



REPLENISH
— *Big Bear* —

Summary: Preliminary Pilot Facility Water Quality Testing

JULY 24, 2024

AGENDA

1. Pilot Water Quality Summary
2. Pilot Purpose & Objectives
3. Background
4. Piloting Sequence
5. Data Collection
6. Results & Findings
7. Next Steps

Pilot Facility Water Quality Summary



REPLENISH
— Big Bear —



Key Treatment System Drivers

Constituent	Units ¹	Drinking Water Objectives for Comparison	Anticipated RBB Permit Objective	Pilot Treatment Results ²
Total Dissolved Solids	ppm	500	175	8
Sodium	ppm	--	20	0.8
Chloride	ppm	250	10	1.1
Sulfate	ppm	250	10	0.1
Total Phosphorus (TP)	ppm as phosphorus	--	0.035	0.013
Total Inorganic Nitrogen (TIN)	ppm as nitrogen	10 for Total Nitrogen	0.15	0.27
Total Organic Carbon (TOC)	ppm	--	0.5	0.16
Total System Recovery	%	--	98% (Target)	98.7%

DESIGN CHANGES UNDERWAY TO MEET OBJECTIVE

TREATMENT PROCESS MET TARGETS

¹ mg/L = milligrams per liter (parts per million)

² Based on CCRO Effluent from Phase Two

Pilot Study Purpose & Objectives



REPLENISH
— Big Bear —



Replenish Big Bear Pilot Study

✓ WHAT IT IS

Small scale test of potential treatment processes using the same water source that would be treated through full-scale system

Opportunity to:

- Collect data to optimize design of final treatment process
- Estimate brine production
- Gain operator experience

✗ WHAT IT ISN'T

- The final Replenish Big Bear treatment process
- An exact report on Replenish Big Bear Program Water quality to be discharged into Stanfield Marsh



Drivers for Replenish Big Bear Pilot Study

Stringent Effluent Water Quality Regulations + Unique Project Needs

- Inform selection of treatment processes needed to meet very low objectives for Big Bear Lake
- Evaluate impacts of winter process temperatures on treatment performance
- Quantify total system recovery and estimate brine to be produced

Background

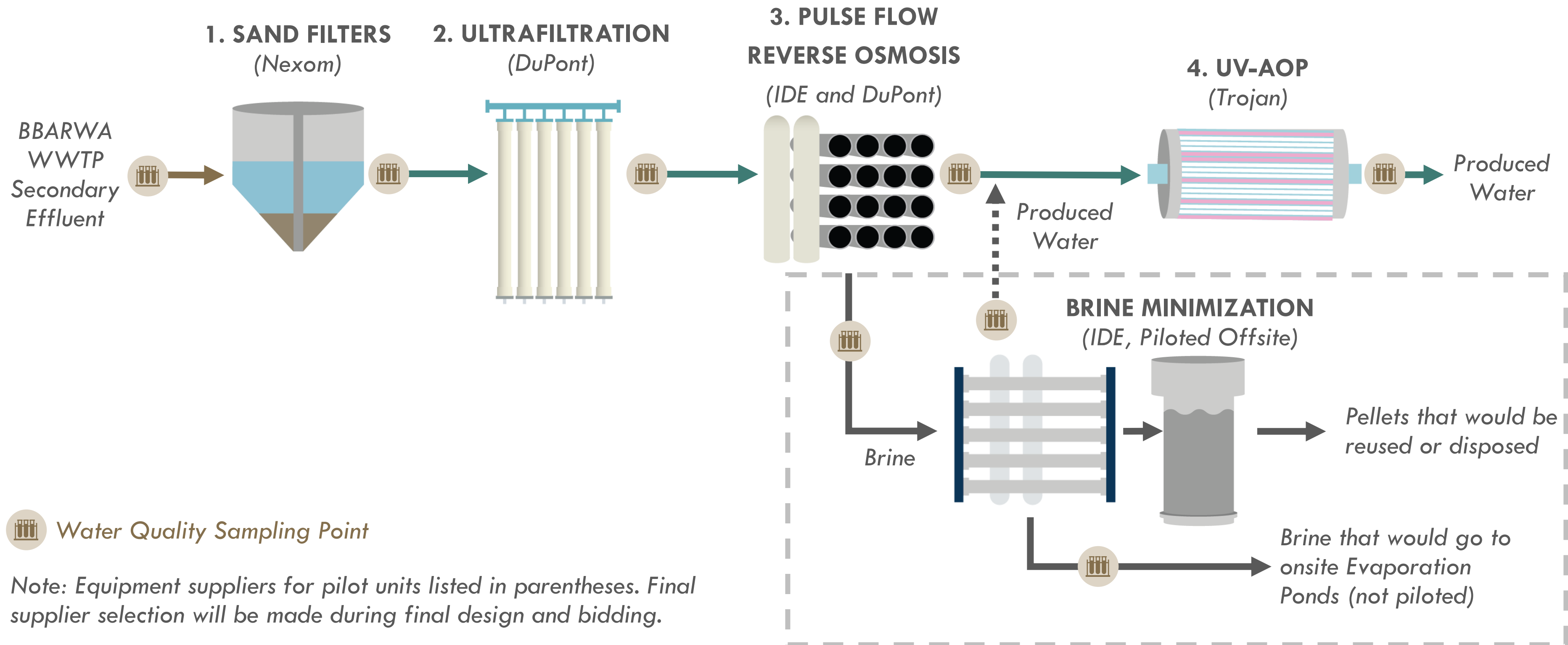


REPLENISH
— Big Bear —



4 Treatment Processes Piloted at BBARWA Site

Pilot ran at ~25 gallons per minute (less than 1% of full-scale flow rate)





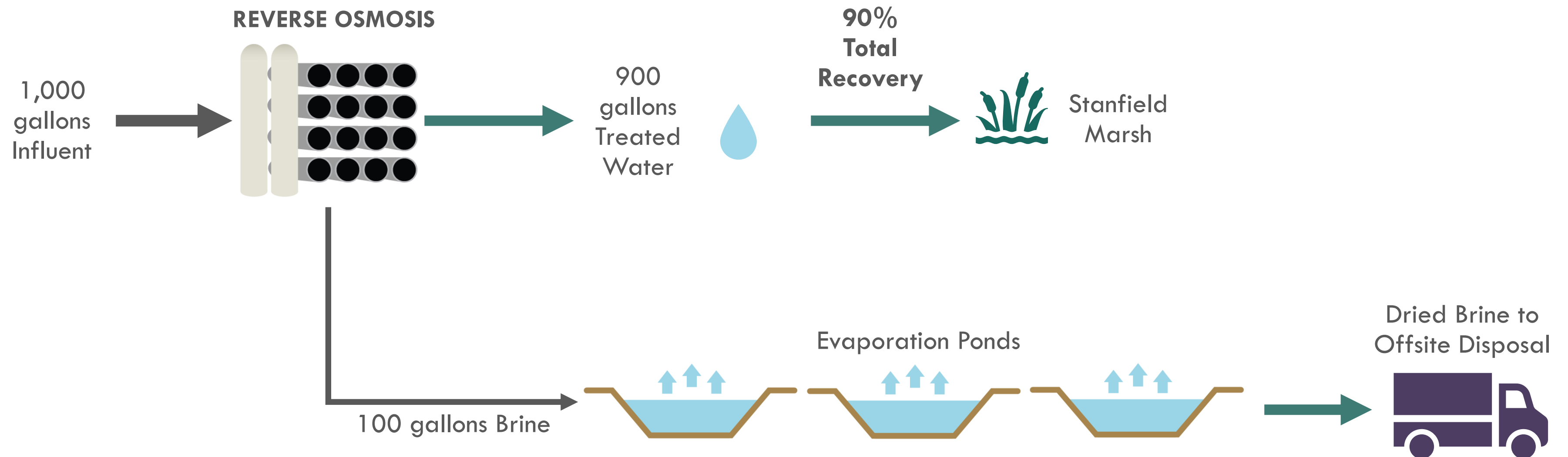
Multiple Processes Required for Treatment

Constituent Targeted	Sand Filter	UF	RO	UV-AOP
Inorganic Nitrogen				
Phosphorus				
Metals				
Solids				
Total Dissolved Solids				
Pathogens				
Organics				
Constituents of Emerging Concern (CEC)				

REPLENISH
— Big Bear —

Why do we need brine minimization?

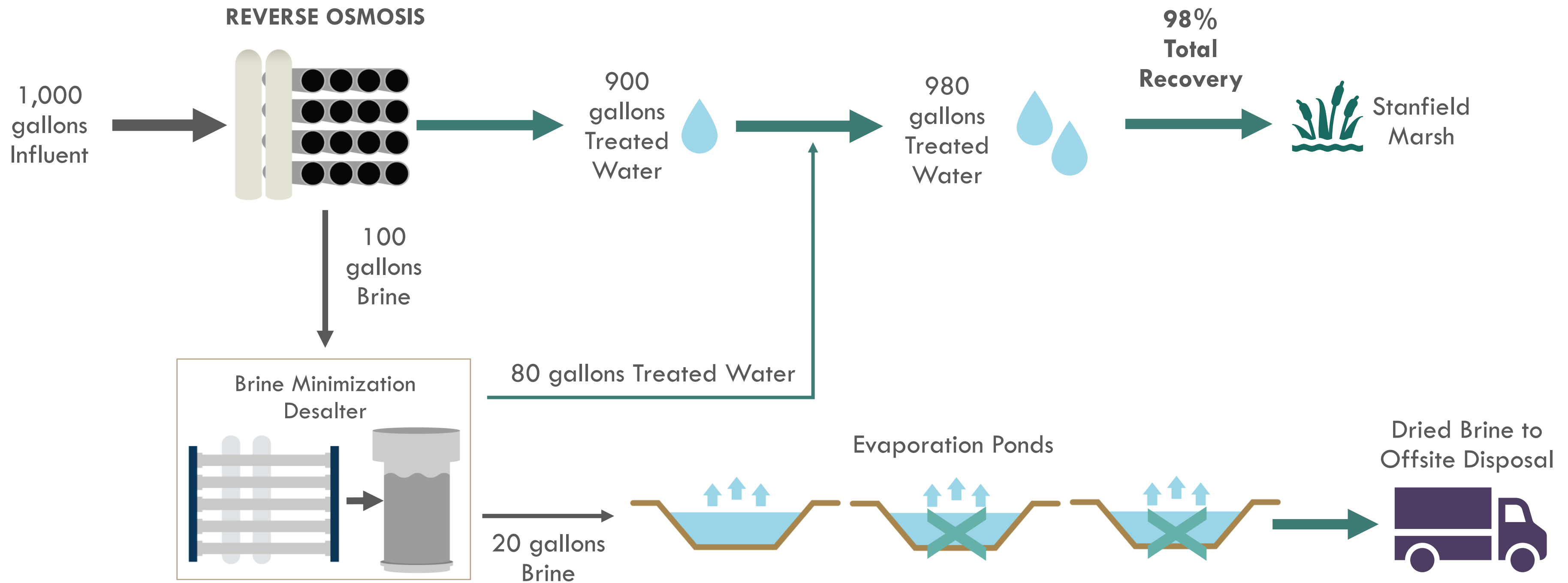
Without Brine Minimization – Lower Total System Recovery



REPLENISH
— Big Bear —

Why do we need brine minimization?

With Brine Minimization – Greater Total System Recovery



Piloting Sequence



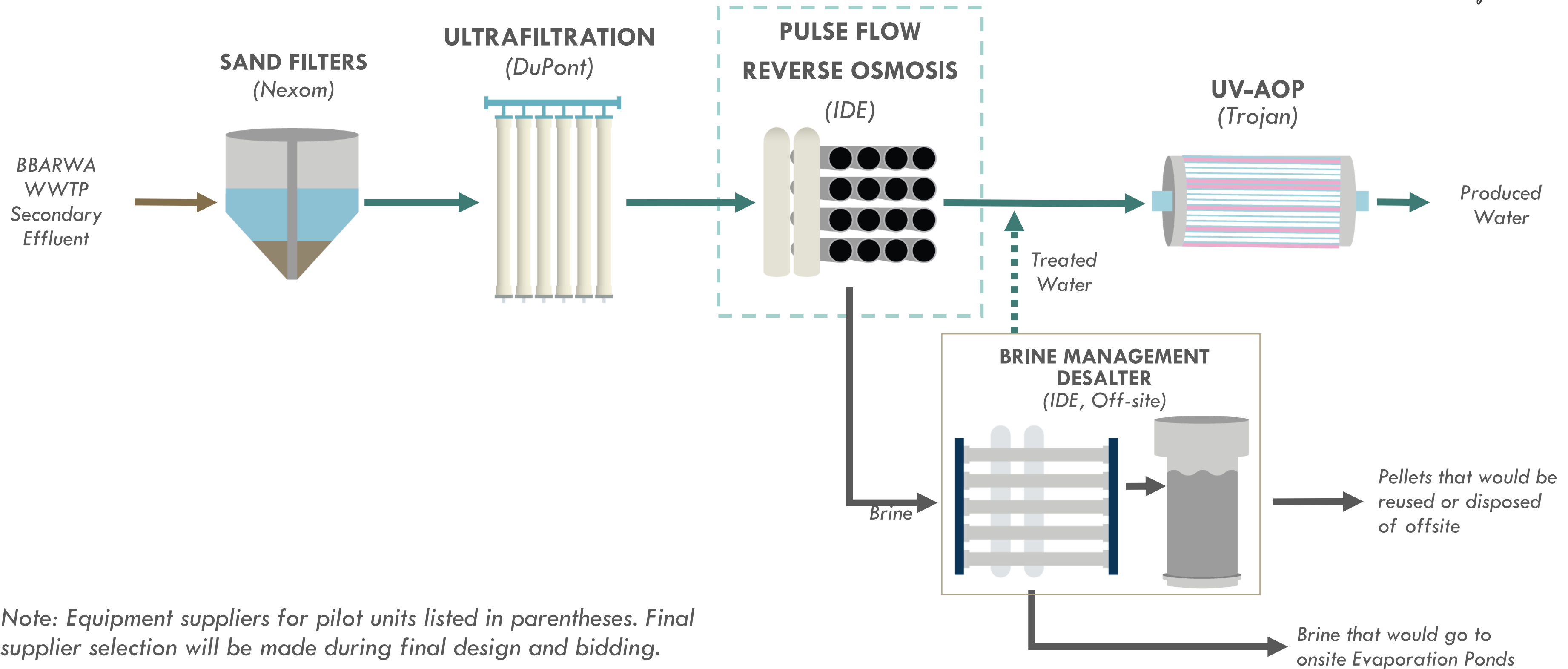
REPLENISH
— Big Bear —

PHASE 1



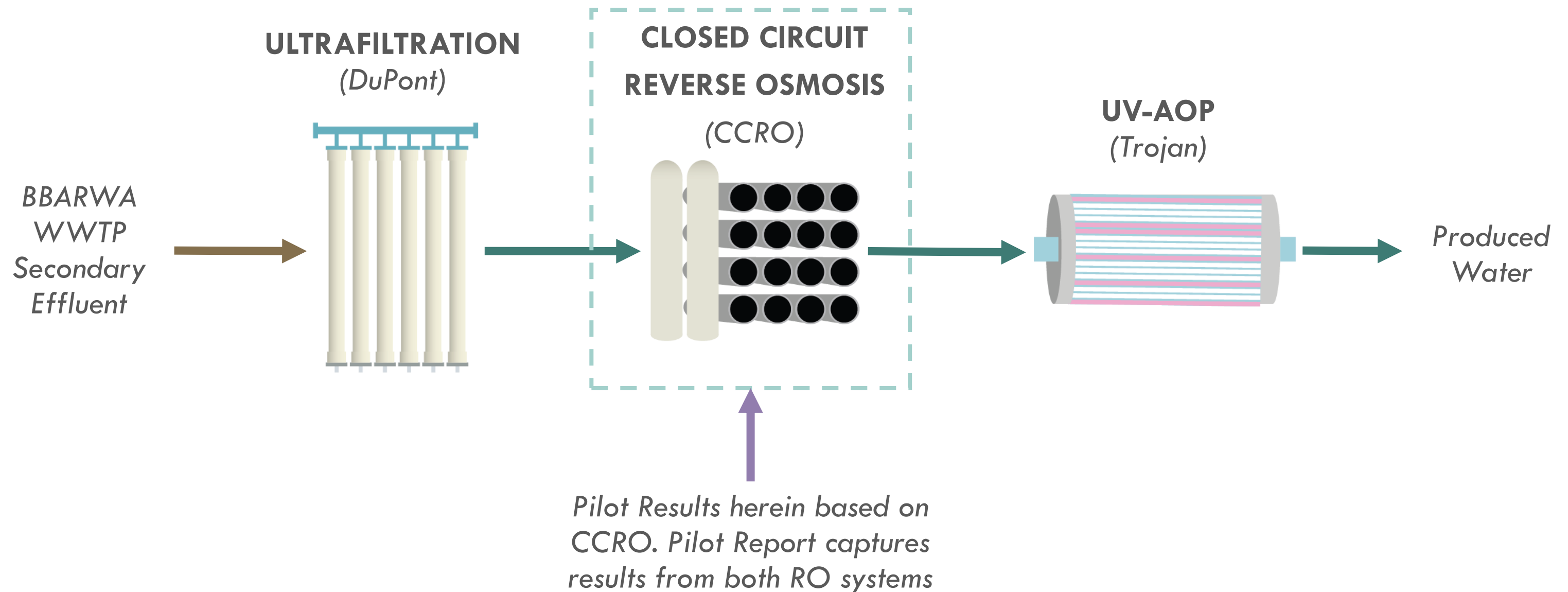
REPLENISH
— Big Bear —

Piloting Sequence





Piloting Sequence



Note: Equipment suppliers for pilot units listed in parentheses. Final supplier selection will be made during final design and bidding.

Data Collection



REPLENISH
— Big Bear —



Data Collection

- Certified Third-Party Water Quality Testing Lab (Eurofins)
 - 200+ constituents analyzed for Pilot Report
 - 3,000+ samples analyzed over 5 sample points
- Certified On-site Water Quality Testing (BBARWA Lab)
- Real-time and Continuous Monitoring of Various Constituents
- Pilot Process Performance Test

Pilot Results & Findings



REPLENISH
— Big Bear —



Key Treatment System Drivers

Constituent	Units ¹	Drinking Water Objectives for Comparison	Anticipated RBB Permit Objective	Pilot Treatment Results ²
Total Dissolved Solids	ppm	500	175	8
Sodium	ppm	--	20	0.8
Chloride	ppm	250	10	1.1
Sulfate	ppm	250	10	0.1
Total Phosphorus (TP)	ppm as phosphorus	--	0.035	0.013
Total Inorganic Nitrogen (TIN)	ppm as nitrogen	10 for Total Nitrogen	0.15	0.27
Total Organic Carbon (TOC)	ppm	--	0.5	0.16
Total System Recovery	%	--	98% (Target)	98.7%

DESIGN CHANGES UNDERWAY TO MEET OBJECTIVE

TREATMENT PROCESS MET TARGETS

¹ mg/L = milligrams per liter (parts per million)

² Based on CCRO Effluent from Phase Two



Key Findings From the Pilot

- Nearly all treatment targets were met by the pilot treatment system.
- Sand Filters will not be used in the full-scale system because they did not achieve reliable nitrogen removal in cold weather conditions.
- A different nitrogen removal treatment process will be added after RO instead of the Sand Filters (such as ion exchange).
- The brine minimization technology that was tested can meet the target of 98% recovery.
- Alternative brine minimization technologies are also being evaluated to optimize the approach for full-scale design (+99% total recovery).



Purified Water Quality Monitoring Results

- In addition to water quality parameters tested for the pilot treatment process, 304 other constituents were monitored, of which 16 were detected. Of the 16 detected, only 11 constituents have established objectives, which were all below the most stringent objective. The remaining constituents were not detected.
- The quality of the purified water produced by the pilot treatment system met all of the established regulatory objectives (except TIN, which will be further reduced by a modified treatment process, as noted in prior slides)

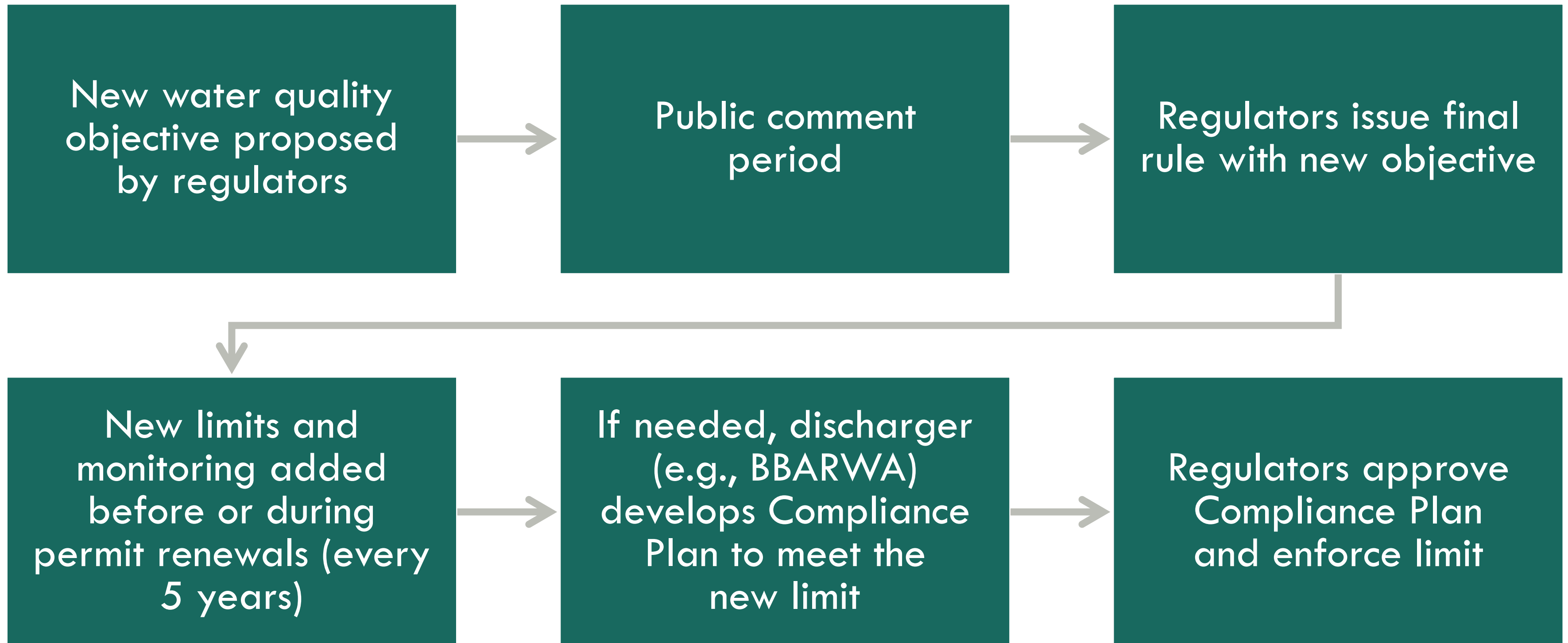


See Appendix D of the **Pilot Report** for full results

www.replenishbigbear.com/documents



Process to Set New Water Quality Objectives



Next Steps



REPLENISH
— Big Bear —



Pilot Study Follow Up Work

1. Perform process modeling for ion exchange nitrogen removal

(to replace sand filters)

2. Brine Minimization Alternatives Analysis

Bench Scale Testing of Softening Process

- Complete — Results indicated high total system recovery is achievable (+99%)
- Softening process would replace brine minimization desalter

*Results of above analyses will be summarized in Preliminary Design Report (expected Fall 2024)
including a comparison to IDE's Brine Minimization Desalter process that was piloted*



Preliminary Design Report



PART I

- Introduction
- Program Benefits
- Regulatory Analysis

PART II

- Preliminary Engineering Work (original Facility Plan)

PART III

- Recommended Project and Updated Cost Estimate
- Preliminary Design Criteria
- Implementation Plan

Discussion and Questions



See the **Pilot Report** for full results, analysis and discussion of how results will be used to refine the final full-scale treatment process

www.replenishbigbear.com/documents