Canyon Road *Meter:* Piccolo II *JN:* 15309

Project: Big Bear Replenishment Program *Source:* *Analyst:* B. Maddux

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	30.4	32.7	29.6	32.3	32.1	31.8	31.4	30.6	30.2	29.7	29.7	29.6	30.4	10.0	40.4
	1	35.1	38.7	32.3	38.6	38.5	38.2	37.8	36.0	34.1	32.7	32.5	32.3	35.1	10.0	45.1
	2	38.1	42.4	34.9	42.2	42.0	41.3	40.9	39.0	37.3	35.4	35.2	35.0	38.1	10.0	48.1
	3	37.8	41.3	35.2	41.1	40.9	40.5	40.1	38.7	37.2	35.6	35.4	35.2	37.8	10.0	47.8
	4	39.9	44.2	36.3	44.0	43.8	43.1	42.6	40.9	39.2	37.0	36.7	36.4	39.9	10.0	49.9
	5	35.8	40.7	32.8	40.2	39.7	38.8	38.1	36.5	35.1	33.4	33.2	32.9	35.8	10.0	45.8
	6	38.5	46.5	32.2	46.1	45.7	44.8	44.2	37.5	34.9	32.8	32.6	32.3	38.5	10.0	48.5
Day	7	41.0	51.5	32.2	51.1	50.4	49.7	47.6	37.0	34.6	32.9	32.6	32.4	41.0	0.0	41.0
	8	50.8	59.6	37.8	59.2	58.7	56.7	54.9	51.6	48.7	39.9	38.9	38.0	50.8	0.0	50.8
	9	48.5	56.4	40.8	55.9	55.2	52.6	51.6	49.6	47.5	42.1	41.5	41.0	48.5	0.0	48.5
	10	51.4	59.3	42.9	58.8	58.3	56.6	55.3	52.1	49.8	44.6	43.8	43.1	51.4	0.0	51.4
	11	47.7	58.9	41.2	57.8	56.6	53.7	51.4	46.6	44.7	42.3	41.9	41.4	47.7	0.0	47.7
	12	45.5	55.5	38.3	54.7	53.8	51.9	50.0	44.4	42.3	39.7	39.2	38.5	45.5	0.0	45.5
	13	56.5	63.9	45.9	63.0	62.1	60.8	60.0	57.5	55.1	50.9	49.4	46.8	56.5	0.0	56.5
	14	45.9	55.2	38.3	54.3	53.6	52.3	51.3	46.6	41.6	39.1	38.7	38.4	45.9	0.0	45.9
	15	42.0	48.2	38.0	47.5	46.9	45.9	45.2	42.6	41.0	38.9	38.6	38.1	42.0	0.0	42.0
	16	41.7	49.2	36.6	49.1	48.7	47.5	45.8	41.5	39.8	37.5	37.0	36.7	41.7	0.0	41.7
	17	42.3	51.3	35.8	50.9	50.3	49.2	47.5	41.2	39.2	36.5	36.2	35.9	42.3	0.0	42.3
	18	42.7	52.2	36.3	51.9	51.5	49.8	47.4	41.1	39.3	37.1	36.8	36.4	42.7	0.0	42.7
	19	43.2	53.6	36.8	53.1	52.6	50.0	46.9	41.5	39.8	37.6	37.2	36.9	43.2	5.0	48.2
	20	38.5	46.4	33.1	45.9	45.6	44.9	42.8	38.1	36.2	33.7	33.5	33.2	38.5	5.0	43.5
	21	36.7	45.3	31.7	45.0	44.7	43.2	41.6	35.6	33.6	32.1	31.9	31.8	36.7	5.0	41.7
Night	22	38.3	41.7	35.6	41.5	41.3	40.8	40.4	39.1	37.8	36.1	35.8	35.6	38.3	10.0	48.3
	23	42.3	45.9	39.0	45.7	45.6	45.1	44.7	43.3	41.7	39.8	39.4	39.1	42.3	10.0	52.3

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	36.7	45.3	31.7	45.0	44.7	43.2	41.6	35.6	33.6	32.1	31.9	31.8
	Max	56.5	63.9	45.9	63.0	62.1	60.8	60.0	57.5	55.1	50.9	49.4	46.8
Energy Average		48.3	Average:		53.2	52.6	51.0	49.3	44.5	42.2	39.0	38.5	37.9
Night	Min	30.4	32.7	29.6	32.3	32.1	31.8	31.4	30.6	30.2	29.7	29.7	29.6
	Max	42.3	46.5	39.0	46.1	45.7	45.1	44.7	43.3	41.7	39.8	39.4	39.1
Energy Average		38.3	Average:		41.3	41.1	40.5	40.0	38.0	36.4	34.7	34.5	34.3

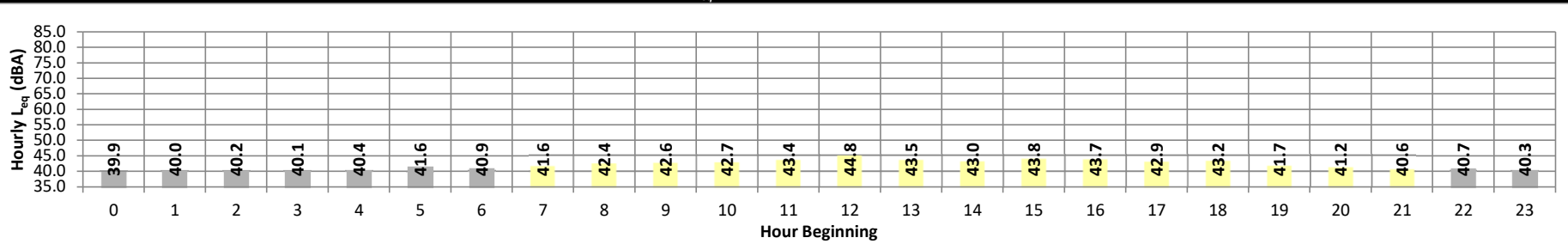
24-Hour CNEL	Leq (dBA) Daytime (7am-10pm)	Leq (dBA) Nighttime (10pm-7am)
48.5	**48.3**	**38.3**

24-Hour Noise Level Measurement Summary

Date: Wednesday, July 12, 2023 *Location:* L6 - Located near 43485 Colusa Drive *Meter:* Piccolo II *JN:* 15309

Project: Big Bear Replenishment Program *Source:* *Analyst:* B. Maddux

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	39.9	40.2	39.8	40.1	40.0	39.9	39.9	39.9	39.8	39.7	39.7	39.7	39.9	10.0	49.9
	1	40.0	40.3	39.9	40.1	40.1	40.0	40.0	39.9	39.9	39.8	39.8	39.8	40.0	10.0	50.0
	2	40.2	40.4	40.0	40.3	40.3	40.2	40.2	40.1	40.0	40.0	40.0	39.9	40.2	10.0	50.2
	3	40.1	40.3	40.0	40.2	40.1	40.1	40.1	40.0	40.0	40.0	40.0	39.9	40.1	10.0	50.1
	4	40.4	41.6	40.1	41.3	41.0	40.8	40.7	40.4	40.2	40.0	40.0	40.0	40.4	10.0	50.4
	5	41.6	47.0	40.0	46.5	46.0	44.9	43.7	41.7	40.6	40.1	40.0	40.0	41.6	10.0	51.6
	6	40.9	44.0	40.1	43.5	43.0	42.2	41.8	41.0	40.5	40.2	40.1	40.1	40.9	10.0	50.9
Day	7	41.6	47.0	40.3	46.4	45.8	44.3	43.2	41.5	40.8	40.4	40.3	40.2	41.6	0.0	41.6
	8	42.4	47.5	40.7	47.0	46.3	45.0	44.2	42.5	41.5	40.9	40.8	40.7	42.4	0.0	42.4
	9	42.6	48.7	41.0	48.3	47.4	45.9	45.1	42.1	41.6	41.0	41.0	40.9	42.6	0.0	42.6
	10	42.7	47.7	41.2	47.2	46.7	45.2	44.4	42.8	42.0	41.3	41.2	41.1	42.7	0.0	42.7
	11	43.4	51.1	41.2	50.6	50.0	47.4	45.6	43.0	42.0	41.4	41.3	41.2	43.4	0.0	43.4
	12	44.8	52.2	41.6	51.3	50.7	48.8	47.7	45.1	43.5	41.8	41.7	41.5	44.8	0.0	44.8
	13	43.5	49.1	41.4	48.7	48.3	46.9	45.9	43.6	42.4	41.6	41.4	41.3	43.5	0.0	43.5
	14	43.0	48.0	41.4	47.6	47.1	45.7	44.8	43.1	42.3	41.5	41.4	41.3	43.0	0.0	43.0
	15	43.8	51.6	41.2	51.2	50.7	48.6	46.8	42.9	42.2	41.4	41.3	41.1	43.8	0.0	43.8
	16	43.7	51.3	41.3	50.6	49.9	47.5	46.0	43.4	42.4	41.5	41.4	41.2	43.7	0.0	43.7
	17	42.9	49.7	40.7	49.2	48.6	46.9	45.7	42.8	41.5	40.8	40.7	40.6	42.9	0.0	42.9
	18	43.2	51.2	40.7	50.7	50.0	48.0	46.2	42.3	41.2	40.8	40.7	40.7	43.2	0.0	43.2
	19	41.7	48.5	40.4	48.0	47.3	45.2	43.6	41.1	40.7	40.4	40.4	40.3	41.7	5.0	46.7
	20	41.2	44.8	40.1	44.5	44.1	43.5	43.0	41.6	40.5	40.1	40.0	40.0	41.2	5.0	46.2
	21	40.6	43.6	40.0	43.2	42.8	41.9	41.6	40.5	40.1	39.9	39.9	39.9	40.6	5.0	45.6
Night	22	40.7	45.2	40.0	44.9	44.3	42.8	41.8	40.5	40.1	40.0	39.9	39.9	40.7	10.0	50.7
	23	40.3	41.0	40.1	40.8	40.7	40.6	40.5	40.3	40.2	40.1	40.0	40.0	40.3	10.0	50.3

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	40.6	43.6	40.0	43.2	42.8	41.9	41.6	40.5	40.1	39.9	39.9	39.9
	Max	44.8	52.2	41.6	51.3	50.7	48.8	47.7	45.1	43.5	41.8	41.7	41.5
Energy Average		42.9	Average:		48.3	47.7	46.1	44.9	42.5	41.7	41.0	40.9	40.8
Night	Min	39.9	40.2	39.8	40.1	40.0	39.9	39.9	39.9	39.8	39.7	39.7	39.7
	Max	41.6	47.0	40.1	46.5	46.0	44.9	43.7	41.7	40.6	40.2	40.1	40.1
Energy Average		40.5	Average:		41.9	41.7	41.3	41.0	40.4	40.1	40.0	40.0	39.9

24-Hour CNEL	Leq (dBA) Daytime (7am-10pm)	Leq (dBA) Nighttime (10pm-7am)
47.6	**42.9**	**40.5**

APPENDIX 8.1:

BBARWA WWTP AND EVAPORATION POND CADNAA CONSTRUCTION NOISE MODEL INPUTS

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15309 - Big Bear Replinishment

CadnaA Noise Prediction Model: 15309-02_Phase1_Construction.cna
Date: 26.09.23
Analyst: B. Maddux

Calculation Configuration

Configuration	
Parameter	**Value**
General	
Max. Error (dB)	**0.00**
Max. Search Radius (#(Unit,LEN))	**2000.01**
Min. Dist Src to Rcvr	**0.00**
Partition	
Raster Factor	**0.50**
Max. Length of Section (#(Unit,LEN))	**999.99**
Min. Length of Section (#(Unit,LEN))	**1.01**
Min. Length of Section (%)	**0.00**
Proj. Line Sources	**On**
Proj. Area Sources	**On**
Ref. Time	
Daytime Penalty (dB)	**0.00**
Recr. Time Penalty (dB)	**5.00**
Night-time Penalty (dB)	**10.00**
DTM	
Standard Height (m)	**0.00**
Model of Terrain	**Triangulation**
Reflection	
max. Order of Reflection	**2**
Search Radius Src	**100.00**
Search Radius Rcvr	**100.00**
Max. Distance Source - Rcvr	**1000.00 1000.00**
Min. Distance Rvcr - Reflector	**1.00 1.00**
Min. Distance Source - Reflector	**0.10**
Industrial (ISO 9613)	
Lateral Diffraction	**some Obj**
Obst. within Area Src do not shield	**On**
Screening	**Incl. Ground Att. over Barrier**
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	**3.0 20.0 0.0**
Temperature (#(Unit,TEMP))	**10**
rel. Humidity (%)	**70**
Ground Absorption G	**0.50**
Wind Speed for Dir. (#(Unit,SPEED))	**3.0**
Roads (TNM)	
Railways (FTA/FRA)	
Aircraft (???)	
Strictly acc. to AzB	

Receiver Noise Levels

Name	M.	ID	Level Lr			Limit. Value			Land Use			Height		Coordinates		
			Day	Night	CNEL	Day	Night	CNEL	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)				(ft)		(ft)	(ft)	(ft)
R1		R1	60.5	55.2	62.8	0.0	0.0	0.0		x	Total	5.00	a	6390842.37	2404958.11	5.00
R2		R2	63.5	56.7	64.9	0.0	0.0	0.0		x	Total	5.00	a	6391087.60	2405366.53	5.00

Point Source(s)

Name	M.	ID	Result. PWL			Lw / Li			Operating Time			Height		Coordinates		
			Day	Evening	Night	Type	Value	norm.	Day	Special	Night			X	Y	Z
			(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	(ft)		(ft)	(ft)	(ft)
Well1		Well1	117.8	117.8	117.8	Lw	117.8					8.00	r	6390831.21	2406459.86	8.00
Well2		Well2	117.8	117.8	117.8	Lw	117.8					8.00	r	6389517.71	2405871.15	8.00

Line Source(s)

Name	M.	ID	Result. PWL			Result. PWL'			Lw / Li			Operating Time			Moving Pt. Src				Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	Number			Speed	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	Day	Evening	Night	(mph)	(ft)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Area Source(s)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height	
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)		
Construction_Area		CA01	121.0	18.0	18.0	78.4	-24.6	-24.6	PWL-Pt	118					8	a
Evaporation Pond		CA2	116.0	16.0	16.0	62.8	-37.2	-37.2	PWL-Pt	116					8	a

Name	ID	Height			Coordinates			
		Begin		End	x	y	z	Ground
		(ft)		(ft)	(ft)	(ft)	(ft)	(ft)
Construction_Area	CA01	8.00	a		6391208.77	2406315.04	8.00	0.00
					6391208.71	2405984.80	8.00	0.00
					6390937.50	2405980.83	8.00	0.00
					6390941.89	2405774.13	8.00	0.00
					6390613.92	2405776.91	8.00	0.00
					6390617.13	2405987.30	8.00	0.00
					6390822.48	2405989.52	8.00	0.00
					6390818.14	2406315.84	8.00	0.00
Evaporation Pond	CA2	8.00	a		6389867.56	2406517.44	8.00	0.00
					6389795.94	2406443.66	8.00	0.00
					6389750.37	2406378.12	8.00	0.00
					6389740.39	2406254.42	8.00	0.00
					6389743.21	2406218.83	8.00	0.00
					6389730.19	2406156.33	8.00	0.00
					6389710.01	2406089.92	8.00	0.00
					6389640.56	2405994.44	8.00	0.00
					6389584.57	2405897.65	8.00	0.00
					6389536.83	2405841.23	8.00	0.00
					6389273.81	2405816.92	8.00	0.00
					6389149.68	2405819.52	8.00	0.00
					6389033.36	2405827.34	8.00	0.00
					6388910.96	2405840.36	8.00	0.00
					6388732.58	2405857.29	8.00	0.00
					6388571.12	2405920.22	8.00	0.00
					6388414.87	2406007.02	8.00	0.00
					6388326.33	2406089.06	8.00	0.00
					6388246.03	2406207.11	8.00	0.00
					6388230.84	2406332.98	8.00	0.00
					6388264.26	2406481.85	8.00	0.00
					6388314.17	2406616.40	8.00	0.00
					6388442.64	2406798.69	8.00	0.00
					6388588.04	2406907.20	8.00	0.00
					6388702.19	2406966.66	8.00	0.00
					6388824.59	2407000.08	8.00	0.00
					6389116.69	2407017.01	8.00	0.00
					6389536.83	2407022.65	8.00	0.00
					6389840.65	2407023.52	8.00	0.00
					6390146.64	2407027.86	8.00	0.00
					6390402.71	2407008.33	8.00	0.00
					6390565.78	2407008.81	8.00	0.00
					6390756.45	2407019.18	8.00	0.00
					6390854.10	2407010.50	8.00	0.00
					6390925.72	2406993.14	8.00	0.00
					6390953.93	2406971.43	8.00	0.00
					6391016.86	2406915.01	8.00	0.00
					6391055.93	2406854.25	8.00	0.00
					6391101.50	2406763.10	8.00	0.00
					6391118.86	2406700.17	8.00	0.00
					6391116.69	2406556.94	8.00	0.00
					6391097.16	2406507.02	8.00	0.00
					6391045.08	2406467.96	8.00	0.00
					6390975.63	2406470.13	8.00	0.00
					6390899.24	2406467.96	8.00	0.00
					6390871.46	2406446.26	8.00	0.00
					6390786.83	2406439.75	8.00	0.00
					6390719.55	2406439.75	8.00	0.00
					6390662.48	2406431.07	8.00	0.00
					6390645.55	2406533.93	8.00	0.00
					6390580.63	2406534.20	8.00	0.00
					6390515.34	2406531.33	8.00	0.00
					6390464.56	2406530.03	8.00	0.00
					6390396.85	2406532.63	8.00	0.00
					6390032.27	2406536.54	8.00	0.00
					6389982.79	2406532.63	8.00	0.00
					6389914.43	2406526.56	8.00	0.00

Barrier(s)

Name	Sel.	M.	ID	Absorption		Z-Ext.	Cantilever		Height		Coordinates			
				left	right		horz.	vert.	Begin	End	x	y	z	Ground
						(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Building(s)

Name	Sel.	M.	ID	RB	Residents	Absorption	Height	Coordinates			
							Begin	x	y	z	Ground
							(ft)	(ft)	(ft)	(ft)	(ft)

Ground Absorption(s)

Name	Sel.	M.	ID	G	Coordinates	
					x	y
					(ft)	(ft)

Contour(s)

Name	Sel.	M.	ID	OnlyPts	Height		Coordinates		
					Begin	End	x	y	z
					(ft)	(ft)	(ft)	(ft)	(ft)

Vertical Area Source(s)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Rail

Name	Sel.	M.	ID	Lw'		Train Class	Correct.	Vmax
				Day	Night		Track	
				(dBA)	(dBA)		(dB)	(km(mph)

Sound Level Spectra

Name	ID	Type	Oktave Spectrum (dB)											Source
			Weight.	31.5	63	125	250	500	1000	2000	4000	8000	A	lin	

Roads

Name	Sel.	M.	ID	Lme			Count Data		exact Count Data						Speed Limit		SCS	Surface		Gradient	Mult. Reflection		
				Day	Evening	Night	DTV	Str.class.	M			p (%)			Auto	Truck	Dist.	Dstro	Type		Drefl	Hbuild	Dist.
				(dBA)	(dBA)	(dBA)			Day	Evening	Night	Day	Evening	Night	(mph)	(mph)		(dB)		(%)	(dB)	(ft)	(ft)

RoadsGeo

Name	Height		Coordinates				Dist	LSlope
	Begin	End	x	y	z	Ground	(ft)	(%)
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		

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APPENDIX 8.2:

SHAY POND CADNAA CONSTRUCTION NOISE MODEL INPUTS

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15309 - Big Bear Replinishment

CadnaA Noise Prediction Model: 15309-02_Shay_Pond.cna
Date: 26.09.23
Analyst: B. Maddux

Calculation Configuration

Configuration	
Parameter	**Value**
General	
Max. Error (dB)	**0.00**
Max. Search Radius (#(Unit,LEN))	**2000.01**
Min. Dist Src to Rcvr	**0.00**
Partition	
Raster Factor	**0.50**
Max. Length of Section (#(Unit,LEN))	**999.99**
Min. Length of Section (#(Unit,LEN))	**1.01**
Min. Length of Section (%)	**0.00**
Proj. Line Sources	**On**
Proj. Area Sources	**On**
Ref. Time	
Daytime Penalty (dB)	**0.00**
Recr. Time Penalty (dB)	**5.00**
Night-time Penalty (dB)	**10.00**
DTM	
Standard Height (m)	**0.00**
Model of Terrain	**Triangulation**
Reflection	
max. Order of Reflection	**2**
Search Radius Src	**100.00**
Search Radius Rcvr	**100.00**
Max. Distance Source - Rcvr	**1000.00 1000.00**
Min. Distance Rvcr - Reflector	**1.00 1.00**
Min. Distance Source - Reflector	**0.10**
Industrial (ISO 9613)	
Lateral Diffraction	**some Obj**
Obst. within Area Src do not shield	**On**
Screening	**Incl. Ground Att. over Barrier**
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	**3.0 20.0 0.0**
Temperature (#(Unit,TEMP))	**10**
rel. Humidity (%)	**70**
Ground Absorption G	**0.50**
Wind Speed for Dir. (#(Unit,SPEED))	**3.0**
Roads (TNM)	
Railways (FTA/FRA)	
Aircraft (???)	
Strictly acc. to AzB	

Receiver Noise Levels

Name	M.	ID	Level Lr			Limit. Value			Land Use			Height		Coordinates		
			Day	Night	CNEL	Day	Night	CNEL	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)				(ft)		(ft)	(ft)	(ft)
R3		R3	68.3	-31.7	65.3	0.0	0.0	0.0		x	Total	5.00	a	6391064.71	2404142.30	5.00
R4		R4	62.6	-37.4	59.6	0.0	0.0	0.0		x	Total	5.00	a	6391088.40	2402348.03	5.00
R5		R5	63.1	-36.9	60.1	0.0	0.0	0.0		x	Total	5.00	a	6392902.24	2399808.91	5.00

Point Source(s)

Name	M.	ID	Result. PWL			Lw / Li			Operating Time			Height	Coordinates		
			Day	Evening	Night	Type	Value	norm.	Day	Special	Night		X	Y	Z
			(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	(ft)	(ft)	(ft)	(ft)

Line Source(s)

Name	M.	ID	Result. PWL			Result. PWL'			Lw / Li			Operating Time			Moving Pt. Src				Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	Number			Speed	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	Day	Evening	Night	(mph)	(ft)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Area Source(s)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height	
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)		
SHAY_POND_PIPELINES_ZVI		0	118.0	18.0	18.0	77.9	-22.1	-22.1	PWL-Pt	118					8	a

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height	
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)		
SHAY_POND_PIPELINES_ZVI		0	118.0	18.0	18.0	86.8	-13.2	-13.2	PWL-Pt	118					8	a
SHAY_POND_PIPELINES_ZVI		0	118.0	18.0	18.0	103.0	3.0	3.0	PWL-Pt	118					8	a

Name	ID	Height				Coordinates			
		Begin		End		x	y	z	Ground
		(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
SHAY_POND_PIPELINES_ZVI	0	8.00	a			6391025.91	2404405.75	8.00	0.00
						6391027.14	2403761.66	8.00	0.00
						6391196.17	2403766.61	8.00	0.00
						6391197.78	2403766.53	8.00	0.00
						6391199.36	2403766.19	8.00	0.00
						6391200.86	2403765.59	8.00	0.00
						6391202.25	2403764.77	8.00	0.00
						6391203.49	2403763.73	8.00	0.00
						6391204.54	2403762.50	8.00	0.00
						6391205.39	2403761.13	8.00	0.00
						6391206.00	2403759.63	8.00	0.00
						6391206.36	2403758.06	8.00	0.00
						6391206.46	2403756.44	8.00	0.00
						6391201.51	2403468.95	8.00	0.00
						6391201.34	2403467.26	8.00	0.00
						6391200.88	2403465.62	8.00	0.00
						6391200.15	2403464.08	8.00	0.00
						6391141.00	2403362.58	8.00	0.00
						6391117.94	2403207.95	8.00	0.00
						6391139.71	2403052.79	8.00	0.00
						6391203.47	2402953.49	8.00	0.00
						6391204.17	2402952.18	8.00	0.00
						6391204.68	2402950.78	8.00	0.00
						6391204.97	2402949.32	8.00	0.00
						6391205.05	2402947.83	8.00	0.00
						6391187.79	2402422.32	8.00	0.00
						6391586.75	2402304.98	8.00	0.00
						6391588.23	2402304.41	8.00	0.00
						6391589.60	2402303.61	8.00	0.00
						6392265.11	2401837.70	8.00	0.00
						6392266.26	2401836.76	8.00	0.00
						6392267.27	2401835.67	8.00	0.00
						6392268.11	2401834.44	8.00	0.00
						6392268.75	2401833.09	8.00	0.00
						6392269.18	2401831.67	8.00	0.00
						6392269.40	2401830.20	8.00	0.00
						6392276.09	2401739.25	8.00	0.00
						6392591.85	2400483.48	8.00	0.00
						6392592.07	2400482.30	8.00	0.00
						6392592.15	2400481.09	8.00	0.00
						6392592.08	2400479.89	8.00	0.00
						6392553.02	2400143.66	8.00	0.00
						6392557.75	2399935.88	8.00	0.00
						6392557.75	2399935.48	8.00	0.00
						6392557.68	2399931.32	8.00	0.00
						6392557.50	2399929.58	8.00	0.00
						6392557.02	2399927.91	8.00	0.00
						6392556.26	2399926.34	8.00	0.00
						6392555.23	2399924.93	8.00	0.00
						6392553.98	2399923.72	8.00	0.00
						6392552.53	2399922.74	8.00	0.00
						6392550.94	2399922.03	8.00	0.00
						6392549.25	2399921.61	8.00	0.00
						6392547.51	2399921.49	8.00	0.00
						6392545.78	2399921.67	8.00	0.00
						6392544.10	2399922.15	8.00	0.00
						6392542.53	2399922.91	8.00	0.00
						6392541.12	2399923.94	8.00	0.00
						6392539.91	2399925.19	8.00	0.00
						6392538.94	2399926.64	8.00	0.00
						6392538.23	2399928.23	8.00	0.00
						6392537.80	2399929.92	8.00	0.00
						6392537.68	2399931.66	8.00	0.00
						6392537.75	2399935.63	8.00	0.00
						6392533.01	2400143.90	8.00	0.00
						6392533.01	2400144.30	8.00	0.00
						6392533.07	2400145.28	8.00	0.00
						6392572.00	2400480.38	8.00	0.00
						6392256.48	2401735.22	8.00	0.00
						6392256.31	2401736.09	8.00	0.00
						6392256.21	2401736.92	8.00	0.00

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
				6392249.81	2401823.95	8.00	0.00
				6391579.57	2402286.24	8.00	0.00
				6391174.72	2402405.31	8.00	0.00
				6391173.19	2402405.90	8.00	0.00
				6391171.78	2402406.73	8.00	0.00
				6391170.52	2402407.78	8.00	0.00
				6391169.46	2402409.01	8.00	0.00
				6391168.60	2402410.41	8.00	0.00
				6391167.99	2402411.93	8.00	0.00
				6391167.63	2402413.52	8.00	0.00
				6391167.54	2402415.16	8.00	0.00
				6391184.95	2402945.30	8.00	0.00
				6391121.69	2403043.83	8.00	0.00
				6391121.01	2403045.06	8.00	0.00
				6391120.52	2403046.38	8.00	0.00
				6391120.21	2403047.75	8.00	0.00
				6391097.93	2403206.60	8.00	0.00
				6391097.83	2403208.16	8.00	0.00
				6391097.94	2403209.46	8.00	0.00
				6391121.50	2403367.44	8.00	0.00
				6391121.76	2403368.67	8.00	0.00
				6391122.18	2403369.87	8.00	0.00
				6391122.75	2403371.00	8.00	0.00
				6391181.56	2403471.90	8.00	0.00
				6391186.28	2403746.31	8.00	0.00
				6391017.45	2403741.37	8.00	0.00
				6391015.85	2403741.45	8.00	0.00
				6391014.29	2403741.78	8.00	0.00
				6391012.80	2403742.36	8.00	0.00
				6391011.43	2403743.17	8.00	0.00
				6391010.19	2403744.18	8.00	0.00
				6391009.14	2403745.38	8.00	0.00
				6391008.29	2403746.73	8.00	0.00
				6391007.67	2403748.20	8.00	0.00
				6391007.28	2403749.75	8.00	0.00
				6391007.15	2403751.35	8.00	0.00
				6391005.92	2404400.99	8.00	0.00
				6390932.09	2404461.53	8.00	0.00
				6390930.90	2404462.68	8.00	0.00
				6390929.92	2404464.01	8.00	0.00
				6390929.17	2404465.48	8.00	0.00
				6390928.67	2404467.06	8.00	0.00
				6390928.44	2404468.70	8.00	0.00
				6390928.49	2404470.35	8.00	0.00
				6390928.80	2404471.97	8.00	0.00
				6390929.38	2404473.52	8.00	0.00
				6390930.20	2404474.95	8.00	0.00
				6390931.25	2404476.23	8.00	0.00
				6390932.49	2404477.31	8.00	0.00
				6390933.89	2404478.18	8.00	0.00
				6390935.42	2404478.81	8.00	0.00
				6390937.03	2404479.17	8.00	0.00
				6390938.68	2404479.27	8.00	0.00
				6390940.33	2404479.09	8.00	0.00
				6390941.92	2404478.64	8.00	0.00
				6390943.41	2404477.94	8.00	0.00
				6390944.77	2404477.00	8.00	0.00
				6391022.25	2404413.47	8.00	0.00
				6391023.32	2404412.46	8.00	0.00
				6391024.22	2404411.30	8.00	0.00
				6391024.95	2404410.02	8.00	0.00
				6391025.48	2404408.65	8.00	0.00
				6391025.80	2404407.22	8.00	0.00
SHAY_POND_PIPELINES_ZVI	0	8.00	a	6393026.81	2400486.65	8.00	0.00
				6393028.44	2400486.50	8.00	0.00
				6393030.03	2400486.08	8.00	0.00
				6393031.53	2400485.40	8.00	0.00
				6393032.89	2400484.49	8.00	0.00
				6393034.09	2400483.36	8.00	0.00
				6393035.09	2400482.06	8.00	0.00
				6393177.09	2400260.90	8.00	0.00
				6393177.90	2400259.36	8.00	0.00
				6393178.43	2400257.70	8.00	0.00
				6393178.66	2400255.97	8.00	0.00
				6393178.59	2400254.23	8.00	0.00
				6393178.22	2400252.52	8.00	0.00
				6393177.56	2400250.91	8.00	0.00

Name	ID	Height				Coordinates			
		Begin		End		x	y	z	Ground
		(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
						6393176.63	2400249.44	8.00	0.00
						6393175.46	2400248.15	8.00	0.00
						6393174.08	2400247.08	8.00	0.00
						6393172.53	2400246.27	8.00	0.00
						6393170.87	2400245.74	8.00	0.00
						6393169.15	2400245.51	8.00	0.00
						6393167.40	2400245.58	8.00	0.00
						6393165.70	2400245.95	8.00	0.00
						6393164.09	2400246.61	8.00	0.00
						6393162.61	2400247.54	8.00	0.00
						6393161.32	2400248.71	8.00	0.00
						6393160.26	2400250.09	8.00	0.00
						6393021.17	2400466.71	8.00	0.00
						6392591.04	2400470.95	8.00	0.00
						6392592.08	2400479.89	8.00	0.00
						6392592.15	2400481.09	8.00	0.00
						6392592.07	2400482.30	8.00	0.00
						6392591.85	2400483.48	8.00	0.00
						6392589.96	2400490.97	8.00	0.00
SHAY_POND_PIPELINES_ZVI	0	8.00	a			6392589.96	2400490.97	8.00	0.00
						6392591.85	2400483.48	8.00	0.00
						6392592.07	2400482.30	8.00	0.00
						6392592.15	2400481.09	8.00	0.00
						6392592.08	2400479.89	8.00	0.00
						6392591.04	2400470.95	8.00	0.00
						6392582.01	2400471.04	8.00	0.00
						6392580.28	2400471.22	8.00	0.00
						6392578.60	2400471.69	8.00	0.00
						6392577.03	2400472.45	8.00	0.00
						6392575.62	2400473.47	8.00	0.00
						6392574.41	2400474.71	8.00	0.00
						6392573.42	2400476.15	8.00	0.00
						6392572.71	2400477.74	8.00	0.00
						6392572.28	2400479.42	8.00	0.00
						6392572.15	2400481.16	8.00	0.00
						6392572.32	2400482.89	8.00	0.00
						6392572.79	2400484.57	8.00	0.00
						6392573.54	2400486.14	8.00	0.00
						6392574.56	2400487.56	8.00	0.00
						6392575.80	2400488.77	8.00	0.00
						6392577.24	2400489.76	8.00	0.00
						6392578.82	2400490.48	8.00	0.00
						6392580.51	2400490.91	8.00	0.00
						6392582.25	2400491.04	8.00	0.00

Barrier(s)

Name	Sel.	M.	ID	Absorption		Z-Ext.	Cantilever		Height		Coordinates			
				left	right		horz.	vert.	Begin	End	x	y	z	Ground
						(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Building(s)

Name	Sel.	M.	ID	RB	Residents	Absorption	Height	Coordinates				
							Begin	x	y	z	Ground	
							(ft)	(ft)	(ft)	(ft)	(ft)	

Ground Absorption(s)

Name	Sel.	M.	ID	G	Coordinates	
					x	y
					(ft)	(ft)

Contour(s)

Name	Sel.	M.	ID	OnlyPts	Height		Coordinates		
					Begin	End	x	y	z
					(ft)	(ft)	(ft)	(ft)	(ft)

Vertical Area Source(s)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Rail

Name	Sel.	M.	ID	Lw'		Train Class	Correct.	Vmax
				Day	Night		Track	
				(dBA)	(dBA)		(dB)	(km(mph)

Sound Level Spectra

Name	ID	Type	Oktave Spectrum (dB)											Source
			Weight.	31.5	63	125	250	500	1000	2000	4000	8000	A	lin	

Roads

Name	Sel.	M.	ID	Lme			Count Data		exact Count Data						Speed Limit		SCS	Surface		Gradient	Mult. Reflection		
				Day	Evening	Night	DTV	Str.class.	M			p (%)			Auto	Truck	Dist.	Dstro	Type		Drefl	Hbuild	Dist.
				(dBA)	(dBA)	(dBA)			Day	Evening	Night	Day	Evening	Night	(mph)	(mph)		(dB)		(%)	(dB)	(ft)	(ft)

RoadsGeo

Name	Height				Coordinates				Dist	LSlope
	Begin		End		x	y	z	Ground	(ft)	(%)
	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)		

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APPENDIX 8.3:

SAND CANYON CADNAA CONSTRUCTION NOISE MODEL INPUTS

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15309 - Big Bear Replinishment

CadnaA Noise Prediction Model: 15309-02_Sand_canyon.cna
Date: 26.09.23
Analyst: B. Maddux

Calculation Configuration

Configuration	
Parameter	**Value**
General	
Max. Error (dB)	**0.00**
Max. Search Radius (#(Unit,LEN))	**2000.01**
Min. Dist Src to Rcvr	**0.00**
Partition	
Raster Factor	**0.50**
Max. Length of Section (#(Unit,LEN))	**999.99**
Min. Length of Section (#(Unit,LEN))	**1.01**
Min. Length of Section (%)	**0.00**
Proj. Line Sources	**On**
Proj. Area Sources	**On**
Ref. Time	
Daytime Penalty (dB)	**0.00**
Recr. Time Penalty (dB)	**5.00**
Night-time Penalty (dB)	**10.00**
DTM	
Standard Height (m)	**0.00**
Model of Terrain	**Triangulation**
Reflection	
max. Order of Reflection	**2**
Search Radius Src	**100.00**
Search Radius Rcvr	**100.00**
Max. Distance Source - Rcvr	**1000.00 1000.00**
Min. Distance Rvcr - Reflector	**1.00 1.00**
Min. Distance Source - Reflector	**0.10**
Industrial (ISO 9613)	
Lateral Diffraction	**some Obj**
Obst. within Area Src do not shield	**On**
Screening	**Incl. Ground Att. over Barrier**
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	**3.0 20.0 0.0**
Temperature (#(Unit,TEMP))	**10**
rel. Humidity (%)	**70**
Ground Absorption G	**0.50**
Wind Speed for Dir. (#(Unit,SPEED))	**3.0**
Roads (TNM)	
Railways (FTA/FRA)	
Aircraft (???)	
Strictly acc. to AzB	

Receiver Noise Levels

Name	M.	ID	Level Lr			Limit. Value			Land Use			Height		Coordinates		
			Day	Night	CNEL	Day	Night	CNEL	Type	Auto	Noise Type			X	Y	Z
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)				(ft)		(ft)	(ft)	(ft)
R6		R6	72.8	-29.5	69.8	0.0	0.0	0.0		x	Total	5.00	a	6378418.88	2389873.77	5.00
R7		R7	65.5	-34.5	62.5	0.0	0.0	0.0		x	Total	5.00	a	6381776.13	2391405.64	5.00
R8		R8	71.9	-28.1	68.9	0.0	0.0	0.0		x	Total	5.00	a	6381444.88	2391401.47	5.00
R9		R9	65.5	-34.5	62.5	0.0	0.0	0.0		x	Total	5.00	a	6380463.03	2391966.65	5.00
R10		R10	66.0	-34.1	63.0	0.0	0.0	0.0		x	Total	5.00	a	6379456.09	2392645.90	5.00

Point Source(s)

Name	M.	ID	Result. PWL			Lw / Li			Operating Time			Height		Coordinates		
			Day	Evening	Night	Type	Value	norm.	Day	Special	Night			X	Y	Z
			(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	(ft)		(ft)	(ft)	(ft)
Pump1		Pump1	113.4	0.0	0.0	Lw	113.4					8.00	r	6378341.69	2389749.43	8.00

Line Source(s)

Name	M.	ID	Result. PWL			Result. PWL'			Lw / Li			Operating Time			Moving Pt. Src				Height
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	Number			Speed	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)	Day	Evening	Night	(mph)	(ft)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Area Source(s)

Name	M.	ID	Result. PWL			Result. PWL''			Lw / Li			Operating Time			Height	
			Day	Evening	Night	Day	Evening	Night	Type	Value	norm.	Day	Special	Night	(ft)	
			(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)			dB(A)	(min)	(min)	(min)		
SAND CANYON PIPELINE_ZVI		0	118.0	18.0	18.0	77.0	-23.0	-23.0	PWL-Pt	118					8	a
SAND CANYON PIPELINE_ZVI		0	118.0	18.0	18.0	88.5	-11.5	-11.5	PWL-Pt	118					0	a
Recharge Area		RA1	115.6	15.6	15.6	69.7	-30.3	-30.3	PWL-Pt	115.6					8	a

Name	ID	Height			Coordinates			
		Begin		End	x	y	z	Ground
		(ft)		(ft)	(ft)	(ft)	(ft)	(ft)
SAND CANYON PIPELINE_ZVI	0	8.00	a		6380818.28	2391756.88	8.00	0.00
					6381040.20	2391699.69	8.00	0.00
					6381041.71	2391699.17	8.00	0.00
					6381043.11	2391698.42	8.00	0.00
					6381584.60	2391350.20	8.00	0.00
					6381691.53	2391405.30	8.00	0.00
					6381693.15	2391405.97	8.00	0.00
					6381694.85	2391406.34	8.00	0.00
					6381696.59	2391406.40	8.00	0.00
					6381698.32	2391406.17	8.00	0.00
					6381699.98	2391405.64	8.00	0.00
					6381701.52	2391404.83	8.00	0.00
					6381702.90	2391403.76	8.00	0.00
					6381704.07	2391402.47	8.00	0.00
					6381705.00	2391401.00	8.00	0.00
					6381705.66	2391399.38	8.00	0.00
					6381706.04	2391397.68	8.00	0.00
					6381706.10	2391395.94	8.00	0.00
					6381705.87	2391394.21	8.00	0.00
					6381705.34	2391392.55	8.00	0.00
					6381704.53	2391391.01	8.00	0.00
					6381703.46	2391389.63	8.00	0.00
					6381702.17	2391388.46	8.00	0.00
					6381700.70	2391387.52	8.00	0.00
					6381588.63	2391329.77	8.00	0.00
					6381587.25	2391329.19	8.00	0.00
					6381585.81	2391328.81	8.00	0.00
					6381584.32	2391328.66	8.00	0.00
					6381582.82	2391328.73	8.00	0.00
					6381581.36	2391329.03	8.00	0.00
					6381579.95	2391329.54	8.00	0.00
					6381578.64	2391330.25	8.00	0.00
					6381033.65	2391680.72	8.00	0.00
					6380818.65	2391736.13	8.00	0.00
					6380633.78	2391560.66	8.00	0.00
					6380633.61	2391560.51	8.00	0.00
					6380375.15	2391325.88	8.00	0.00
					6380485.72	2391200.48	8.00	0.00
					6380575.28	2391102.63	8.00	0.00
					6380576.33	2391101.26	8.00	0.00
					6380577.13	2391099.73	8.00	0.00
					6380577.65	2391098.08	8.00	0.00
					6380577.89	2391096.36	8.00	0.00
					6380583.93	2390971.26	8.00	0.00
					6380583.88	2390969.62	8.00	0.00
					6380583.55	2390968.01	8.00	0.00
					6380534.47	2390797.48	8.00	0.00
					6380581.12	2390640.13	8.00	0.00
					6380581.44	2390638.68	8.00	0.00
					6380581.53	2390637.19	8.00	0.00
					6380581.40	2390635.70	8.00	0.00
					6380566.86	2390545.48	8.00	0.00
					6380566.59	2390544.29	8.00	0.00
					6380566.18	2390543.14	8.00	0.00
					6380565.63	2390542.05	8.00	0.00
					6380512.11	2390449.94	8.00	0.00
					6380571.25	2390336.27	8.00	0.00
					6380571.78	2390335.05	8.00	0.00
					6380572.15	2390333.78	8.00	0.00
					6380572.34	2390332.47	8.00	0.00
					6380572.36	2390331.15	8.00	0.00
					6380556.11	2390004.72	8.00	0.00
					6380555.89	2390003.08	8.00	0.00
					6380555.41	2390001.50	8.00	0.00
					6380554.67	2390000.03	8.00	0.00
					6380553.70	2389998.69	8.00	0.00
					6380552.52	2389997.53	8.00	0.00
					6380551.17	2389996.58	8.00	0.00
					6380549.68	2389995.87	8.00	0.00
					6380548.09	2389995.41	8.00	0.00

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
				6380546.45	2389995.22	8.00	0.00
				6380207.34	2389983.83	8.00	0.00
				6380020.65	2389923.10	8.00	0.00
				6380019.24	2389922.75	8.00	0.00
				6380017.79	2389922.61	8.00	0.00
				6380016.34	2389922.68	8.00	0.00
				6380014.92	2389922.96	8.00	0.00
				6380013.55	2389923.44	8.00	0.00
				6379771.14	2390029.42	8.00	0.00
				6379769.90	2390030.06	8.00	0.00
				6379768.77	2390030.87	8.00	0.00
				6379767.76	2390031.83	8.00	0.00
				6379766.89	2390032.93	8.00	0.00
				6379657.05	2390193.28	8.00	0.00
				6379505.79	2390388.69	8.00	0.00
				6379504.95	2390389.96	8.00	0.00
				6379504.65	2390390.54	8.00	0.00
				6379419.68	2390570.33	8.00	0.00
				6379295.75	2390521.79	8.00	0.00
				6379307.61	2390299.64	8.00	0.00
				6379307.62	2390298.93	8.00	0.00
				6379307.56	2390297.98	8.00	0.00
				6379277.86	2390034.18	8.00	0.00
				6379277.55	2390032.58	8.00	0.00
				6379276.98	2390031.06	8.00	0.00
				6379276.17	2390029.64	8.00	0.00
				6379275.15	2390028.38	8.00	0.00
				6379273.93	2390027.30	8.00	0.00
				6379272.55	2390026.43	8.00	0.00
				6379271.05	2390025.80	8.00	0.00
				6379269.47	2390025.42	8.00	0.00
				6379267.85	2390025.30	8.00	0.00
				6378739.79	2390029.11	8.00	0.00
				6378738.14	2390029.27	8.00	0.00
				6378736.55	2390029.69	8.00	0.00
				6378735.04	2390030.37	8.00	0.00
				6378733.67	2390031.29	8.00	0.00
				6378636.96	2390108.42	8.00	0.00
				6378635.82	2390109.48	8.00	0.00
				6378634.86	2390110.71	8.00	0.00
				6378634.10	2390112.07	8.00	0.00
				6378633.56	2390113.54	8.00	0.00
				6378633.26	2390115.07	8.00	0.00
				6378607.08	2390337.59	8.00	0.00
				6378607.01	2390339.08	8.00	0.00
				6378607.17	2390340.55	8.00	0.00
				6378607.55	2390341.99	8.00	0.00
				6378648.14	2390460.90	8.00	0.00
				6378597.42	2390512.35	8.00	0.00
				6378478.70	2390395.34	8.00	0.00
				6378275.78	2390181.54	8.00	0.00
				6378275.55	2390181.30	8.00	0.00
				6378268.55	2390174.40	8.00	0.00
				6378267.28	2390173.35	8.00	0.00
				6378265.86	2390172.51	8.00	0.00
				6378264.32	2390171.92	8.00	0.00
				6378262.70	2390171.59	8.00	0.00
				6378261.05	2390171.54	8.00	0.00
				6378259.41	2390171.75	8.00	0.00
				6378257.83	2390172.24	8.00	0.00
				6378256.35	2390172.97	8.00	0.00
				6378255.01	2390173.94	8.00	0.00
				6378253.85	2390175.12	8.00	0.00
				6378252.90	2390176.47	8.00	0.00
				6378252.19	2390177.96	8.00	0.00
				6378251.73	2390179.55	8.00	0.00
				6378251.54	2390181.19	8.00	0.00
				6378251.62	2390182.84	8.00	0.00
				6378251.97	2390184.45	8.00	0.00
				6378252.58	2390185.98	8.00	0.00
				6378253.43	2390187.40	8.00	0.00
				6378254.51	2390188.65	8.00	0.00
				6378261.39	2390195.43	8.00	0.00
				6378464.31	2390409.23	8.00	0.00
				6378464.54	2390409.47	8.00	0.00
				6378590.50	2390533.62	8.00	0.00
				6378591.85	2390534.73	8.00	0.00

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
				6378593.36	2390535.59	8.00	0.00
				6378595.00	2390536.17	8.00	0.00
				6378596.72	2390536.46	8.00	0.00
				6378598.47	2390536.45	8.00	0.00
				6378600.18	2390536.14	8.00	0.00
				6378601.82	2390535.53	8.00	0.00
				6378603.32	2390534.65	8.00	0.00
				6378604.65	2390533.52	8.00	0.00
				6378666.72	2390470.54	8.00	0.00
				6378667.74	2390469.33	8.00	0.00
				6378668.55	2390467.97	8.00	0.00
				6378669.14	2390466.51	8.00	0.00
				6378669.49	2390464.97	8.00	0.00
				6378669.60	2390463.39	8.00	0.00
				6378669.46	2390461.81	8.00	0.00
				6378669.06	2390460.28	8.00	0.00
				6378627.21	2390337.68	8.00	0.00
				6378652.65	2390121.49	8.00	0.00
				6378743.44	2390049.09	8.00	0.00
				6379258.99	2390045.36	8.00	0.00
				6379287.59	2390299.40	8.00	0.00
				6379275.39	2390527.94	8.00	0.00
				6379275.43	2390529.50	8.00	0.00
				6379275.71	2390531.04	8.00	0.00
				6379276.23	2390532.51	8.00	0.00
				6379276.97	2390533.89	8.00	0.00
				6379277.92	2390535.13	8.00	0.00
				6379279.05	2390536.21	8.00	0.00
				6379280.33	2390537.10	8.00	0.00
				6379281.73	2390537.78	8.00	0.00
				6379421.09	2390592.36	8.00	0.00
				6379422.68	2390592.84	8.00	0.00
				6379424.34	2390593.04	8.00	0.00
				6379426.01	2390592.97	8.00	0.00
				6379427.64	2390592.62	8.00	0.00
				6379429.19	2390592.00	8.00	0.00
				6379430.61	2390591.14	8.00	0.00
				6379431.88	2390590.05	8.00	0.00
				6379432.94	2390588.76	8.00	0.00
				6379433.78	2390587.32	8.00	0.00
				6379522.27	2390400.07	8.00	0.00
				6379673.05	2390205.30	8.00	0.00
				6379673.39	2390204.83	8.00	0.00
				6379781.77	2390046.59	8.00	0.00
				6380018.08	2389943.30	8.00	0.00
				6380202.50	2390003.29	8.00	0.00
				6380204.02	2390003.66	8.00	0.00
				6380205.25	2390003.78	8.00	0.00
				6380536.59	2390014.90	8.00	0.00
				6380552.25	2390329.44	8.00	0.00
				6380491.83	2390445.59	8.00	0.00
				6380491.18	2390447.14	8.00	0.00
				6380490.80	2390448.77	8.00	0.00
				6380490.70	2390450.44	8.00	0.00
				6380490.88	2390452.11	8.00	0.00
				6380491.34	2390453.72	8.00	0.00
				6380492.05	2390455.23	8.00	0.00
				6380547.40	2390550.50	8.00	0.00
				6380561.29	2390636.63	8.00	0.00
				6380514.46	2390794.59	8.00	0.00
				6380514.16	2390795.98	8.00	0.00
				6380514.05	2390797.40	8.00	0.00
				6380514.15	2390798.81	8.00	0.00
				6380514.44	2390800.20	8.00	0.00
				6380563.87	2390971.95	8.00	0.00
				6380558.08	2391091.79	8.00	0.00
				6380470.84	2391187.12	8.00	0.00
				6380353.63	2391320.04	8.00	0.00
				6380352.60	2391321.43	8.00	0.00
				6380351.83	2391322.98	8.00	0.00
				6380351.33	2391324.63	8.00	0.00
				6380351.13	2391326.35	8.00	0.00
				6380351.23	2391328.07	8.00	0.00
				6380351.62	2391329.75	8.00	0.00
				6380352.29	2391331.34	8.00	0.00
				6380353.23	2391332.79	8.00	0.00
				6380354.41	2391334.06	8.00	0.00

Name	ID	Height				Coordinates			
		Begin		End		x	y	z	Ground
		(ft)		(ft)		(ft)	(ft)	(ft)	(ft)
						6380620.09	2391575.24	8.00	0.00
						6380808.90	2391754.45	8.00	0.00
						6380810.21	2391755.50	8.00	0.00
						6380811.68	2391756.32	8.00	0.00
						6380813.27	2391756.87	8.00	0.00
						6380814.93	2391757.16	8.00	0.00
						6380816.62	2391757.16	8.00	0.00
SAND CANYON PIPELINE_ZVI	0	0.00	a			6378337.87	2389749.79	0.00	0.00
						6378336.17	2389749.67	0.00	0.00
						6378334.47	2389749.83	0.00	0.00
						6378332.83	2389750.29	0.00	0.00
						6378331.29	2389751.01	0.00	0.00
						6378329.89	2389751.99	0.00	0.00
						6378328.68	2389753.19	0.00	0.00
						6378327.69	2389754.57	0.00	0.00
						6378326.95	2389756.11	0.00	0.00
						6378288.77	2389856.43	0.00	0.00
						6378288.32	2389857.96	0.00	0.00
						6378288.12	2389859.54	0.00	0.00
						6378288.18	2389861.13	0.00	0.00
						6378288.49	2389862.69	0.00	0.00
						6378338.63	2390041.45	0.00	0.00
						6378253.09	2390176.17	0.00	0.00
						6378252.29	2390177.71	0.00	0.00
						6378251.76	2390179.38	0.00	0.00
						6378251.54	2390181.11	0.00	0.00
						6378251.62	2390182.85	0.00	0.00
						6378252.00	2390184.55	0.00	0.00
						6378252.67	2390186.16	0.00	0.00
						6378253.61	2390187.63	0.00	0.00
						6378254.79	2390188.91	0.00	0.00
						6378256.17	2390189.97	0.00	0.00
						6378257.72	2390190.77	0.00	0.00
						6378259.38	2390191.29	0.00	0.00
						6378261.11	2390191.52	0.00	0.00
						6378262.85	2390191.44	0.00	0.00
						6378264.55	2390191.06	0.00	0.00
						6378266.16	2390190.39	0.00	0.00
						6378267.63	2390189.45	0.00	0.00
						6378268.91	2390188.27	0.00	0.00
						6378269.97	2390186.89	0.00	0.00
						6378357.91	2390048.41	0.00	0.00
						6378358.68	2390046.92	0.00	0.00
						6378359.20	2390045.33	0.00	0.00
						6378359.45	2390043.67	0.00	0.00
						6378359.41	2390041.99	0.00	0.00
						6378359.09	2390040.34	0.00	0.00
						6378308.64	2389860.47	0.00	0.00
						6378345.65	2389763.22	0.00	0.00
						6378346.10	2389761.67	0.00	0.00
						6378346.29	2389760.07	0.00	0.00
						6378346.23	2389758.46	0.00	0.00
						6378345.90	2389756.88	0.00	0.00
						6378345.33	2389755.37	0.00	0.00
						6378344.52	2389753.97	0.00	0.00
						6378343.50	2389752.72	0.00	0.00
						6378342.29	2389751.66	0.00	0.00
						6378340.92	2389750.80	0.00	0.00
						6378339.43	2389750.17	0.00	0.00
Recharge Area	RA1	8.00	a			6381760.75	2391392.47	8.00	0.00
						6381678.63	2391308.15	8.00	0.00
						6381268.62	2391682.13	8.00	0.00
						6380673.54	2391981.81	8.00	0.00
						6380478.22	2392010.02	8.00	0.00
						6380115.53	2392014.11	8.00	0.00
						6379379.05	2392497.22	8.00	0.00
						6379102.52	2392639.46	8.00	0.00
						6379188.88	2392782.33	8.00	0.00
						6380158.13	2392166.27	8.00	0.00
						6380511.83	2392124.98	8.00	0.00
						6380691.14	2392132.02	8.00	0.00
						6381377.75	2391764.80	8.00	0.00
						6381637.08	2391538.02	8.00	0.00

Barrier(s)

Name	Sel.	M.	ID	Absorption		Z-Ext.	Cantilever		Height		Coordinates			
				left	right		horz.	vert.	Begin	End	x	y	z	Ground
						(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Building(s)

Name	Sel.	M.	ID	RB	Residents	Absorption	Height	Coordinates			
							Begin	x	y	z	Ground
							(ft)	(ft)	(ft)	(ft)	(ft)

Ground Absorption(s)

Name	Sel.	M.	ID	G	Coordinates	
					x	y
					(ft)	(ft)

Contour(s)

Name	Sel.	M.	ID	OnlyPts	Height		Coordinates		
					Begin	End	x	y	z
					(ft)	(ft)	(ft)	(ft)	(ft)

Vertical Area Source(s)

Name	ID	Height		Coordinates			
		Begin	End	x	y	z	Ground
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)

Rail

Name	Sel.	M.	ID	Lw'		Train Class	Correct.	Vmax
				Day	Night		Track	
				(dBA)	(dBA)		(dB)	(km(mph)

Sound Level Spectra

Name	ID	Type	Oktave Spectrum (dB)											Source
			Weight.	31.5	63	125	250	500	1000	2000	4000	8000	A	lin	

Roads

Name	Sel.	M.	ID	Lme			Count Data		exact Count Data						Speed Limit		SCS	Surface		Gradient	Mult. Reflection		
				Day	Evening	Night	DTV	Str.class.	M			p (%)			Auto	Truck	Dist.	Dstro	Type		Drefl	Hbuild	Dist.
				(dBA)	(dBA)	(dBA)			Day	Evening	Night	Day	Evening	Night	(mph)	(mph)		(dB)		(%)	(dB)	(ft)	(ft)

RoadsGeo

Name	Height				Coordinates				Dist	LSlope
	Begin		End		x	y	z	Ground	(ft)	(%)
	(ft)		(ft)		(ft)	(ft)	(ft)	(ft)		

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

Office
73-720 Fred Waring Dr. #100
Palm Desert, CA 92260

waterboards.ca.gov/coloradoriver/

ORDER R7-2021-0023

Order Information

Discharger:	Big Bear Regional Wastewater Agency
Facility:	Export of Recycled Water to Lucerne Valley
Address:	122 Palomino Drive, Big Bear City, California 92314
County:	San Bernardino County
WDID:	7A360100011
GeoTracker ID:	WDR100027897

I, PAULA RASMUSSEN, Executive Officer, hereby certify that the following is a full, true, and correct copy of the order adopted by the California Regional Water Quality Control Board, Colorado River Basin Region, on May 11, 2021.

Original signed by
PAULA RASMUSSEN
Executive Officer

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

ORDER R7-2021-0023

WASTE DISCHARGE REQUIREMENTS
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
LUCERNE VALLEY-SAN BERNARDINO COUNTY

The California Regional Water Quality Control Board, Colorado River Basin Region (Regional Water Board) hereby makes the following Findings:

1. Big Bear Area Regional Wastewater Agency (BBARWA or Discharger), P.O. Box 517, Big Bear City, California 92314, owns 480 acres in the Lucerne Valley, of which 340 acres are irrigated with recycled water from the Discharger's Wastewater Treatment Plant (WWTP). There are an additional 140 acres available for irrigation, also in the Lucerne Valley. BBARWA's WWTP provides sewerage service to the City of Big Bear Lake, Big Bear City Community Services District, and County Service Area 53-B. The WWTP is located at 122 Palomino Drive, Big Bear City, California 92314, and has a design treatment capacity of 4.89 million gallons-per-day (MGD) and a hydraulic capacity of 9.2 MGD. The Facility is assigned California Integrated Water Quality System (CIWQS) number CW-208930, Waste Discharge Identification (WDID) number 7A360100011, and GeoTracker Global Identification number WDR100027897.

2. The WWTP is located outside the boundary of the Colorado River Basin Water Board (Regional Water Board) and is regulated by the California Regional Water Quality Control Board, Santa Ana Region (Santa Ana Water Board) under Waste Discharge Requirements (WDRs) Order R8-2005-0044.

3. The WWTP has the following types of treatment: preliminary treatment, secondary treatment, and sludge drying and treatment. Secondary treated wastewater from the WWTP is disposed of through three possible discharge points that are designated in Order R8-2005-0044 as Point 001, Point 002, and Point 003. The discharges from the WWTP at Points 002 and 003 are regulated by the Santa Ana Regional Water Quality Control Board. The majority of the treated wastewater is discharged through Discharge Point 001 into the Lucerne Valley to irrigate fodder, fiber, and seed crops. A minimal volume of treated wastewater is discharged through Points 002 and 003 for recycling and reuse at various sites for irrigation, dust control at construction sites, and wildlife habitat restoration in the Baldwin Lake.

4. This Order regulates the discharge from the WWTP at Point 001. Infrastructure associated with this discharge includes a concrete-lined reservoir and two overflow

ponds that are used to dispose of treated recycled wastewater by percolation and evaporation in the Lucerne Valley (Lucerne Valley Facility or Facility).

5. The Lucerne Valley Facility is located near the intersection of State Highway 247 (Old Woman Springs Road) and Camp Rock Road in the Lucerne Valley of San Bernardino County in Section 14, T4N, R1E, SBB&M, and Assessor's Parcel Number (APN) 0449-082-040000, 34.438554°N Latitude, -116.851225°W Longitude. The Facility's location is shown in **Attachment A**- Vicinity Map, made part of this Order by reference.

6. The Lucerne Valley Facility was most recently regulated by WDRs in Order R7-2016-0026, which was adopted by the Regional Water Board on June 30, 2016.

7. On October 28, 2020, the Discharger submitted an application and Report of Waste Discharge (ROWD) to the Regional Water Board, applying for updated WDRs for the Facility.

8. This Order updates the WDRs to comply with current laws and regulations applicable to the discharge. Accordingly, this Order supersedes WDRs in Order R7-2016-0026 upon the effective date of this Order, except for enforcement purposes.

Wastewater Treatment Facility and Discharge

9. Wastewater that is discharged at the Lucerne Valley Facility goes through preliminary and secondary treatment at the WWTP before it is sent via gravity to the concrete reservoir at the Lucerne Valley Facility. The WWTP components that are used for treatment are described below and the Process Flow Diagram for the WWTP is shown in **Attachment B**–Process Flow Diagram.

    a. **Preliminary Treatment**. Untreated wastewater flows to the preliminary treatment system, which consists of bar screens, aerated grit chamber with grit washer, and a flow bypass channel. This treatment stage removes screenings, rag material, and grit.

    b. **Secondary Treatment**. Effluent flows by gravity from the preliminary treatment system to three parallel oxidation ditches for secondary (biological) treatment and timed processes for nutrient (nitrogen) removal. The number of ditches in operation depends on the seasonal fluctuations of the influent flow. The effluent from the oxidation ditches flows into a system of three secondary clarifiers for removal of floatable and settleable solids/materials. The secondary treated effluent flows to two cement-lined balancing chambers and then flows to equalization storage ponds at the WWTP until pumped for offsite irrigation disposal.

    c. **Offsite Irrigation/Disposal**. Undisinfected secondary treated wastewater is pumped from the WWTP's main pump building (5.2 MGD) or auxiliary

pump building (9.2 MGD) approximately 16.5 miles to an offsite 2.26-million-gallon, concrete-lined reservoir (undisinfected secondary recycled water reservoir). This reservoir is located one mile south of the irrigation site. Wastewater from the reservoir flows by gravity through an outfall line connected to the irrigation system. In the event of an overflow at the concrete-lined reservoir, the wastewater flows by gravity to earthen overflow ponds located adjacent to the irrigation site.

10. Approximately 2.12 MGD of undisinfected secondary recycled water (as defined in California Code of Regulations, title 22, section 60301.900) is discharged to the Lucerne Valley Facility for irrigation of fodder and fiber crops. Undisinfected secondary wastewater was approved by the California Department of Public Health (succeeded by the State Water Resources Control Board's [State Water Board] Division of Drinking Water) for irrigation use at this site. Approximately 340 acres are currently irrigated at the Lucerne Valley Facility, with an additional 140 acres available for irrigation at the site. The effluent discharge limit of 4.8 MGD in this Order is based on the capacity of the irrigated crops to take up nitrogen. The Lucerne Valley Facility site layout is shown in **Attachment C**, made part of this Order by reference.

11. The State Water Board's Division of Drinking Water has established statewide reclamation criteria in California Code of Regulations, title 22, section 60301 et seq. for the use of recycled water and developed guidelines for specific uses. Section 60304(d)(4) allows the use of undisinfected, secondary recycled water for the surface irrigation of fodder and fiber crops and pasture for animals not producing milk for human consumption. BBARWA's Title 22 Engineering Report was initially approved on November 3, 1980 and was last updated November 4, 1998, to allow for the use of tertiary treated wastewater in the Big Bear Area.

12. The grazing of sheep on the irrigation site has been allowed under certain conditions, as outlined in a letter from Regional Water Board staff dated November 15, 1994, and in Discharge Specification D.18 of this Order.

13. No sewage sludge is discharged at the recycled water reuse site.

14. BBARWA's Self-Monitoring Reports (SMRs) from January 2016 through December 2020 characterize the WWTP effluent as follows:

Table 1. Effluent Characterization

Constituent	Units	Average	Maximum	Minimum
Flow	MGD	2.12	8.39	0.441

Constituent	Units	Average	Maximum	Minimum
20° C BOD_5[1]	mg/L[2]	8	36	ND[3]
TSS[4]	mg/L	8	44	1
pH	s.u.[5]	7.61	8.46	6.85
Total Dissolved Solids (TDS)	mg/L	441	520	350
Total Inorganic Nitrogen (TIN)[6]	mg/L	3.9	22.3	0.4
Total Nitrogen (TN)	mg/L	4.9	12	1.8
Nitrate as N	mg/L	1.7	7.7	0.04
Chloride	mg/L	56	87	34
Sulfate	mg/L	40	48	29
Fluoride	mg/L	0.43	0.61	0.24
Boron	mg/L	0.20	0.32	<0.1

Hydrogeologic Conditions

15. Lucerne Valley Groundwater Basin underlies Lucerne and North Lucerne Valleys and is bounded on the south by the San Bernardino Mountains and on the west by the Granite Mountains and the Helendale fault. The Ord Mountains bound the basin on the north. The Camp Rock fault and Kane Wash Area Groundwater Basin bound this basin on the east and the Fry Mountains bound this basin on the southeast. Parts of the eastern and southeastern boundaries are surface drainage

[1] 5-day biochemical oxygen demand at 20 degrees Celsius.

[2] Milligrams per Liter

[3] Not Detected at the laboratory's Reporting Limit.

[4] Total Suspended Solids

[5] Standard pH units

[6] Total Inorganic Nitrogen is the sum of nitrate, nitrite, and total ammonia.

divides. Surface water drains toward Lucerne (dry) Lake in the western portion of the basin, which has an altitude of 2,850 feet above sea level (Schaefer 1979[7]).

16. The principal water-bearing deposits are Quaternary age alluvium, and dune sand. The deposits are unconsolidated or semi-consolidated and the alluvium is composed of gravel, sand, silt, clay, and occasional boulders. Where saturated, the alluvium yields water freely to wells. The average specific yield for these deposits is 11 percent. Irrigation wells in the basin yield as much as 1,000 gallons per minute (Schaefer 1979).

17. BBARWA has three groundwater monitoring wells (MW-1-upgradient; MW-2-downgradient; and MW-3-downgradient). Groundwater levels in monitoring wells have increased since the wells were constructed in 1991. BBARWA has reported that the depth to groundwater at the Lucerne Valley Facility is within the range of 125 to 175 feet below ground surface (bgs) and groundwater flow direction is generally to the northwest, towards Lucerne Dry Lake.

18. Groundwater monitoring data collected from monitoring wells MW-1, MW-2, and MW-3 during the period from 2017 through 2020 show the following average characteristics:

Table 2. Groundwater Monitoring Data

Constituent	Units	MW-1	MW-2	MW-3
Depth to Groundwater	ft	170	125.2	138.1
TDS	mg/L	435.5	655.2	583
TN	mg/L	9.54	15.1	15.9
Nitrate as N	mg/L	8.97	14.5	15.4
Sulfate	mg/L	62.1	138.4	179.7
Chloride	mg/L	70.3	123.4	109.1
Fluoride	mg/L	0.19	0.14	0.24
Boron	mg/L	0.12	0.11	0.09
VOCs	ug/L	ND	ND	ND

[7] Schaefer, D.H. 1979. *Ground-Water Conditions and Potential for Artificial Recharge in Lucerne Valley, San Bernardino County, California*. U.S. Geological Survey Water Resources Investigations 78-118. 37 p.

19. Annual precipitation in the Lucerne Valley region averages about 14 inches.

20. Typically, November through April are considered wet weather, while May through October are considered dry weather months.

21. There are several domestic wells in the vicinity of the irrigation recycled use area and the evaporation/percolation ponds.

22. Water supply to the Big Bear area communities is from numerous groundwater production wells located in Big Bear Valley. TDS in the water supply averages about 280 mg/L based on data reported in the BBARWA's SMRs from 2017 through 2020.

23. BBARWA conducted a geotechnical study referenced as *Geotechnical Study, Irrigation Site, Lucerne Valley Area, San Bernardino County, California for Big Bear Area Regional Wastewater Agency, July 29, 1977,* as an initial investigation of the site for use for irrigation. The report shows that the site is underlain by soils consisting of fine to coarse, clean to silty sands containing various amounts of gravel from 5 to 24 feet below ground surface. Beneath this, to a depth of 60 to 100 feet below ground surface, the soil consists of fine to medium silty sands containing varying amounts of gravel and is locally cemented with calcium carbonate accumulated during deposition of the sediments. Bedrock underlies the older alluvium at a depth of 400 to 600 feet.

Basin Plan, Beneficial Uses, and Regulatory Considerations

24. The Water Quality Control Plan for the Colorado River Basin Region (Basin Plan), adopted on November 17, 1993 and most recently amended on January 8, 2019, designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. Pursuant to Water Code section 13263, subdivision (a), WDRs must implement the Basin Plan and take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of Water Code section 13241.

25. The Facility is located within the Lucerne Hydrologic Unit, and the Basin Plan designates the following beneficial uses for groundwater:

    a. Municipal Supply (MUN),
    b. Industrial Supply (IND), and
    c. Agricultural Supply (AGR).

26. This Order establishes WDRs pursuant to division 7, chapter 4, article 4 of the Water Code for discharges that are not subject to regulation under Clean Water Act section 402 (33 U.S.C. § 1342).

27. These WDRs implement numeric and narrative water quality objectives for groundwater and surface waters established by the Basin Plan and other applicable state and federal laws and policies. The numeric objectives for groundwater designated for municipal and domestic supply include the maximum contaminant levels (MCLs) specified in California Code of Regulations, title 22, section 64421 et seq. Groundwater for use as domestic or municipal water supply (MUN) must not contain taste- or odor-producing substances in concentrations that adversely affect beneficial uses as a result of human activity.

28. It is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. This Order promotes that policy by requiring discharges to meet MCLs designed to protect human health and ensure that water is safe for domestic use.

29. The discharge authorized by this Order, except for discharges of residual sludge and solid waste, are exempt from the solid waste requirements of California Code of Regulations, title 27, section 20005 et seq. This exemption is based on section 20090, subdivisions (a) and (b) of title 27 of the California Code of Regulations, which provides that discharges of domestic sewage or wastewater to land, including but not limited to evaporation ponds, percolation ponds, or subsurface leach fields are not subject to the requirements of title 27 if the following exemption conditions are met:

    a. The applicable regional water board has issued WDRs, reclamation requirements, or waived such issuance;

    b. The discharge is in compliance with the applicable water quality control plan; and

    c. The wastewater does not need to be managed according to chapter 11, division 4.5, title 22 of the California Code of Regulations as a “hazardous waste.”

30. The discharge of waste authorized by these WDRs satisfies the conditions to be exempted from the requirements of title 27 of the California Code of Regulations, because (1) the discharge is regulated by these WDRs; (2) these WDRs will ensure the discharge complies with the Basin Plan; and (3) the discharge will not be of a “hazardous waste.”

31. Consistent with Water Code section 13241, the Regional Water Board, in establishing the requirements contained herein, considered factors including, but not limited to, the following:

a. Past, present, and probable future beneficial uses of water;

b. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;

c. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;

d. Economic considerations;

e. The need for developing housing within the region(s); and

f. The need to develop and use recycled water.

32. Water Code section 13267 authorizes the Regional Water Board to require technical and monitoring reports. The monitoring and reporting requirements in Monitoring and Reporting Program (MRP) R7-2021-0023 are necessary to demonstrate compliance with this Order. The State Water Resources Control Board's (State Water Board's) electronic database, GeoTracker Information Systems, facilitates the submittal and review of monitoring and reporting documents. The burden, including costs, of the MRP bears a reasonable relationship to the need for that information and the benefits to be obtained from that information.

33. Pursuant to Water Code section 13263, subdivision (g), the discharge of waste is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.

Antidegradation Analysis

34. State Water Board Resolution 68-16, entitled *Statement of Policy with Respect to Maintaining High Quality Waters in California* (Resolution 68-16), generally prohibits the Regional Water Board from authorizing discharges that will result in the degradation of high quality waters, unless it is demonstrated that any change in water quality will (a) be consistent with maximum benefit to the people of the state, (b) not unreasonably affect beneficial uses, and (c) not result in water quality less than that prescribed in state and regional policies (e.g., the violation of one or more water quality objectives). The discharger must also employ best practicable treatment or control (BPTC) to minimize the degradation of high quality waters. High quality waters are surface waters or areas of groundwater that have a baseline water quality better than required by water quality control plans and policies.

35. Some degradation of groundwater from the discharge to the irrigation recycled use area and the infiltration basins is consistent with Resolution 68-16, provided that the degradation:

a. Is confined to a reasonable area;

b. Is minimized by means of full implementation, regular maintenance, and optimal operation of BPTC measures by the Discharger;

c. Is limited to waste constituents typically encountered in domestic wastewater;

d. Does not unreasonably affect any beneficial uses of groundwater prescribed in the Basin Plan, and will not result in the violation of any water quality objective; and

e. Is consistent with the maximum benefit to the people of the state.

36. Recycled water used for irrigation at the Lucerne Valley Facility is treated to secondary standards and has undergone substantial removal of soluble organic matter, solids, and nitrogen treatment. Constituents in the wastewater effluent that have the potential to degrade groundwater include nitrogen, chloride, sulfate, TDS, and total coliform. Each of these constituents is discussed below:

a. **Nitrogen.** The Primary Maximum Contaminant Level (MCL) found in California Code of Regulations, title 22, section 64431 for nitrate plus nitrite as nitrogen is 10 mg/L. To account for the fate of transport for the various components of total nitrogen, as a conservative value, it is assumed that all nitrogen present converts to nitrate/nitrite. BBARWA's SMRs report an average of 3.9 mg/L for Total Inorganic Nitrogen and 4.9 mg/L for Total Nitrogen between January 2016 and December 2020. BBARWA conducted a study of the groundwater in the vicinity of the recycled water irrigation use site in September 2016 which included an analysis of potential sources of nitrate in the groundwater other than BBARWA recycled water. Some of the sources included onsite farming practices, irrigation and fertilization in excess of plant demands, and potential upgradient sources, such as discharges from individual onsite septic systems. The study found that nitrate concentrations have been increasing in the upgradient groundwater monitoring well but have been decreasing in the downgradient monitoring wells. To verify no degradation due to nitrogen is occurring, this Order requires quarterly total nitrogen and nitrate as nitrogen monitoring in the groundwater monitoring wells. This Order also provides an average monthly effluent limit for total nitrogen of 10 mg/L.

b. **Chloride and Sulfate**. The "recommended" Secondary MCLs in California Code of Regulations, title 22, section 64449 for chloride and sulfate are both 250 mg/L. Concentrations of chloride and sulfate are included in TDS measurements. BBARWA's SMRs report an average of 56 and 40 mg/L for chloride and sulfate, respectively, between January 2016 and December 2020. Additionally, BBARWA's SMRs, for the same time period, report a maximum of 87 and 48 mg/L for chloride and sulfate, respectively.

BBARWA occasionally experience increases in chloride due to the use of salt and brine on local roadways prior to snowstorm events. To evaluate the incremental degradation due to chloride and sulfate, this Order requires quarterly chloride and sulfate monitoring in the groundwater monitoring wells. This Order also provides an average monthly effluent limit of 60 mg/L and a daily maximum effluent limit of 80 mg/L for both chloride and sulfate.

c. **TDS.** The Secondary MCL specified in California Code of Regulations, title 22, section 64449 for TDS ranges between the "recommended" consumer acceptance level of 500 mg/L and the "upper" consumer acceptance level of 1,000 mg/L, if it is neither reasonable nor feasible to provide more suitable waters. The typical incremental addition of dissolved salts from domestic water usage in wastewater treatment plants ranges from 150 to 380 mg/L. Domestic water supply to the Big Bear area communities showed an average concentration of about 280 mg/L based on data reported in the BBARWA's SMRs from 2017 through 2020. From 2016 to December 2020, treated wastewater discharged had an average TDS concentration of approximately 440 mg/L. Thus, the average TDS increase over the domestic water supply in the discharge was about 160 mg/L. Based on the study that the Discharger conducted in September 2016, which analyzed the impacts of groundwater by the discharge, the results would help establish an appropriate effluent limitation for TDS. The study states that the average TDS concentration in the Lucerne Valley Groundwater Basin is closer to 500 mg/L in the vicinity of the discharge location, whereas the Basin as a whole has an average of approximately 1,100 mg/L. Downgradient TDS concentrations in groundwater were found to be equal to or above concentrations of water delivered to the discharge location and the basin-wide average TDS concentration is above that of the delivered water. Therefore, the delivered water is not expected to degrade the existing groundwater quality or limit existing downgradient beneficial uses. To verify there is no degradation due to TDS is occurring, this Order includes quarterly TDS monitoring in the groundwater monitoring wells. This Order also provides an effluent limit for TDS of 550 mg/L over a 12-month period.

d. **Total Coliform.** Secondary treatment reduces fecal coliform densities by 90 to 99%; the remaining organisms in effluent are still 10^5 to 10^6 most probable number (MPN)/100 mL (U.S. Environmental Protection Agency, *Design Manual: Municipal Wastewater Disinfection*, EPA/625/1-86/021, October 1986.) Other sources of *E. Coli* may include residential septic systems and runoff from animal waste, which are both present in the areas surrounding the groundwater monitoring wells. Given the depth to groundwater, which is approximately 125 to 175 feet, it is not likely that pathogen-indicator bacteria will reach groundwater in excess of that prescribed in California Code of Regulations, title 22, section 64426.1, due to significant attenuation and removal in the soils in the vadose zone. To evaluate the potential degradation to groundwater due to pathogens, this

Order includes quarterly *E. coli* monitoring in the groundwater monitoring wells and monthly *E. coli* monitoring in the effluent.

37. The discharge of wastewater from the Facility, as permitted herein, reflects BPTC. The Facility incorporates:

    a. Technology for secondary treated domestic wastewater;

    b. Structural controls to dispose of waste constituents in a designated area;

    c. A network of groundwater monitoring wells;

    d. An operation and maintenance manual;

    e. An Irrigation Management Plan;

    f. Staffing to ensure proper operation and maintenance; and

    g. A standby emergency power generator of sufficient size to operate the treatment plant and ancillary equipment during periods of loss of commercial power.

38. Degradation of groundwater by some of the typical waste constituents associated with discharges from a facility treating domestic wastewater, after effective source control, treatment, and control measures are implemented, is consistent with the maximum benefit to the people of the state. The technology, energy, water recycling, and waste management advantages of regional utility service far exceed any benefits derived from reliance on numerous, concentrated individual wastewater systems, and the impact on water quality will be substantially less. These factors, when taken in conjunction with the associated increase in waste constituents, are consistent with the maximum benefit to the people of the state. Accordingly, the discharge, as authorized, is consistent with the antidegradation provisions of Resolution 68-16 and applicable water quality objectives.

Stormwater

39. Federal regulations for stormwater discharges were promulgated by the U.S. Environmental Protection Agency on November 16, 1990 (40 C.F.R. parts 122, 123, and 124) to implement the Clean Water Act's stormwater program set forth in Clean Water Act section 402, subdivision (p) (33 U.S.C. § 1342(p)). In relevant part, the regulations require specific categories of facilities that discharge stormwater associated with industrial activity to "waters of the United States" to obtain National Pollutant Discharge Elimination System (NPDES) permits and to require control of such pollutant discharges using Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to prevent and reduce pollutants and any more stringent controls necessary to meet water quality standards.

40. The State Water Board adopted Order 2014-0057-DWQ (NPDES No. CAS000001), *General Permit for Storm Water Discharges Associated with Industrial Activities* (Industrial General Permit) on July 1, 2015. Facilities used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage with a design flow of one million gallons per day or more, or that are required to have an approved pretreatment program under 40 Code of Federal Regulations part 403, are required to enroll under the Industrial General Permit, unless there is no discharge of industrial stormwater to waters of the United States.

CEQA and Public Participation

41. Pursuant to California Code of Regulations, title 14, section 15301, the issuance of these WDRs, which govern the operation of an existing facility involving negligible or no expansion of use beyond that previously existing, is exempt from the provisions of the California Environmental Quality Act (CEQA), Public Resources Code section 21000 et seq.

42. The Regional Water Board has notified the Discharger and all known interested agencies and persons of its intent to issue WDRs for this discharge, and has provided them with an opportunity for a public meeting and to submit comments.

43. The Regional Water Board, in a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED that Order R7-2016-0026 is rescinded upon the effective date of this Order, except for enforcement purposes, and, in order to meet the provisions contained in division 7 of the Water Code, and regulations adopted thereunder, the Discharger shall comply with the following:

A. Effluent Limitations

1. Effluent used for irrigation in the recycled use area or discharged into the overflow evaporation/percolation ponds for disposal shall not exceed the following effluent limits:

Table 3. Effluent Limitations

Constituent	Units	Monthly Average	Weekly Average	Daily Maximum
20°C BOD_5	mg/L	30	45	--
Total Suspended Solids	mg/L	30	45	--
Chloride	mg/L	60	--	80

Constituent	Units	Monthly Average	Weekly Average	Daily Maximum
Sulfate	mg/L	60	--	80
Boron	mg/L	--	--	0.75
Total Nitrogen	mg/L	10	--	--

2. The 30-day average daily dry weather discharge for irrigation shall not exceed 4.8 MGD.

3. The hydrogen ion concentration (pH) in the effluent discharge for irrigation shall be maintained within the limits of 6.0 to 9.0 standard units.

4. The TDS concentration of the effluent shall not exceed a 12-month average effluent limit of 550 mg/L. The reported concentration shall be determined by the arithmetic mean of the last twelve months of monitoring.

5. The overflow evaporation/percolation ponds shall be maintained so that they continuously operate in aerobic conditions. The dissolved oxygen content in the upper zone (one foot) of the infiltration basins shall be equal to or greater than 1.0 mg/L.

B. Receiving Water Limitations

1. The discharge of wastewater from the Facility shall not cause groundwater to: exceed applicable water quality objectives; acquire taste, odor, toxicity, or color that create nuisance conditions; impair beneficial uses; or contain constituents in excess of California Maximum Contaminant Levels (MCLs), as set forth in title 22 of the California Code of Regulations (including, but not limited to, section 64426.1 for bacteriological constituents; section 64431 for inorganic chemicals; section 64444 for organic chemicals; and section 64678 for lead and copper).

C. Discharge Prohibitions

1. Discharge of waste classified as “hazardous,” as defined in California Code of Regulations, title 27, section 20164, or “designated,” as defined in Water Code section 13173 and California Code of Regulations, title 27, section 20164, is prohibited.

2. The discharge of treated wastewater at a location other than the designated disposal areas or as recycled water used for irrigation at approved use areas, is prohibited.

3. The discharge of wastewater and/or recycled water to surface waters or surface drainage courses is prohibited.

4. The Discharger shall not accept waste in excess of the design treatment capacity of the Facility's disposal system.

5. Surfacing or ponding of wastewater outside of the designated disposal locations is prohibited.

6. Application of treated wastewater for irrigation in excess of agronomic rates is prohibited.

7. Bypass or overflow of untreated or partially-treated waste is prohibited, except as permitted in Standard Provision E.13.

8. The discharge of wastewater to a location or in a manner different from that described in this Order is prohibited.

9. The discharge of wastewater to land not owned or controlled by the Discharger, or not authorized for such use, is prohibited.

10. The storage, treatment, or disposal of wastes from the Facility shall not cause contamination, pollution, or nuisance as defined in Water Code section 13050, subdivisions (k), (l), and (m).

D. Discharge Specifications

1. The Discharger shall maintain sufficient freeboard in the overflow evaporation/percolation ponds to accommodate seasonal precipitation and to contain a 100-year storm event, but in no case no less than two (2) feet of freeboard (measured vertically). Freeboard shall be utilized for wake and waves of fluid motion and emergency or natural disaster purposes only.

2. All treatment, storage, and disposal areas shall be designed, constructed, operated and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

3. Evaporation/percolation ponds shall have sufficient capacity to accommodate allowable wastewater flow, design seasonal precipitation, ancillary inflow, and infiltration. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns.

4. The evaporation/percolation ponds shall be managed to prevent breeding of mosquitoes. In particular:

a. An erosion control program should ensure that small coves and irregularities are not created around the perimeter of the water surface.

b. Weeds shall be minimized through control of water depth, harvesting, or herbicides.

c. Dead algae, vegetation, and debris shall not accumulate on the water surface.

5. Public contact with wastewater shall be precluded through such means as fences, signs, or other acceptable alternatives.

6. Objectionable odors originating at the Facility shall not be perceivable beyond the property boundary.

7. The evaporation/percolation ponds shall be maintained and operated so as to maximize infiltration and minimize the increase of salinity in the groundwater.

8. Onsite wastes, including windblown spray from recycled water application, shall be strictly confined to the lands specifically designated for the disposal operation, and onsite irrigation practices shall be managed so there is no runoff of effluent from irrigated areas.

9. No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

10. No spray irrigation of any recycled water shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground or schoolyard.

11. Except as allowed under California Code of Regulations, title 17, section 7604, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

12. Undisinfected secondary recycled water, as defined in California Code of Regulations, title 22, section 60301.900, may only be used for irrigation in the following applications:

a. Orchards where the recycled water does not come into contact with the edible portion of the crop;

b. Vineyards where the recycled water does not come into contact with the edible portion of the crop;

c. Non-food bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public);

d. Fodder and fiber crops and pasture for animal not producing milk for human consumption;

e. Seed crops not eaten by humans;

f. Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans; and

g. Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

13. No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with edible portions of food crops eaten raw by humans.

14. The delivery or use of recycled water shall conform with the reclamation criteria contained in California Code of Regulations, title 22 or amendments thereto, for the irrigation of food crops, irrigation of fodder, fiber, and seed crops, landscape irrigation, supply of recreational impoundments, and groundwater recharge.

15. Prior to delivering recycled water to any new user, the Discharger shall submit to the Regional Water Board a report discussing any new distribution system being constructed by the Discharger to provide service to the new user.

16. Recycled water shall not be delivered to any new user who has not first received a discharge permit from the Regional Water Board and approval from the State Water Board’s Division of Drinking Water.

17. Treated or untreated sludge or similar solid waste materials shall be disposed of at locations approved by the Regional Water Board’s Executive Officer.

18. Grazing of sheep on the irrigation site is allowed only under the following conditions, unless otherwise approved by the Regional Water Board 's Executive Officer:

a. Grazing will only be conducted in October or November after the last cutting of hay has been baled;

b. Grazing animals will not be allowed into a portion of the site until 10 days after it was last irrigated;

c. Temporary fences will be erected to contain the grazing animals in an area of 40 acres or less;

d. Only ewes that are about to lamb or ewes with newly born will be grazed;

e. No animals will be sold for slaughter within 90 days after grazing; and

f. No milk produced by sheep that have grazed at the irrigation site shall be used for human consumption.

E. Standard Provisions

1. **Noncompliance.** The Discharger shall comply with all of the terms, requirements, and conditions of this Order and MRP R7-2021-0023. Noncompliance is a violation of the Porter-Cologne Water Quality Control Act (Water Code, § 13000 et seq.) and grounds for: (1) an enforcement action; (2) termination, revocation and reissuance, or modification of these waste discharge requirements; or (3) denial of an Order renewal application.

2. **Enforcement.** The Regional Water Board reserves the right to take any enforcement action authorized by law. Accordingly, failure to timely comply with any provisions of this Order may subject the Discharger to enforcement action. Such actions include, but are not limited to, the assessment of administrative civil liability pursuant to Water Code sections 13323, 13268, and 13350, a Time Schedule Order (TSO) issued pursuant to Water Code section 13308, or referral to the California Attorney General for recovery of judicial civil liability.

3. **Proper Operation and Maintenance.** The Discharger shall at all times properly operate and maintain all systems and components of collection, treatment, and control installed or used by the Discharger to achieve compliance with this Order. Proper operation and maintenance includes, but is not limited to, effective performance, adequate process controls, and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities/systems when necessary to achieve compliance with this Order. All systems in service or reserved shall be inspected and maintained on a regular basis. Records of inspections and maintenance shall be retained and made available to the Regional Water Board on request.

4. **Reporting of Noncompliance.** The Discharger shall report any noncompliance that may endanger human health or the environment,

including spills in excess of one thousand (1,000) gallons occurring within the Facility or collection system. Information shall be provided orally to the Regional Water Board office and the Office of Emergency Services within twenty-four (24) hours of when the Discharger becomes aware of the incident. If noncompliance occurs outside of business hours, the Discharger shall leave a message on the Regional Water Board's office voicemail. A written report shall also be provided within five business days of the time the Discharger becomes aware of the incident. The written report shall contain a description of the noncompliance and its cause, the period of noncompliance, the anticipated time to achieve full compliance, and the steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. A final certified report must be submitted through the online GeoTracker system, within 15 calendar days of the conclusion of spill response and remediation. Additional information may be added to the certified report, in the form of an attachment, at any time. All other forms of noncompliance shall be reported with the Discharger's next scheduled Self-Monitoring Report (SMR), or earlier if requested by the Regional Water Board's Executive Officer or if required by an applicable standard for sludge use and disposal.

5. **Duty to Mitigate.** The Discharger shall take all reasonable steps to minimize or prevent any discharge in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment.

6. **Material Changes.** Prior to any modifications which would result in any material change in the quality or quantity of wastewater treated or discharged, or any material change in the location of discharge, the Discharger shall report all pertinent information in writing to the Regional Water Board, and if required by the Regional Water Board, obtain revised requirements before any modifications are implemented.

7. **Design Capacity Report.** The Discharger shall provide a report to the Regional Water Board when it determines that the Facility's average dry-weather flow rate for any month exceeds 80 percent of the design capacity. The report should indicate what steps, if any, the Discharger intends to take to provide for the expected wastewater treatment capacity necessary when the plant reaches design capacity.

8. **Operational Personnel.** The Facility shall be supervised and operated by persons possessing certification of appropriate grade pursuant to section 3680, chapter 26, division 3, title 23 of the California Code of Regulations.

9. **Familiarity with Order.** The Discharger shall ensure that all site-operating personnel are familiar with the content of this Order and maintain a copy of this Order at the site.

10. **Inspection and Entry.** The Discharger shall allow the Regional Water Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

    a. Enter the premises regulated by this Order, or the place where records are kept under the conditions of this Order;

    b. Have access to and copy, at reasonable times, records kept under the conditions of this Order;

    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

    d. Sample or monitor at reasonable times, for the purpose of assuring compliance with this Order or as otherwise authorized by the Water Code, any substances or parameters at this location.

11. **Records Retention.** The Discharger shall retain copies of all reports required by this Order and the associated MRP. Records shall be maintained for a minimum of five years from the date of the sample, measurement, report, or application. Records may be maintained electronically. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Regional Water Board's Executive Officer.

12. **Change in Ownership.** This Order is not transferable to any person without written approval by the Regional Water Board's Executive Officer. Prior to any change in ownership of this operation, the Discharger shall notify the Regional Water Board's Executive Officer in writing at least 30 days in advance. The notice must include a written transfer agreement between the existing owner and the new owner. At a minimum, the transfer agreement must contain a specific date for transfer of responsibility for compliance with this Order and an acknowledgment that the new owner or operator is liable for compliance with this Order from the date of transfer. The Regional Water Board may require modification or revocation and reissuance of this Order to change the name of the Discharger and incorporate other requirements as may be necessary under the Water Code.

13. **Bypass.** Bypass (i.e., the intentional diversion of waste streams from any portion of the treatment facilities, except diversions designed to meet variable effluent limits) is prohibited. The Regional Water Board may take enforcement action against the Discharger for bypass unless:

    a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment

facilities that causes them to be inoperable, or substantial and permanent loss of natural resources reasonably expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in fee collection; and

b. There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities or retention of untreated waste. This condition is not satisfied if adequate back-up equipment was not installed to prevent bypass occurring during equipment downtime, or preventative maintenance; or

c. Bypass is (1) required for essential maintenance to ensure efficient operation; (2) neither effluent nor receiving water limitations are exceeded and (3) the Discharger notifies the Regional Water Board ten (10) days in advance.

In the event of an unanticipated bypass, the Discharger shall immediately report the incident to the Regional Water Board. During non-business hours, the Discharger shall leave a message on the Regional Water Board's office voicemail. A written report shall be provided within five (5) business days after the Discharger is aware of the incident. The written report shall include a description of the bypass, any noncompliance, the cause, period of noncompliance, anticipated time to achieve full compliance, and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

14. **Backup Generators.** Standby, power generating facilities shall be available to operate the Facility during a commercial power failure.

15. **Format of Technical Reports.** The Discharger shall furnish, under penalty of perjury, technical monitoring program reports, and such reports shall be submitted in accordance with California Code of Regulations, title 23, division 3, chapter 30, as raw data uploads electronically over the Internet into the State Water Board's GeoTracker database. Documents that are normally mailed by the Discharger to the Regional Water Board, such as regulatory documents, narrative monitoring reports or materials, and correspondence, shall also be uploaded into GeoTracker in the appropriate Microsoft Office software application format, such as Word or Excel files, or as a Portable Document Format (PDF) file. Large documents must be split into appropriately-labelled, manageable file sizes and uploaded into GeoTracker.

16. **Qualified Professionals.** In accordance with Business and Professions Code sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of California registered professionals (i.e., civil engineer, engineering geologist, geologist, etc.) competent and proficient in the fields pertinent to

the required activities. All technical reports required under this Order that contain work plans, describe the conduct of investigations and studies, or contain technical conclusions and recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately-qualified professional(s), even if not explicitly stated. Each technical report submitted by the Discharger shall contain a statement of qualifications of the responsible licensed professional(s) as well as the professional's signature and/or stamp of the seal. Additionally, all field activities are to be conducted under the direct supervision of one or more of these professionals.

17. **Certification Under Penalty of Perjury.** All technical reports required in conjunction with this Order shall include a statement by the Discharger, or an authorized representative of the Discharger, certifying under penalty of perjury under the laws of the State of California, that the reports were prepared under his or her supervision in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted, and that based on his or her inquiry of the person or persons who manage the system, the information submitted is, to the best of his or her knowledge and belief, true, complete, and accurate.

18. **Violation of Law.** This Order does not authorize violation of any federal, state, or local laws or regulations.

19. **Property Rights.** This Order does not convey property rights of any sort, or exclusive privileges, nor does it authorize injury to private property or invasion of personal rights.

20. **Modification, Revocation, Termination.** This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for an Order modification, rescission, or reissuance, or the Discharger’s notification of planned changes or anticipated noncompliance, does not stay any Order condition. Causes for modification include, but are not limited to, the violation of any term or condition contained in this Order, a material change in the character, location, or volume of discharge, a change in land application plans or sludge use/disposal practices, or the adoption of new regulations by the State Water Board, Regional Water Board (including revisions to the Basin Plan), or federal government.

21. **Severability.** The provisions of this Order are severable. If any provision of this Order is found invalid, the remainder of these requirements shall not be affected.

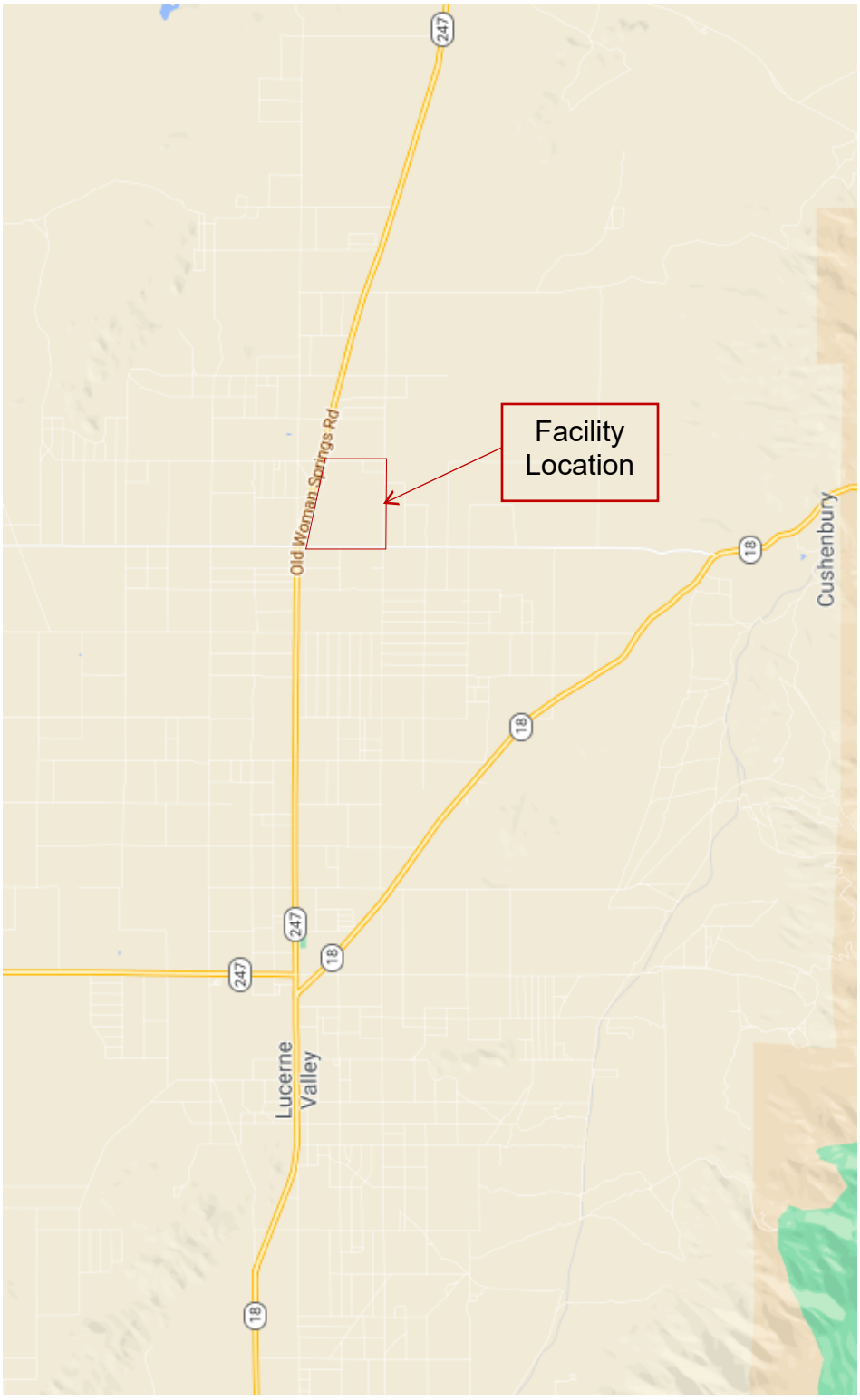
Any person aggrieved by this Regional Water Board action may petition the State Water Board for review in accordance with Water Code section 13320 and California Code of Regulations, title 23, section 2050 et seq. The State Water

Board must receive the petition by 5:00 p.m. on the 30th day after the date of this Order; if the 30th day falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the statutes and regulations applicable to filing petitions are available on the State Water Board's website and can be provided upon request.

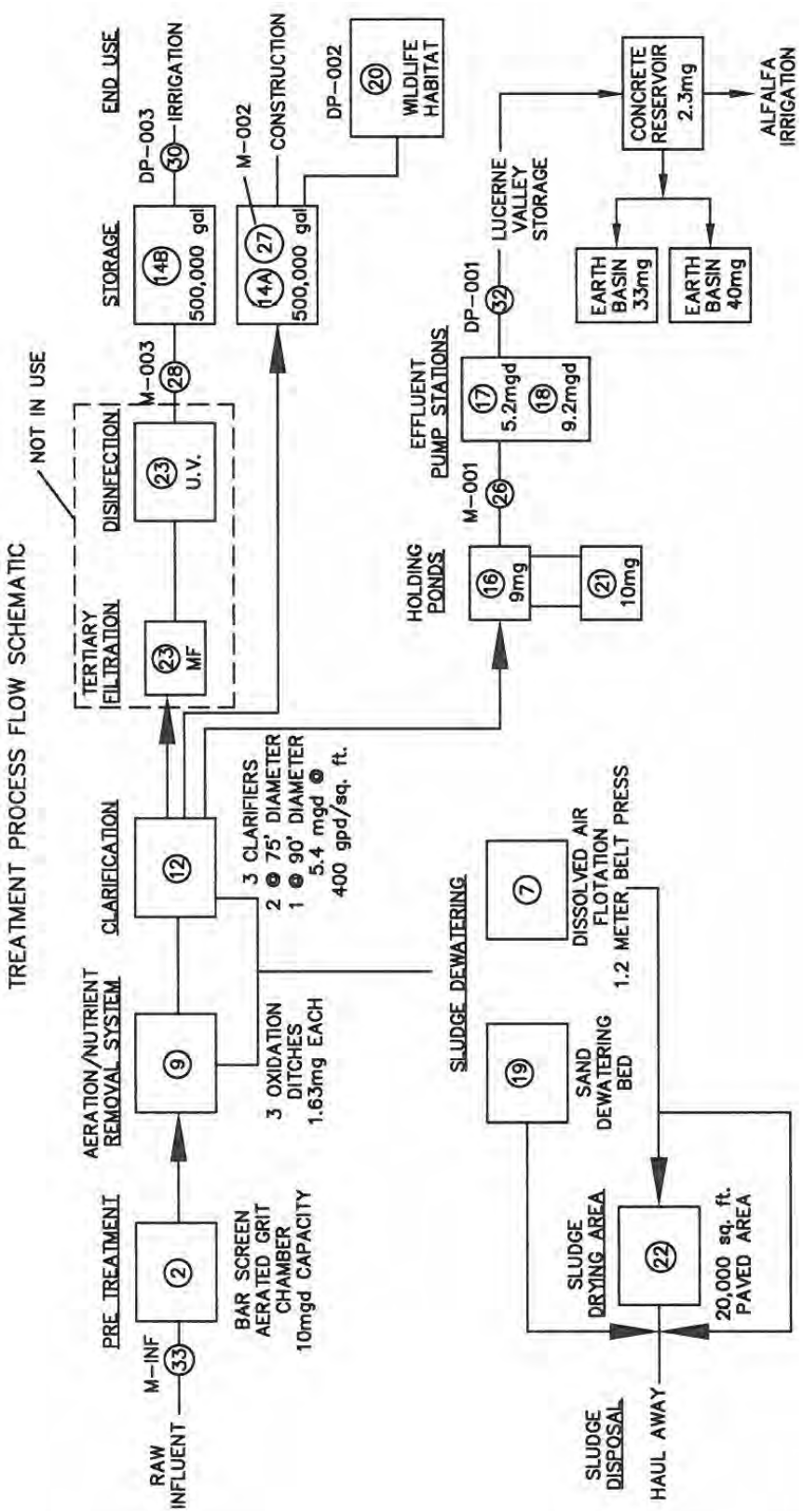
Order Attachments

Attachment A—Vicinity Map
Attachment B—Process Flow Diagram
Attachment C—Lucerne Valley Facility Layout
Monitoring and Reporting Program R7-2021-0023

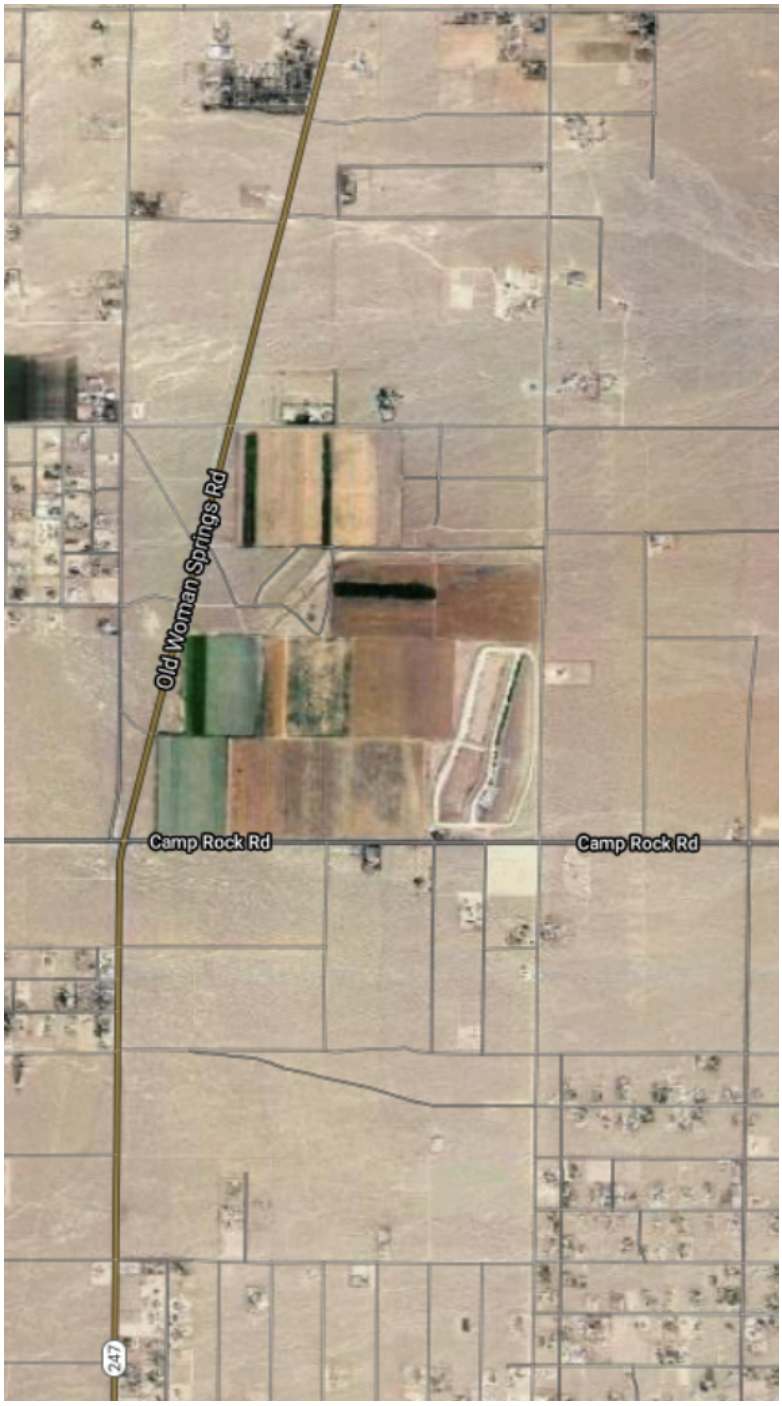
ATTACHMENT A—VICINITY MAP



ATTACHMENT B—PROCESS FLOW DIAGRAM



ATTACHMENT C—LUCERNE VALLEY FACILITY LAYOUT



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN

MONITORING AND REPORTING PROGRAM R7-2021-0023
FOR
BIG BEAR AREA REGIONAL WASTEWATER AGENCY, OWNER/OPERATOR
EXPORT OF RECYCLED WATER TO LUCERNE VALLEY
LUCERNE VALLEY-SAN BERNARDINO COUNTY

This Monitoring and Reporting Program (MRP) is issued pursuant to Water Code section 13267 and describes requirements for monitoring the relevant wastewater system and groundwater quality. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Regional Water Board or its Executive Officer.

The Discharger owns and operates the wastewater treatment system that is subject to Order R7-2021-0023. The reports required herein are necessary to ensure that the Discharger complies with the Order. Pursuant to Water Code section 13267, the Discharger shall implement the MRP and shall submit monitoring reports described herein.

A. Sampling and Analysis General Requirements

1. **Testing and Analytical Methods.** The collection, preservation, and holding times of all samples shall be in accordance with U.S. Environmental Protection Agency (USEPA)-approved procedures. All analyses shall be conducted in accordance with the latest edition of either the USEPA's *Guidelines Establishing Test Procedures for Analysis of Pollutants Under the Clean Water Act* (40 C.F.R. part 136) or *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium* (SW-846), unless otherwise specified in the MRP or approved by the Regional Water Board's Executive Officer.

2. **Laboratory Certification.** All analyses shall be conducted by a laboratory certified by the State Water Board, Division of Drinking Water's Environmental Laboratory Accreditation Program (ELAP), unless otherwise approved by the Regional Water Board's Executive Officer.

3. **Reporting Levels.** All analytical data shall be reported with method detection limits (MDLs) and with either the reporting level or limits of quantitation (LOQs) according to 40 Code of Federal Regulations part 136, Appendix B. The laboratory reporting limit for all reported monitoring data shall be no greater than the practical quantitation limit (PQL).

4. **Sampling Location(s).** Samples shall be collected at the location(s) specified in the WDRs. If no location is specified, sampling shall be conducted at the most representative sampling point available.

5. **Representative Sampling.** All samples shall be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the chain of custody form for the sample. If composite samples are collected, the basis for sampling (time or flow weighted) shall be approved by Regional Water Board staff.

6. **Instrumentation and Calibration.** All monitoring instruments and devices used by the Discharger shall be properly maintained and calibrated to ensure their continued accuracy. Any flow measurement devices shall be calibrated at least once per year to ensure continued accuracy of the devices. In the event that continuous monitoring equipment is out of service for a period greater than 24 hours, the Discharger shall obtain representative grab samples each day the equipment is out of service. The Discharger shall correct the cause(s) of failure of the continuous monitoring equipment as soon as practicable. The Discharger shall report the period(s) during which the equipment was out of service and if the problem has not been corrected, shall identify the steps which the Discharger is taking or proposes to take to bring the equipment back into service and the schedule for these actions.

7. **Field Test Instruments.** Field test instruments (such as those used to test pH, dissolved oxygen, and electrical conductivity) may be used provided that:

    a. The user is trained in proper use and maintenance of the instruments;

    b. The instruments are field calibrated prior to monitoring events at the frequency recommended by the manufacturer;

    c. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and

    d. Field calibration reports are submitted.

8. **Records Retention.** The Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, for a minimum of five (5) years from the date of the sampling or measurement. This period may be extended by request of the Regional Water Board's Executive Officer at any time. Records of monitoring information shall include:

a. The date, exact place, and time of sampling or measurement(s);

b. The individual(s) who performed the sampling or measurement(s);

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or method used; and

f. All sampling and analytical results, including:

i. units of measurement used;

ii. minimum reporting limit for the analyses;

iii. results less than the reporting limit but above the method detection limit (MDL);

iv. data qualifiers and a description of the qualifiers;

v. quality control test results (and a written copy of the laboratory quality assurance plan);

vi. dilution factors, if used; and

vii. sample matrix type.

9. **Inoperative Facility.** If the Facility is not in operation, or there is no discharge during a required reporting period, the Discharger shall forward a letter to the Regional Water Board indicating that there has been no activity during the required reporting period.

B. Effluent Monitoring

1. Representative samples of the undisinfected secondary recycled water shall be taken at the WWTP. The samples shall be analyzed for the following constituents and according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Irrigation Flow	MGD	Flow Meter Reading	Daily	Monthly

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
20°C BOD_5[8]	mg/L	24 Hr. Composite	2x/Month	Monthly
Total Suspended Solids (TSS)	mg/L	24 Hr. Composite	2x/Month	Monthly
pH	s.u.[9]	Grab	Daily	Monthly
Dissolved Oxygen[10]	mg/L	Grab	Monthly	Monthly
Total Dissolved Solids (TDS)	mg/L	24 Hr. Composite	Monthly	Monthly
Sulfate	mg/L	24 Hr. Composite	Monthly	Monthly
Chloride	mg/L	24 Hr. Composite	2x/Month	Monthly
Fluoride	mg/L	24 Hr. Composite	Monthly	Monthly
Nitrate as N	mg/L	24 Hr. Composite	Monthly	Monthly
Total Nitrogen	mg/L	24 Hr. Composite	Monthly	Monthly
E. Coli	MPN/100mL[11]	Grab	Monthly	Monthly
Volatile Organic Compounds (VOCs)	µg/L[12]	24 Hr. Composite	Annually	Annually

[8] 5-Day Biochemical Oxygen Demand at 20 degrees Celsius.

[9] Standard pH units

[10] Dissolved Oxygen shall be monitored at the upper one-foot layer of the storage or percolation ponds.

[11] Most Probable Number per 100 milliliters.

[12] Micrograms per liter

C. Overflow Pond Monitoring

1. During months when the overflow evaporation/percolation ponds are not used, the Discharger shall report that there has been no activity. During months when the overflow evaporation/percolation ponds are in use, the ponds shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Flow	MGD	Flow Measurement	Daily	Monthly
Dissolved Oxygen	mg/L	Grab	2x/Month	Monthly
pH	s.u.	Grab	2x/Month	Monthly
Total Dissolved Solids	mg/L	Grab	2x/Month	Monthly
Freeboard	ft	Measurement	2x/Month	Monthly

D. Domestic Water Supply Monitoring

1. The domestic water supply shall be a flow weighted composite sample monitored at the water supply production wells in Big Bear Valley and include notations of which wells are non-operating for a reporting period and monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Total Dissolved Solids	mg/L	Grab	Quarterly	Quarterly
General Minerals[13]	mg/L	Grab	Annually	Annually

[13] General Minerals shall include: total dissolved solids, calcium, chloride, fluoride, iron, magnesium, manganese, nitrate, potassium, sodium, sulfate, barium, total alkalinity (including alkalinity series), and hardness.

E. Groundwater Monitoring

1. The groundwater monitoring wells shall be monitored according to the following schedule:

Constituent	Units	Type of Sample	Monitoring Frequency	Reporting Frequency
Depth to Groundwater	ft (msl)[14]	Measurement	Quarterly	Quarterly
Groundwater Gradient[15]	NA	Direction	Quarterly	Quarterly
Total Nitrogen	mg/L	Grab	Quarterly	Quarterly
Nitrate as N	mg/L	Grab	Quarterly	Quarterly
Chloride	mg/L	Grab	Quarterly	Quarterly
Fluoride	mg/L	Grab	Quarterly	Quarterly
Sulfate	mg/L	Grab	Quarterly	Quarterly
E. Coli	MPN/100mL	Grab	Quarterly[16]	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly	Quarterly
Boron	mg/L	Grab	Quarterly	Quarterly
VOCs	μg/L	Grab	Annually	Annually

F. Reporting Requirements

1. Daily, weekly, and monthly monitoring shall be included in the Monthly Self-Monitoring Reports (SMRs). Monthly SMRs shall be submitted by the **15th day of the following month.** Quarterly SMRs shall be submitted by

[14] Above mean sea level.

[15] Groundwater flow direction.

[16] After two years of groundwater monitoring that show consistent negligible impacts to groundwater, the Discharger may request to have the monitoring schedule revised with Executive Officer approval.

January 15th, April 15th, July 15th, and October 15th. Annual SMRs shall be submitted by **January 31st** of the following year.

2. SMRs shall include, at a minimum, the following:

   a. **Cover Letter.** A transmittal letter summarizing the essential points in the report.

   b. **Maps.** Maps depicting the Facility layout and the location of sampling points.

   c. **Summary of Monitoring Data.** Tables of the data collected. The tables shall include all of the data collected to-date at each monitoring point, organized in chronological order, with the oldest data in the top row and progressively newer data in rows below the top row. Each row shall be a monitoring event and each column shall be a separate parameter at a single location (or a single average, as appropriate).

   d. **Graphical Display.** Graphs depicting monitoring parameters through time, with the concentrations being the y-axis and time being the x-axis. Logarithmic scales can be used for values that vary by orders of magnitude. Individual graphs can combine multiple locations or multiple chemicals if that allows the data to be compared more easily.

   e. **Compliance Summary.** Identification of any violations found since the last report was submitted, and actions taken or planned for correcting each violation. If the Discharger previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. If no violations have occurred since the last submittal, this shall be stated.

3. SMRs shall be certified under penalty of perjury to be true and correct. Each SMR submitted to the Regional Water Board shall contain the following completed declaration:

   “I declare under the penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

   Executed on the _____day of _____ at _____

_____(Signature)

_____(Title)"

4. The SMRs and any other information requested by the Regional Water Board shall be signed by a principal executive officer or ranking elected official. A duly authorized representative of the Discharger may sign the documents if:

    a. The authorization is made in writing by the person described above;

    b. The authorization specified an individual or person having responsibility for the overall operation of the regulated disposal system; and

    c. The written authorization is submitted to the Regional Water Board's Executive Officer.

5. The results of any analysis taken more frequently than required at the locations specified in this MRP shall be reported to the Regional Water Board.

6. As specified in Standard Provision F.15, technical reports shall be prepared by or under the direction of appropriately qualified professional(s). Each technical report submitted shall contain a statement of qualification of the responsible licensed professional(s) as well as the professional's signature and/or stamp of the seal.

7. As specified in Standard Provision F.14, the Discharger shall comply with Electronic Submittal of Information (ESI) requirements by submitting all correspondence and reports required under MRP R7-2021-0023 and any future revision(s) hereto, including groundwater monitoring data and discharge location data (latitude and longitude), correspondence, and PDF monitoring reports to the State Water Board's Geotracker database. Documents too large to be uploaded into Geotracker should be broken down into smaller electronic files and labelled properly prior to uploading into Geotracker.

RESOLUTION NO. 94-63

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BIG BEAR LAKE, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AFFIRMING THE CITY OF BIG BEAR LAKE'S RIGHT TO REUSE TREATED WASTEWATER IN BIG BEAR VALLEY

WHEREAS, the wastewater generated within the City of Big Bear Lake is collected and transmitted to the Big Bear Area Regional Wastewater Agency (BBARWA) treatment plant; and

WHEREAS, the water generated within the City of Big Bear Lake is derived from ground water extracted from local ground water basins; and

WHEREAS, the BBARWA treatment plant treats said wastewater and then transmits the treated wastewater to Lucerne Valley in BBARWA's "outfall pipeline"; and

WHEREAS, BBARWA owns a section of land in Lucerne Valley upon which said treated wastewater is beneficially utilized for irrigation of alfalfa and other crops; and

WHEREAS, the City of big Bear Lake's Department of Water & Power has developed plans to reuse a significant portion of the City's wastewater in a project referred to as: "The Sand Canyon Wastewater Reuse Project"; and

WHEREAS, the City is aware of a water adjudication proceeding which involves the Lucerne Valley area; and

WHEREAS, the City wants to notify the adjudication's proposed water master, the Mojave Water Agency, that the wastewater that originates in Big Bear Valley and is utilized for irrigation in Lucerne Valley, is the property of the people of Big Bear Valley and part or all of the wastewater will be reused in Big Bear Valley for the benefit of the people of Big Bear Valley.

NOW, THEREFORE, BE IT RESOLVED, that the enclosed letter to the Mojave Water Agency is hereby approved and the Special Counsel is authorized to sign and transmit said letter.

PASSED, APPROVED AND ADOPTED this 21st day of December, 1994.

AYES:	Foulkes, Hertzmann, Mellen, Shoettger, Walker
NOES:	None
ABSENT:	None

December 21, 1994
Date

Neal Hertzmann, Mayor

ATTEST:

Katherine E. Jefferies
City Clerk

STATE OF CALIFORNIA)
COUNTY OF SAN BERNARDINO) ss
CITY OF BIG BEAR LAKE)

I, Katherine E. Jefferies, City Clerk of the City of Big Bear Lake, California, do hereby certify that the whole number of the City Council of the said City is five; that the foregoing Resolution, being Resolution No. 94-63 was duly passed and adopted by the said City Council and attested by the City Clerk of said city, all at a regular meeting of the said Council held on the 21st day of December, 1994, and that the same was so passed and adopted by the following vote:

AYES:	Foulkes, Hertzmann, Mellen, Schoettger, Walker
NOES:	None
ABSENT:	None

Witness my hand and the official seal of said City this 21st day of December, 1994.

Katherine E. Jefferies
City Clerk

RECEIVED
JAN 12 1995
Best, Best & Krieger

Mojave Water Agency

Mr. Wayne K. Lemieux
200 North Westlake Blvd., Suite 100
Westlake Village, CA 91362-3765

January 10, 1995

RE: Mojave Basin Area Adjudication

Dear Mr. Lemieux:

The Mojave Water Agency is in receipt of your letter dated December 23, 1994 regarding the Mojave Basin Area Adjudication. Your letter seeks clarification regarding reliance by MWA upon reclaimed water produced by the Big Bear Area Regional Wastewater Agency (BBARWA) to balance the Lucerne Valley Basin. Your letter infers that due to the water rights adjudication which includes the Lucerne Valley, a legal claim will be made to the reclaimed water for use in Lucerne Valley.

The Stipulated Judgment, in its current form, requires that the Court appointed Watermaster annually assess the water supply yield of the five subareas within the adjudicated basins. The annual determination of yield, following a prescribed water production "ramp-down" process, will establish the quantity of water that can be pumped from the basin without replacement by supplemental water. The annual determination of yield would be based upon a total hydrologic inventory of supplies which, by definition, would include return flows from wastewater applied to agriculture by BBARWA in Lucerne Valley, as is the current practice. To the extent that return flows are available in the future, those values would continue to be included in the annual hydrologic inventory by the Watermaster's engineer.

The inclusion of the BBARWA wastewater flow in the annual yield calculation does not result in an adjudicated water right or claim to that source of water supply by the Mojave Water Agency, the Watermaster or the parties to the adjudication, since BBARWA has not been named as a party to the Adjudication. Should the method of disposal from BBARWA change at some future date, the net effect could be a reduction in yield to the basin and consequently an increased need for supplemental water supply from other sources.

22450 Headquarters • P.O. Box 1089 • Apple Valley, CA 92307 • (619) 240-9201 • FAX (619) 240-2642

George R. Parker, Division #1 | Carl N. Dalton, Division #2 | Bill A. Christopher, Division #3 | Peggy Sartor, Division #4 | Thomas H. Irwin, Division #5
Beverly J. Lowry, Division #6 | John H. Russell, Division #7 | Larry W. Rowe, P.E., General Manager / Chief Engineer

Please contact me should you have any further questions.

Sincerely,

Larry W. Rowe
General Manager/Chief Engineer

c. BBARWA
Eric Garner, Best Best and Krieger

STUART L. SOMACH
ADMITTED IN CALIFORNIA AND
IN THE DISTRICT OF COLUMBIA

DE CUIR & SOMACH
A PROFESSIONAL CORPORATION
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400 CAPITOL MALL
SUITE 1900
SACRAMENTO, CA 95814-4407
TELEPHONE (916) 446-7979
FACSIMILE (916) 446-8199

March 15, 1995

VIA FACSIMILE

William J. Brunick, Esq.
Brunick, Alvarez & Battersby
1839 Commercenter West
P.O. Box 6425
San Bernardino, CA 92412

Re: *City of Barstow, et al. v. City of Adelanto, et al.*
Riverside County Superior Court, Case No. 208568

Dear Mr. Brunick:

I have reviewed your March 14, 1995 letter to me as well as Mr. Rowe's January 10, 1995 letter to Wayne Lemieux. I do believe that the two letters contain the fabric from which a solution can be crafted. As I noted in my letter to Mr. Rowe, the goal is not to upset the proposed Stipulated Judgment. The City of Big Bear Lake and other Big Bear Area Regional Wastewater Agency ("BBARWA") members only want reasonable assurances that the proposed Stipulated Judgment, once it is adopted and Ordered by the court, cannot be utilized by anyone, in any way, as a means to block the reclamation of water now exported to the Lucerne Valley for re-use within Big Bear Valley.

As I read Mr. Rowe's letter to Mr. Lemieux, the Mojave Water Agency ("MWA") understands the judgment to provide that the Watermaster shall annually assess the water supply of the five subareas within the adjudicated basin; that based upon this annual determination, the Watermaster will establish the quantity of water that can be pumped from each basin, assuming the absence of supplemental water. The annual determination of yield is based upon a total calculation of the available water supplies which would include, so long as they continue, return flows from wastewater applied to agricultural lands within Lucerne Valley by BBARWA. It is my understanding that return flows are assumed to be 50% of applied water.

I glean from Mr. Rowe's letter two main concepts of significance to the City of Big Bear Lake. First, the proposed Stipulated Judgment only controls the quantity of water that can be pumped from the respective basins. The proposed Stipulated Judgment does not compel the addition of supplemental water, nor does it compel an entity to continue to import water. Thus, BBARWA would be free, at any time, to cease its importation of wastewater into Lucerne Valley.

The second concept is that the practical impact this would have on the application of the provisions of the proposed Stipulated Judgment would be a reduced quantity of return flow calculated as part of the annual water availability figures and a potential reduction in pumping local basins.

In addition to these two concepts, and, perhaps derived from them, it is my understanding that no party considers the inclusion of the BBARWA wastewater flow in annual yield calculations as an adjudication or claim to that supply. Instead, they only consider it to be an accounting for that supply so long as it is imported to the basin. Moreover, since BBARWA is not a party to the adjudication, it cannot be bound by the adjudication or by the proposed Stipulated Judgment.

Finally, in this regard, you have represented to me that Bill Dendy and other witnesses have specifically testified on this matter in their discussion of Exhibit C-1. This testimony, I believe, includes reference to the fact that Exhibit C-1, appended to the proposed Stipulated Judgment, is clearly marked as an example and that the exhibit itself will be modified, on an annual basis, to reflect changed circumstances, as would be the case if the importation of wastewater to Lucerne Valley by BBARWA ceases.

Assuming the foregoing accurately reflects MWA's understanding of the situation, I believe that the matter could be resolved through the execution of a simple letter agreement or MOU between MWA, as the proposed Watermaster under the proposed Stipulated Judgment, and BBARWA and the City of Big Bear Lake memorializing this understanding. Indeed, I believe a letter from the MWA, as the proposed Watermaster under the proposed Stipulated Judgment, acknowledging and concurring in the foregoing, might well be sufficient.

On a directly related topic, to the extent it is available, I would appreciate it if you could forward to me the Dendy and related testimony discussed above and noted within your letter. Also, under the proposed Stipulated Judgment, is the 50% assumed return flow from BBARWA Lucerne Valley lands conclusively presumed or is it a calculated number that may vary?

I hope that what I have proposed above resolves the situation. Your immediate attention to this matter is essential. Please do not hesitate to contact me if you have any questions or need additional information.

Very truly yours,

Stuart L. Somach
Attorney

SLS:sb

cc: Larry Rowe
Wayne Lemieux, Esq.
Eric Garner, Esq.
Michael Perry

ATTACHMENT 2

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REC'D APR 5 1995

PLEASE REFER TO

March 31, 1995

7MW-0009

De Cuir & Somach
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Attn: Stuart L. Somach

RE: City of Barstow, et al. v. City of Adelanto, et al.
Riverside Superior Court Case No. 208568

Dear Stuart:

In response to your letter of March 15, 1995, please find enclosed testimony of Jim Hansen and Bill Dendy regarding Exhibit C-1. I believe the best explanation of the Judgment is the Judgment itself. I have enclosed a copy of the stipulated Judgment for your review. It should be made clear that the Court may change the terms of the Stipulated Judgment if the Court decides to impose a different physical solution. We should have some idea as to the position of the Court on April 10, 1995.

I believe my letter of March 14, 1995 and Mr. Rowe's letter of January 10, 1995 states the position of the Mojave Water Agency as to the reclamation of water discharge by Big Bear Area Regional Waste Water Agency in Lucerne Valley. The inclusion of this discharge on Exhibit C-1 is an example only.

This exhibit will be modified to reflect changed circumstances as would be the case if the importation of waste water to Lucerne Valley by BBARWA ceases. Moreover, since BBARWA is not a party to the adjudication, I do not see how it could be bound by the adjudication or terms of the Stipulated Judgment.

If you desire further clarification of the Mojave Water Agency's position in this matter, please contact this office.

Very truly yours,

BRUNICK, ALVAREZ & BATTERSBY

William J. Brunick

WJB/dkr

cc: Larry Rowe

ATTACHMENT 3

about.

What is this basically, and what's its purpose, Mr. Dendy?

A This was a table labeled C-1. It appears in Appendix C of the stipulated judgment.

Q I'll stop you there.

This Table C-1, is this exactly the same as Table C-1 in the judgment, which is Exhibit 4001?

A No, it isn't.

Q Why? What's the difference?

A When that was prepared, the process of verification of production was still in progress. And we always knew that as when final figures were obtained that there would have to be an amendment to show some adjustment in this table to reflect the fact that some production had not been verified and perhaps some additional use is found. And so this table is the latest update of that, probably the final one, as far as I know.

Q Okay.

Let's take a look at what's on here. What's reflected -- what -- What does "water supply" mean as reflected in this table?

A Water supply here refers to the -- what is the long-term average water supply that's expected to exist over the next -- in the future. It's based -- the natural sources of supply are based upon the sixty-year long-term average annual natural water supply of water to the basin.

Q Okay. Let's stop for a second before you run

way far ahead of these concepts.

Why does this table utilize an average when you're talking about water supply coming into a subarea?

A The -- When dealing with a large groundwater basin, or basins as we are, there's a huge amount of water in storage. And the water supply is highly variable from year to year. There can be very wet years in which a lot of water is put into storage. There can be very dry years, series of dry years in which very little, if any, water goes into storage. The use of the water to support an economy can't rely on that kind of variability. The economy of water used by people and farmers, industry, needs to be fairly predictable and stable. And so by using the long-term storage capacity of the basins, the water in storage can be allowed to fluctuate up and down over time. But as long as the average usage doesn't exceed the average net supply, it should remain in balance.

Q Is the average net supply calculated over a typical period of wet and dry years?

A In this case, as in other cases and other basins, you use the best record you have. And what we happen to have here is sixty years of pretty good record as to what the water supply has been. Because it included some series -- long series of wet years. There's some very extreme wet years. It's included some extended periods of drought, very dry years. Both kinds of years as well as some more or less average years are included in the record. Hydrologists believe it is representative of what

can be relied on for long-term average.

Q And now in that average year you have different types of water supply as I see this. I think the court has heard testimony on all about imports. I don't recall much testimony on imports. What are those two imports down at the bottom of that column, Mr. Dendy?

A These imports represent the -- that's wastewater from two sources, Lake Arrowhead Community Services District and the Big Bear Area Regional Wastewater Authority, which for the past several years have been exported from those areas and disposed of in the Mojave Basin area. For purposes of projecting water supply available in the future the assumption made here is that those discharges will continue. We actually suspect that they will increase. But all we know right now is that they are at this level, and so that's the number we've used to project as being available in the future as part of the water supply.

Q Are these waters deposited somewhere in this basin area just as the VVWRA waters are deposited after sewage treatment?

A I believe some of the water is just disposed of in percolation basins. It doesn't go to the river directly.

Q Yes.

A And some is actually applied for use.

Q Now, could this net average water supply as we go through the administration of this judgment out into

the future, could that average change under changed circumstances? Would it have to be recomputed?

A The first three items, surface water inflow, subsurface inflow, and deep percolation precipitation will not change. It's highly unlikely that the sixty-year average of those items is going to be changed in the future.

Q How about the imports?

A The imports could change. As I say, the most likely thing is they might go up. These people might find someplace else to dispose of their wastewater outside the Mojave Basin area. If they did, those numbers would have to be taken off and a new calculation.

Q If a new import came on line through a contract, would you take that into account?

A If -- Yes. If we believed that it was going to be a reliable supply in the future, it should be added in here.

Q Okay.

Now, getting down to consumptive use and outflow, starting with consumptive use, what is consumptive use differentiated from water production or water produced?

A Well, consumptive use refers to the -- the best word I can use is evaporation. It is water that is lost from the system permanently by evaporation into the air.

Q It's not synonymous -- It's not equal to production?