Brine Minimization Maximizes Potential for Inland Potable Reuse Project

Wendie Heie – Rancho California Water District

Fred Gerringer, D.Env, PE, BCEE – Hazen and Sawyer

Acknowledgements

- Rancho California Water District
  - **Jeff Kirshberg**
  - **Jake Wiley**
- Hazen and Sawyer
  - **Dawn Guendert**
  - **Troy Walker**
  - **Jeff Neale**
  - **Jazz Jacobs**
  - **Ryan Gustafson**
- SPI
  - **Alex Wesner**
  - **Gabi Downey**
- Mickley & Associates
  - **Mike Mickley**
- DDB Engineering
  - **Debbie Burris**
- Michael Welch

Agenda

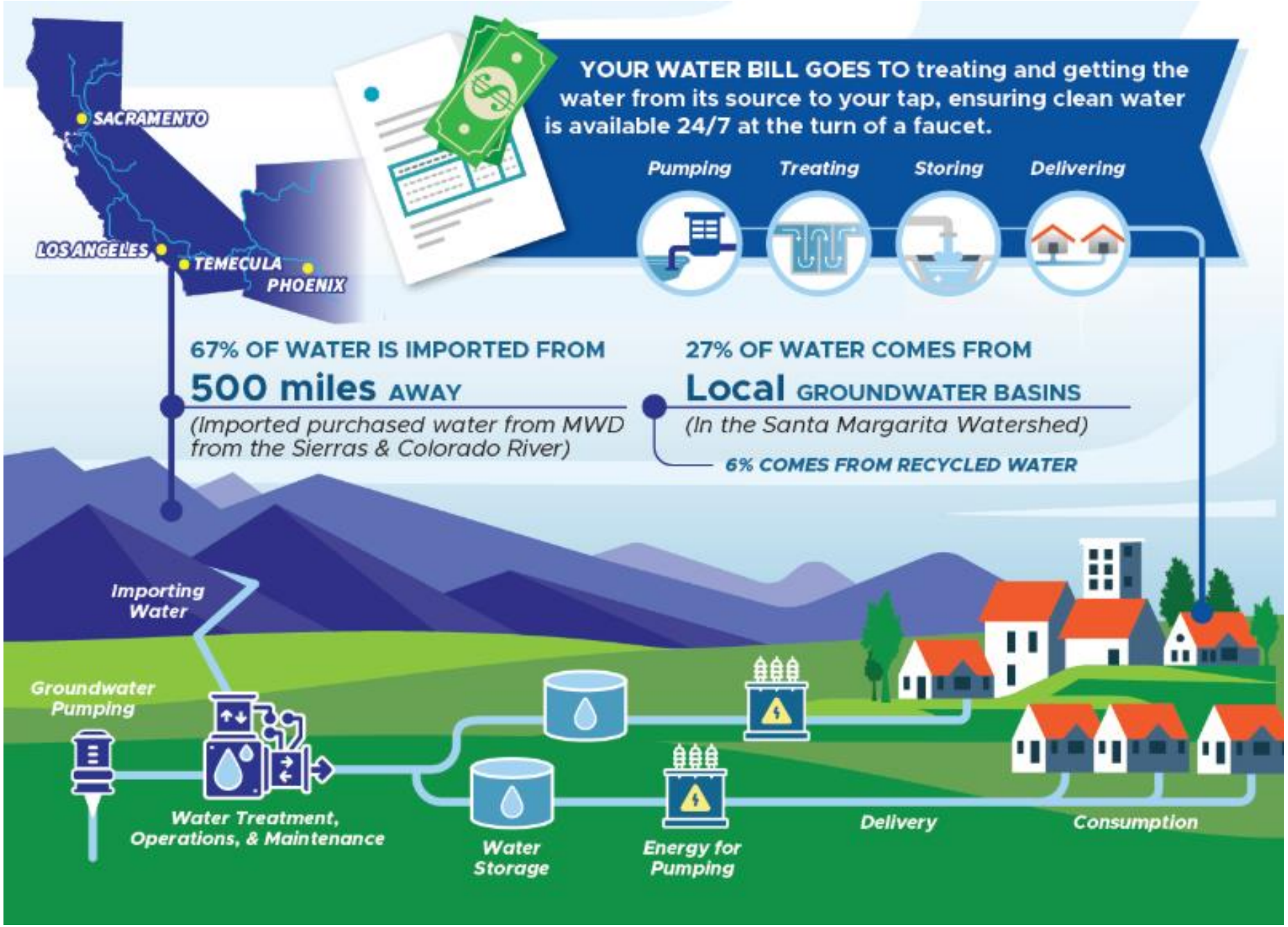
- Background to Rancho Water
- Existing Water Reuse Infrastructure
- Drivers for Potable Reuse
- Project Constraints
- Treatment Options
- High Recovery RO Systems
- Brine Management
- Next Steps

Rancho Water… Who We Are

Figure 1

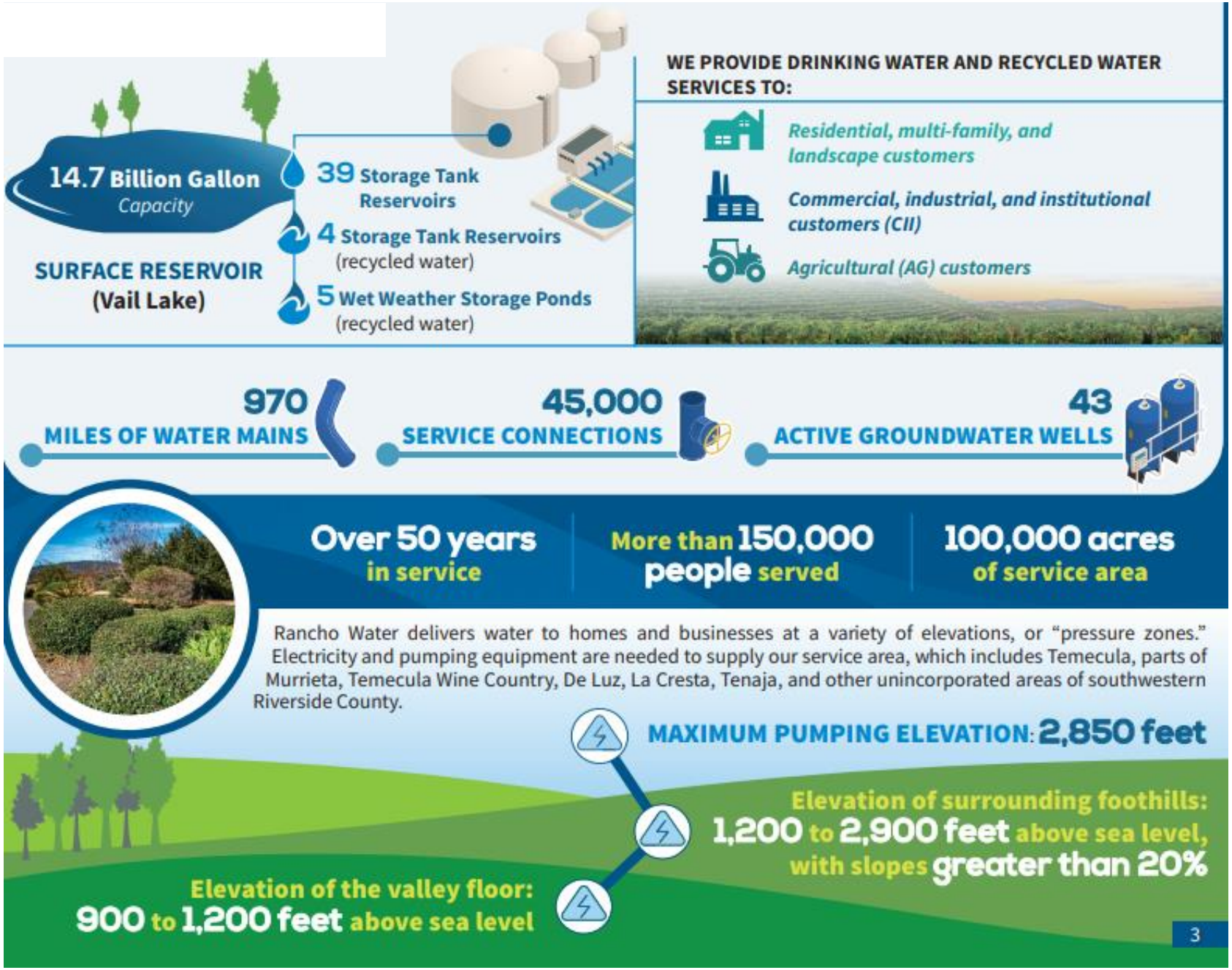
- **Purchases** water from MWD via Eastern Municipal Water District (EMWD) & Western Municipal Water District (WMWD)
- **Operates** 5 MGD Santa Rosa Water Reclamation Facility on behalf of Santa Rosa Regional Resources Authority (SRRRA)
- **Distributes** own wastewater from SRWRF & purchased wastewater from EMWD
- **Manages** the Temecula Valley Groundwater Basin

From Peaks to Pipe



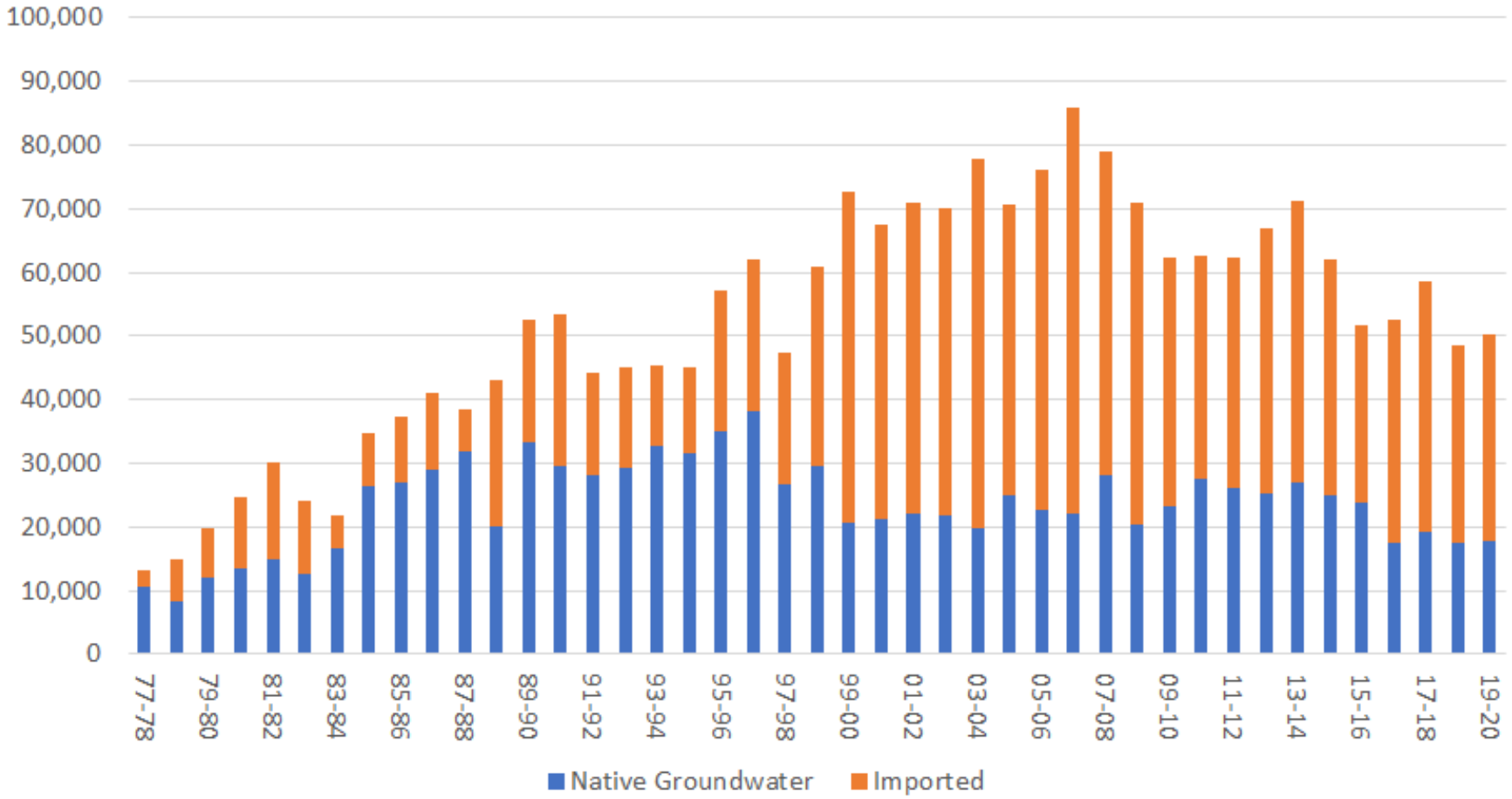
Rancho Water At-A-Glance

The mission of Rancho California Water District is to deliver reliable, high-quality water, wastewater, and recycled water services to its customers and communities in a prudent and sustainable manner.



Water Supply Sources

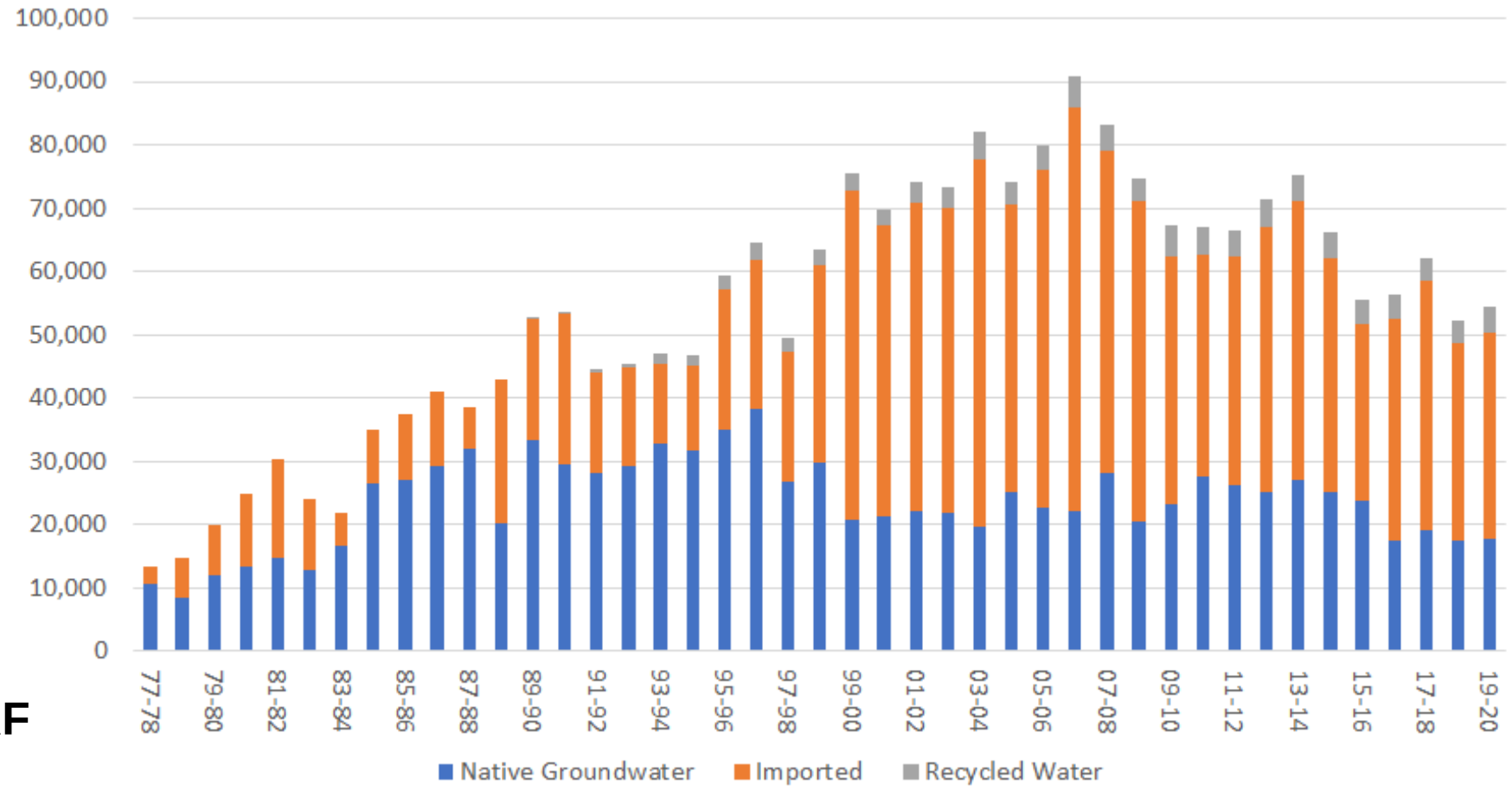
- Historical water supply
  - **Groundwater**
  - **Supplemented with imported water**



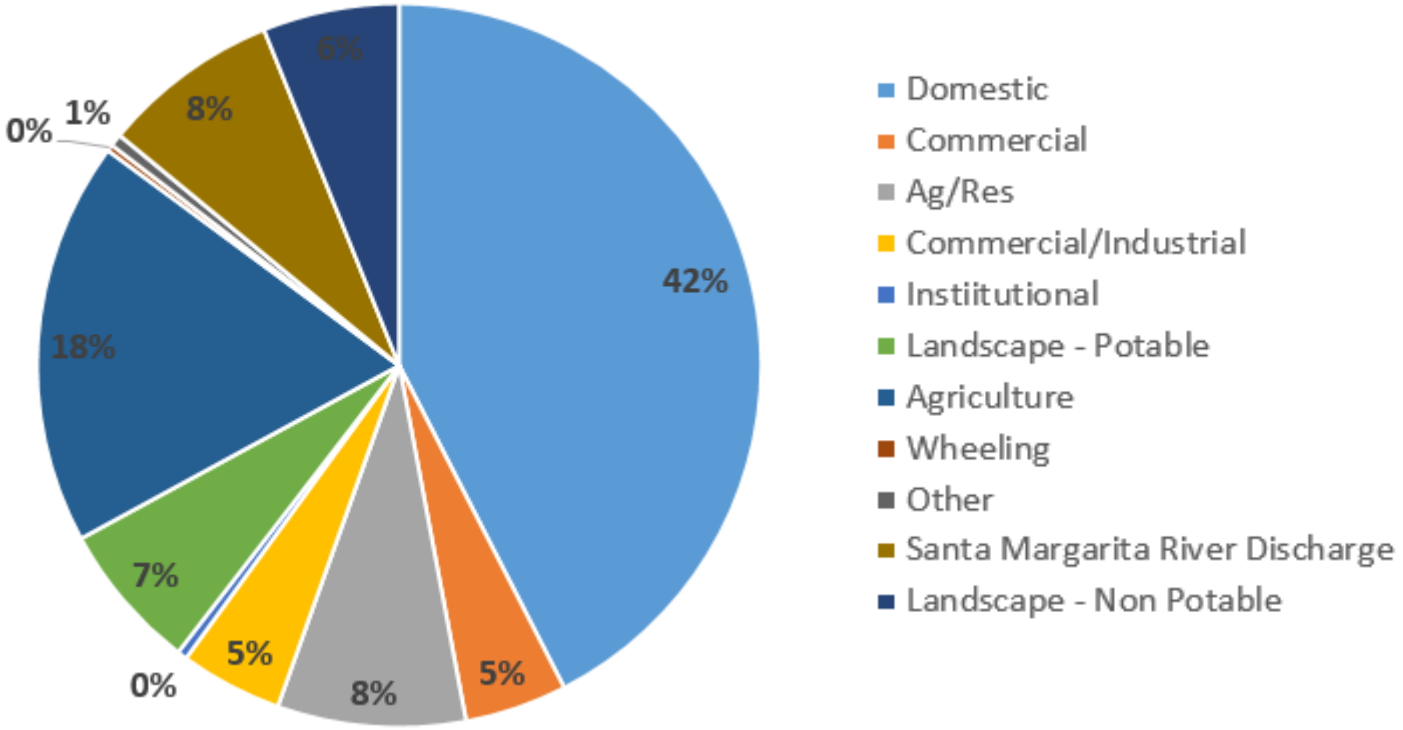
Water Supply Sources

- Historical water supply
  - **Groundwater**
  - **Supplemented with imported water**
- Began using recycled water in 1990

2020	**54,317 AF**
Native GW	33%
Imported	60%
Recycled	7%

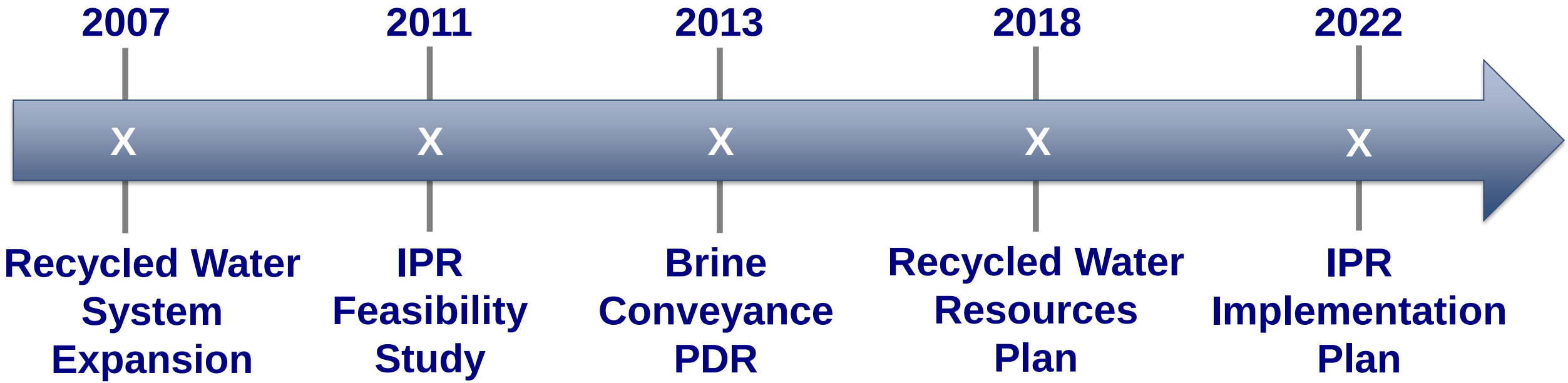


WHO WE SERVE…


42%
5%
8%
5%
0%
7%
18%
0%
1%
8%
6%
Domestic
Commercial
Ag/Res
Commercial/Industrial
Instiitutional
Landscape - Potable
Agriculture
Wheeling
Other
Santa Margarita River Discharge
Landscape - Non Potable

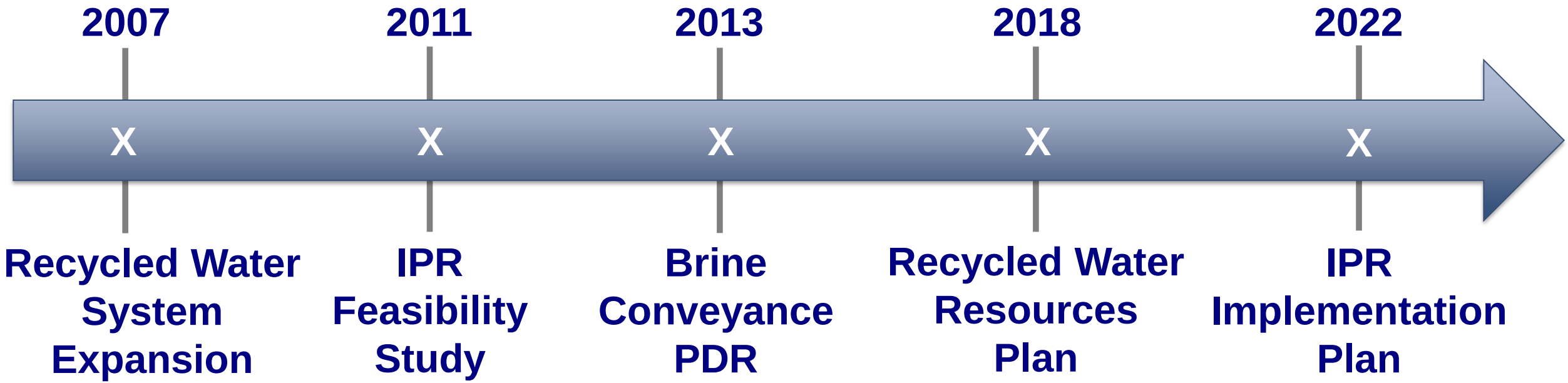
RANCHO WATER'S ROAD TO IPR…

Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990



RANCHO WATER'S ROAD TO IPR…

Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990

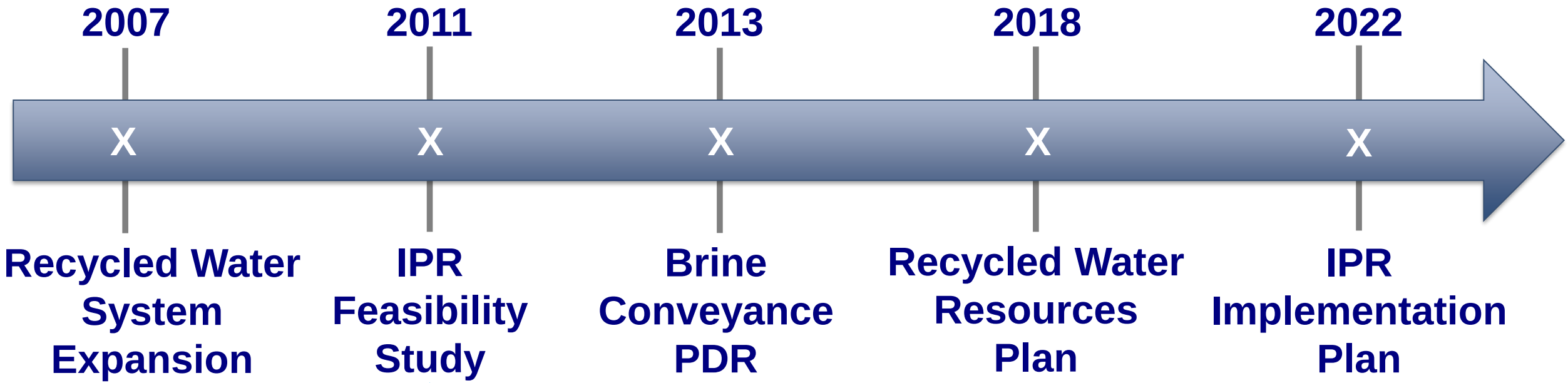


Constrained by groundwater basin TDS objectives

- Groundwater basin: 500 mg/L
- Recycled water: 750 mg/L

RANCHO WATER'S ROAD TO IPR…

Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990

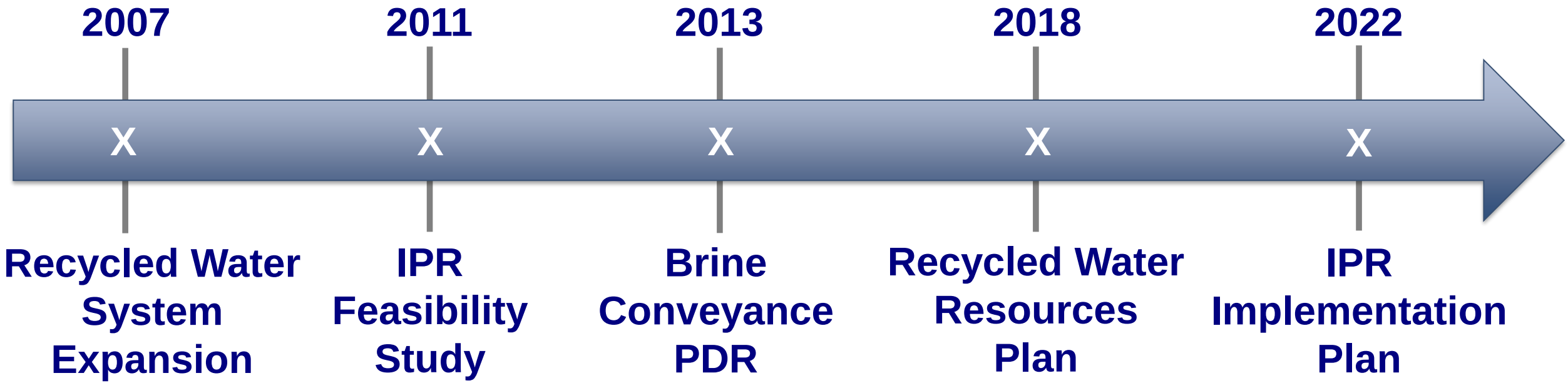


Evaluated 15 alternatives

- 5000 AFY (4.5 MGD)
- Surface spreading and injection

RANCHO WATER'S ROAD TO IPR…

Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990

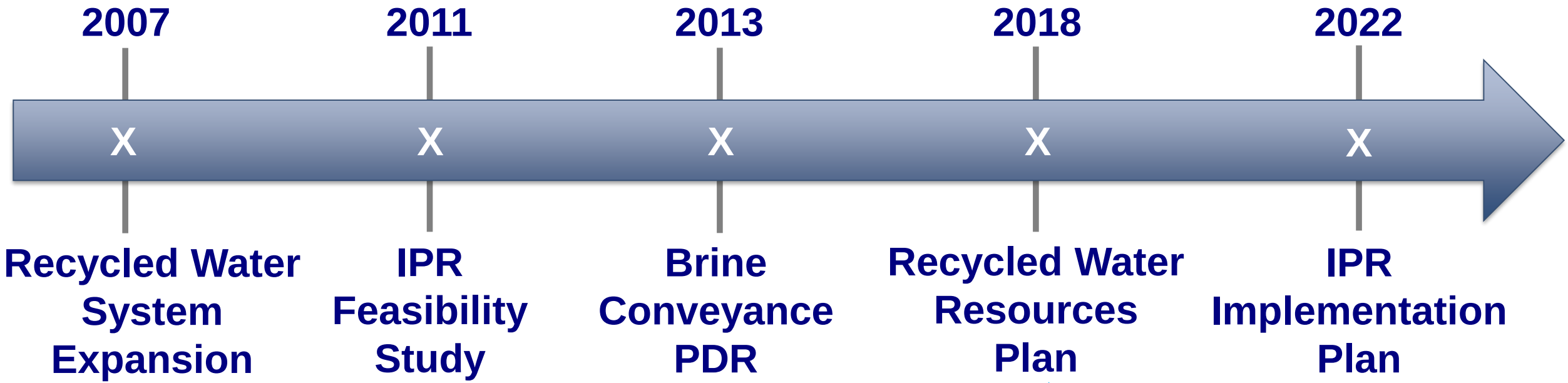


Brine disposal pipeline preliminary design

- 15-mile pipeline to nearby agency
- Estimated costs: $30M

RANCHO WATER'S ROAD TO IPR…

Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990

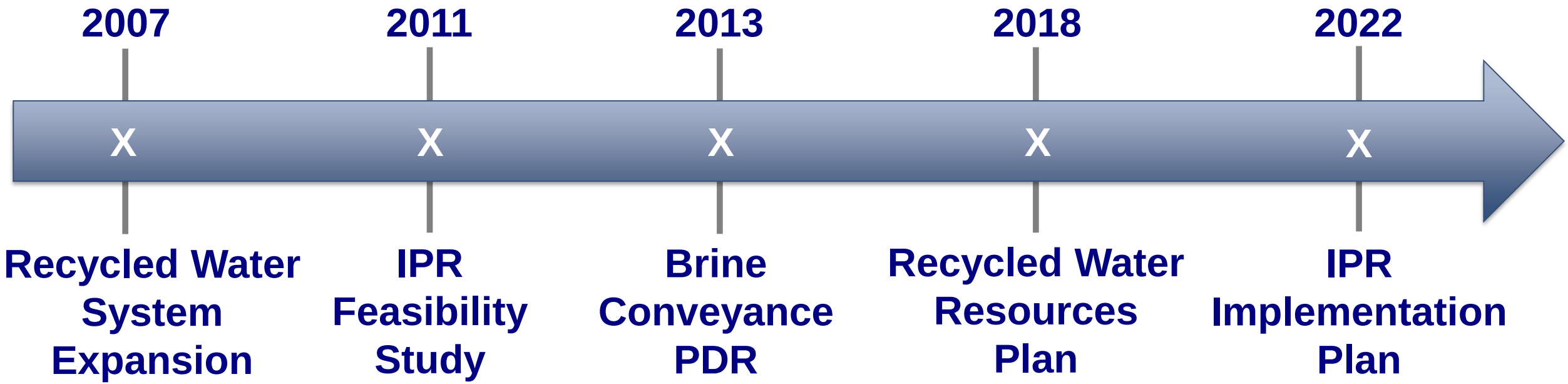


Evaluate potable and non-potable reuse (NPR) options

- 16 alternatives
- Selected alternative: expand NPR and small groundwater injection IPR (0.5 MGD)

RANCHO WATER'S ROAD TO IPR…

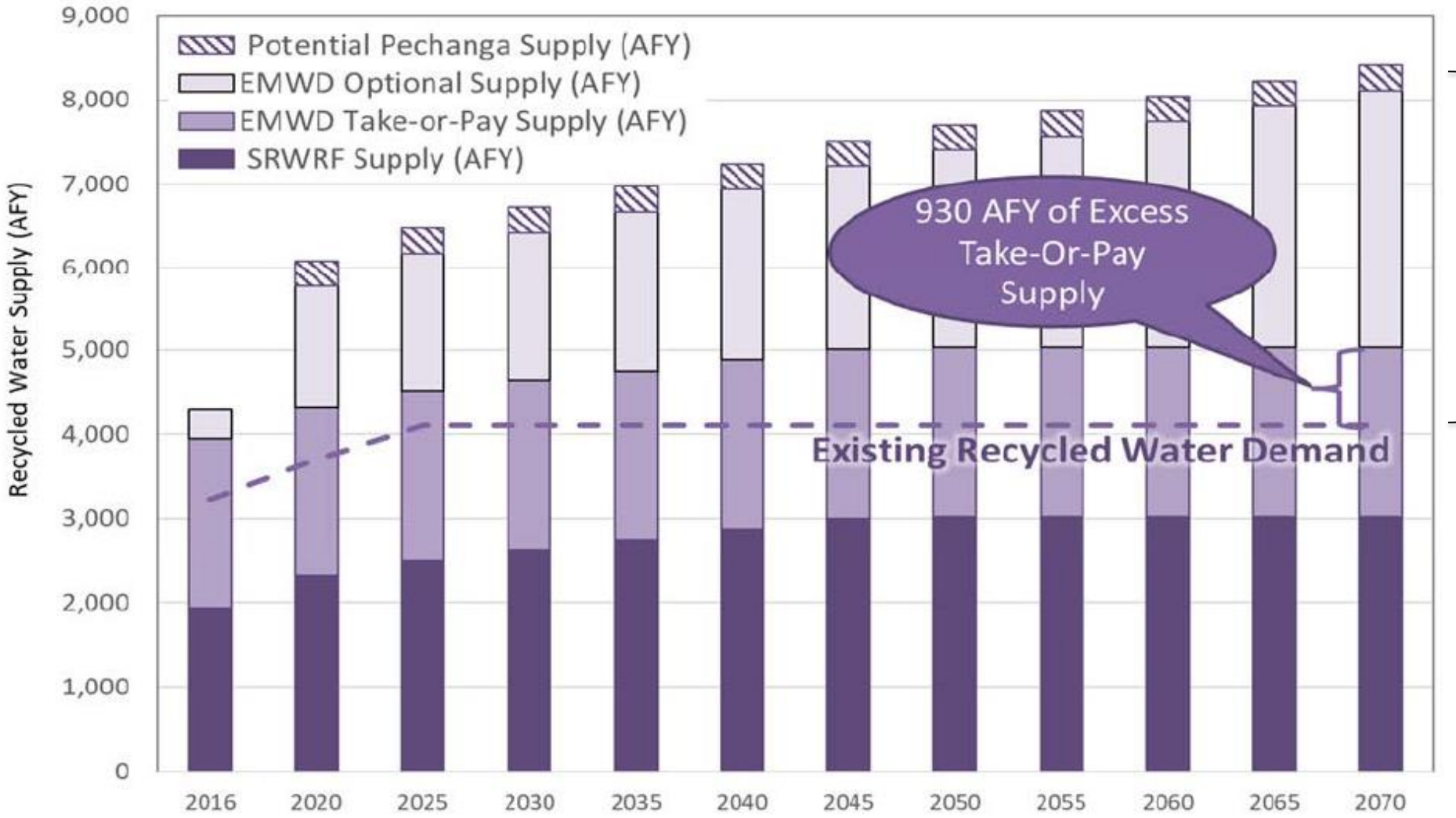
Rancho Water has been engaged in efforts to diversify its water supply portfolio since it began using recycled water in 1990



1. Source water quality
2. Stakeholder approach
3. Regulatory engagement
4. Implementation roadmap

WHY IPR?

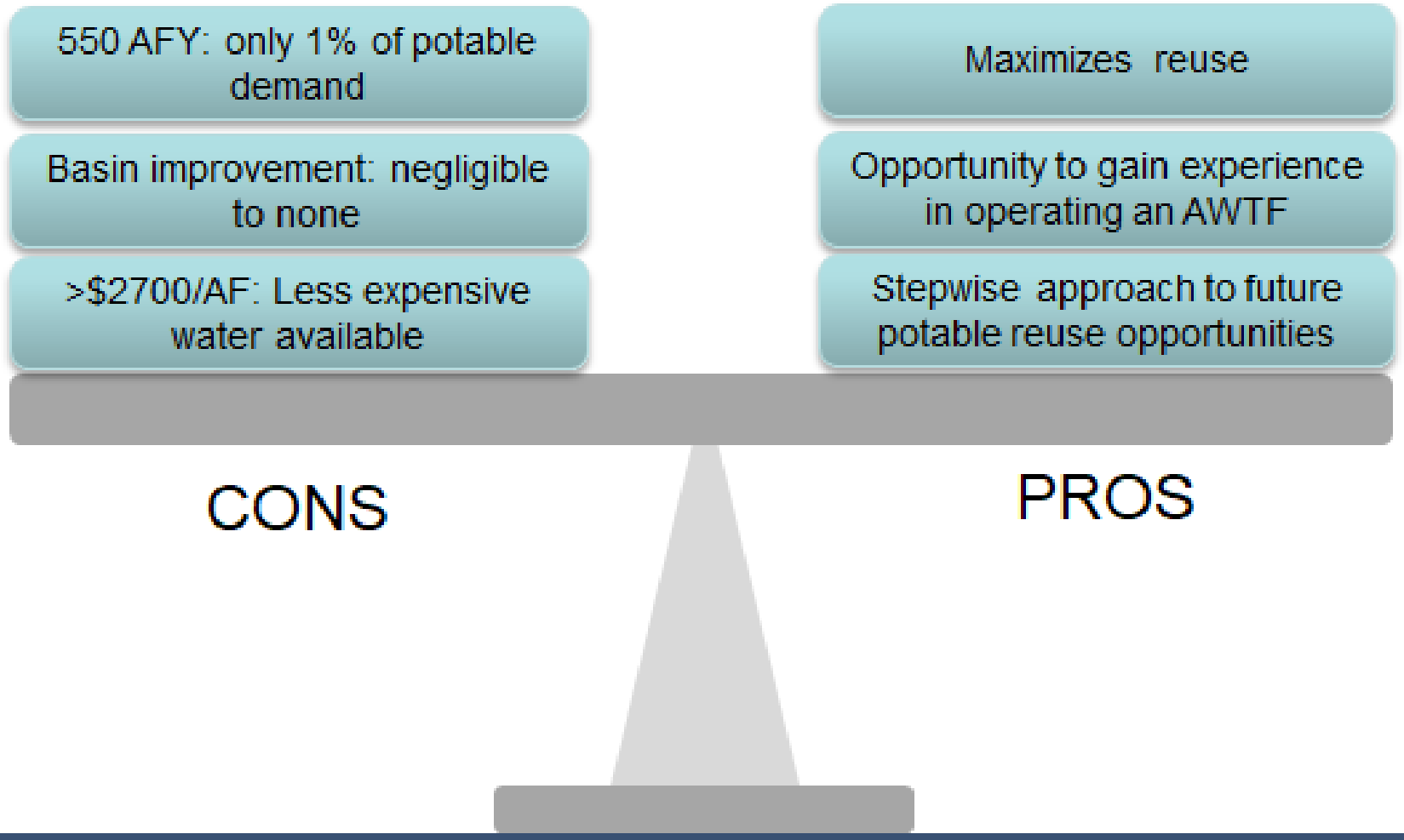
2018: Existing and Projected Recycled Water Supply



4,300 AFY
(3.8 MGD)
surplus in 2070

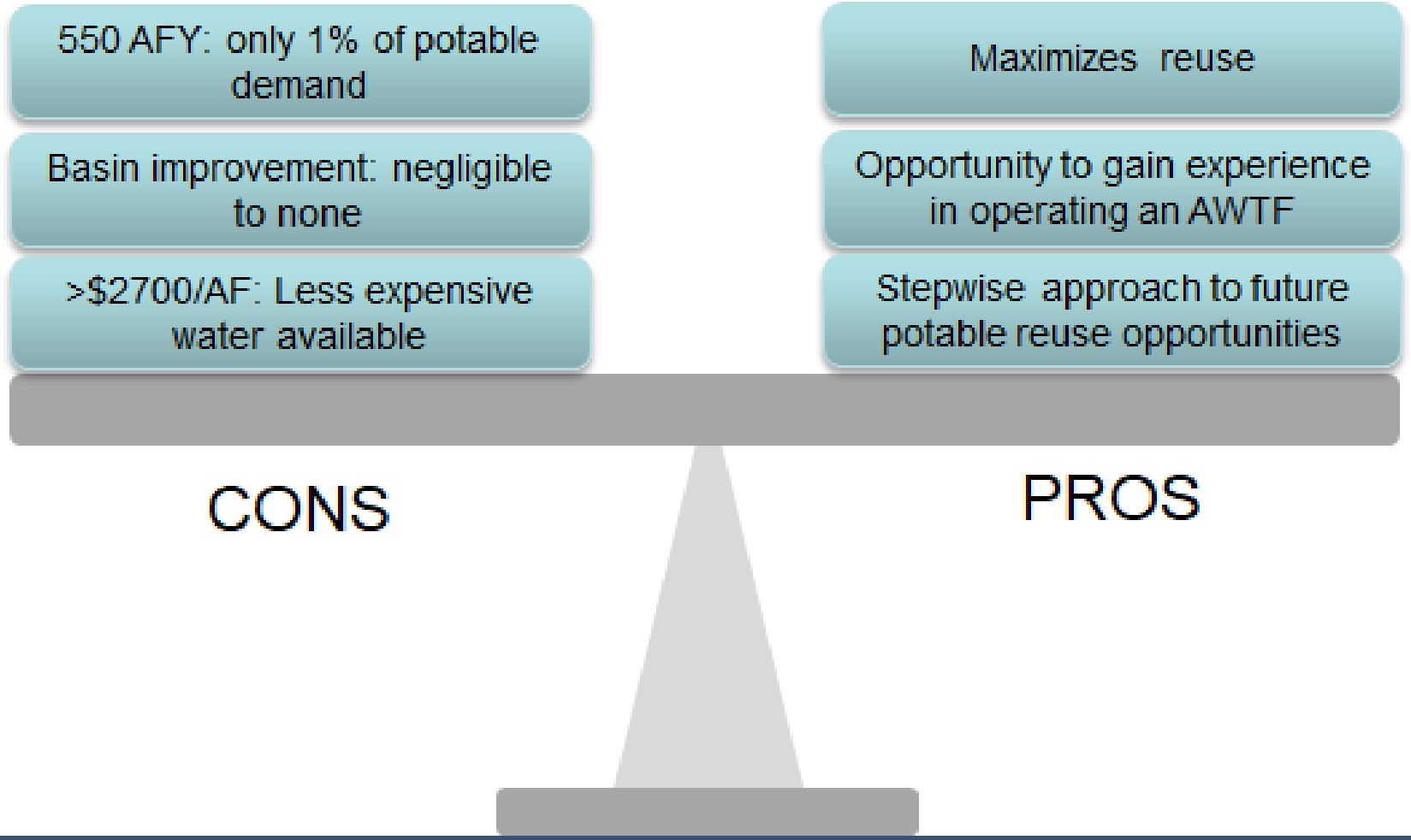
Groundwater basin water quality objectives prevent full utilization of recycled water

WHY IPR?


550 AFY: only 1% of potable demand
Basin improvement: negligible to none
>$2700/AF: Less expensive water available
Maximizes reuse
Opportunity to gain experience in operating an AWTF
Stepwise approach to future potable reuse opportunities
CONS
PROS

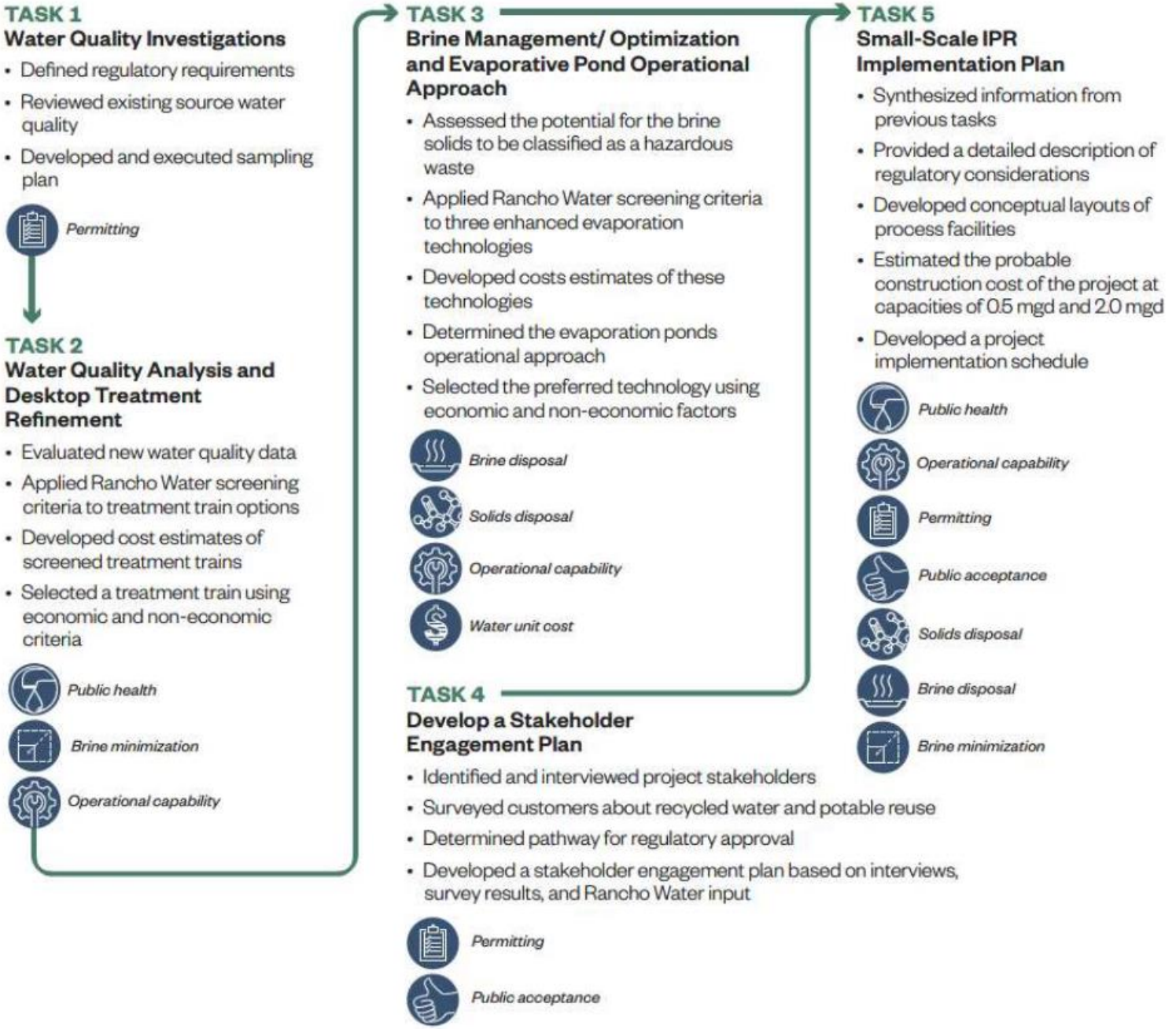
WHY IPR?

*Vision: "**innovative**, responsive, and prudent steward of the water and recycling service responsibility entrusted to us"*



Implementation Plan

Implementation Plan Tasks



Water Quality Risk Assessment

Indirect Potable Reuse Requirements

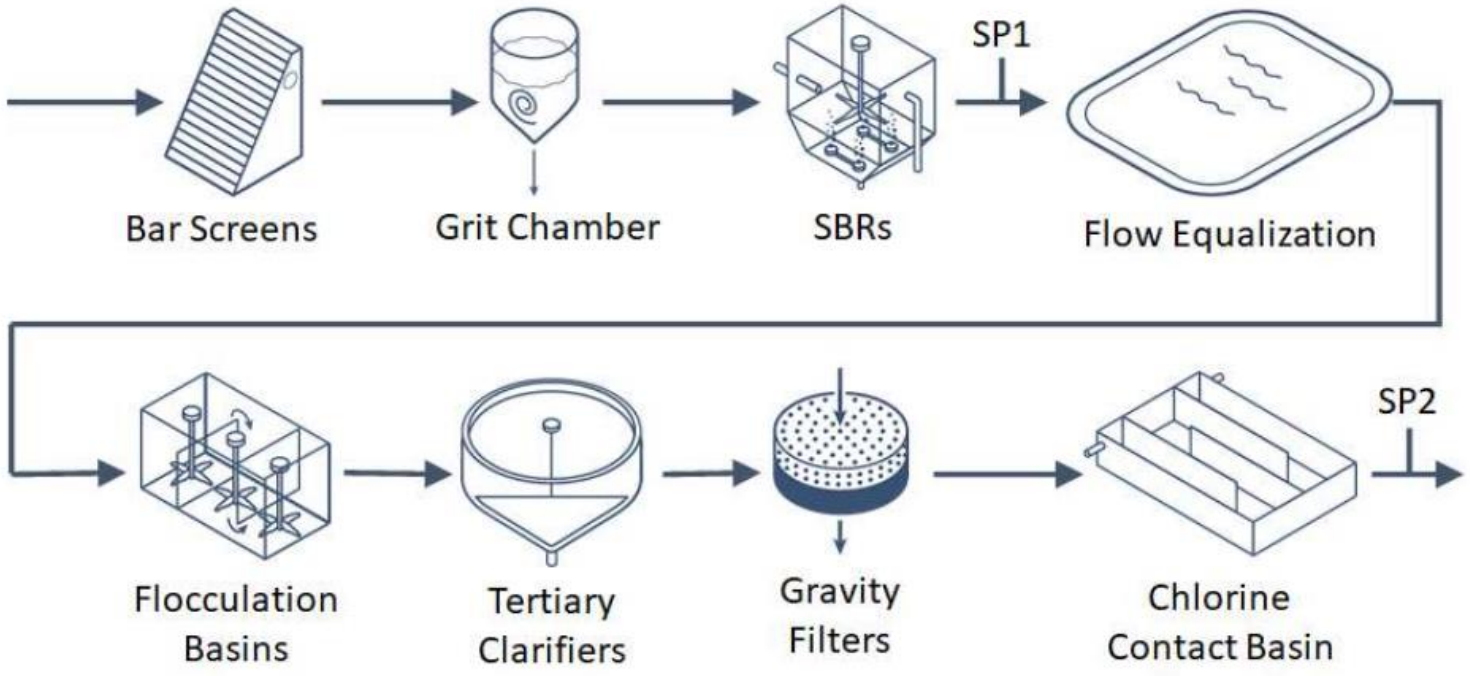
Area of Regulation	Requirement	Impact to Process Selection
General Requirements §60320.200	Water to be injected into the aquifer must meet California and USEPA drinking water standards.	Sufficient treatment must be provided to achieve drinking water standards.
	Injected water does not have an adverse impact that could mobilize or convey a contaminant already within the aquifer to the point of extraction (for example arsenic).	A treated water stabilization process is required.
Advanced Treatment Criteria §60320.201	RO and an oxidation treatment process must be used.	RO is required. UVAOP is required.
	RO must achieve a TOC level of < 0.25 mg/L for the first 20 weeks of operation and then 0.5 mg/L thereafter.	Guides selection of RO membranes and minimum rejection performance that must be maintained.
	Sufficient removal of 9 different families of organic chemicals, with one indicator selected from each group, must be demonstrated or, alternatively, a 0.5 log removal of 1,4 dioxane as an indicator compound is achieved.	Provides treatment targets for removal of 1,4 dioxane for UVAOP.
Pathogenic Microorganism Control §60320.208	Requires a minimum reduction of 12 logs of enteric virus, 10 logs of giardia cysts, and 10 logs of cryptosporidium oocysts. Three separate treatment processes are required with at least 1-log reduction each. Maximum of 6-log reduction for any single process. Underground retention time provides 1.0 log virus removal per month.	Provides log removal targets for the combination of AWTF and underground retention. A detailed review of log removal targets for the selected process is addressed in Section 3.2.2.

Groundwater Basin Plan Requirements

Parameter	Basin Plan Objectives	Units
Total Dissolved Solids	750	mg/L
Chloride	250	mg/L
Sulfate	250	mg/L
Percent Sodium	60	%
Total Nitrate	45	mg/L
Boron	0.75	mg/L
Iron	0.3	mg/L
Manganese	0.05	mg/L

Water Quality Risk Assessment

Santa Rosa Water Reclamation Facility



SRWRF Sample Locations

- **SP1 – Secondary Effluent**
- **SP2 – Recycled Water**

Sampled EMWD Recycled Water

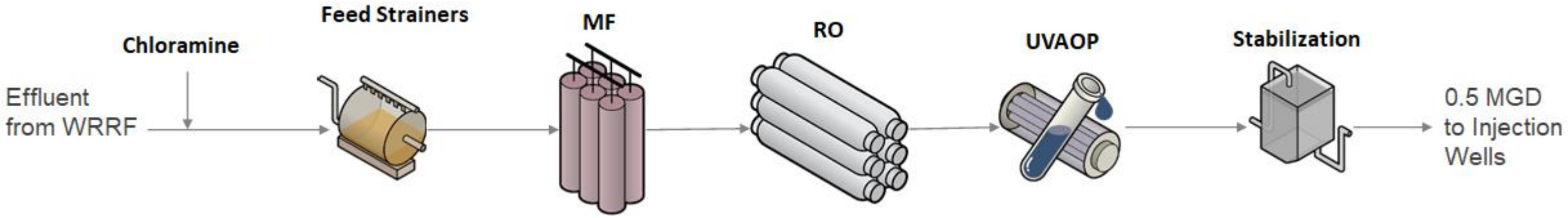
Sample Analyses

- **25 RO Design Parameters**
- **NDMA, 1,4 dioxane**
- **HAA5, PFOS/PFOA**
- **63 Parameters – brine pond**

All water quality goals can be met with advanced treatment proposed.
Attention on TTHM and HAA5.

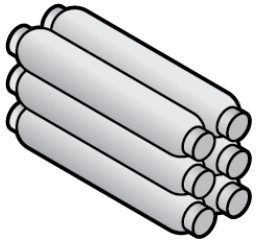
Treatment Options – Main AWT Backbone

Treatment Process	Purpose
Chloramine	Disinfecting agent for membranes.
MF	Pretreatment for RO and log reduction of crypto and giardia.
RO	Mandated by Title 22, provides removal of dissolved constituents.
UVAOP	Oxidation process mandated. Meets 1,4 dioxane removal.
Stabilization	Required to prevent mobilization of contaminants in groundwater.



Treatment Options – Main Process Selections

RO

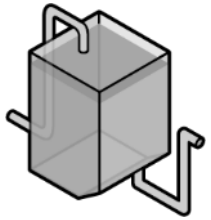


High Recovery Options

UVAOP

Oxidant Options

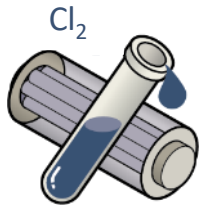
Product Water Stabilization

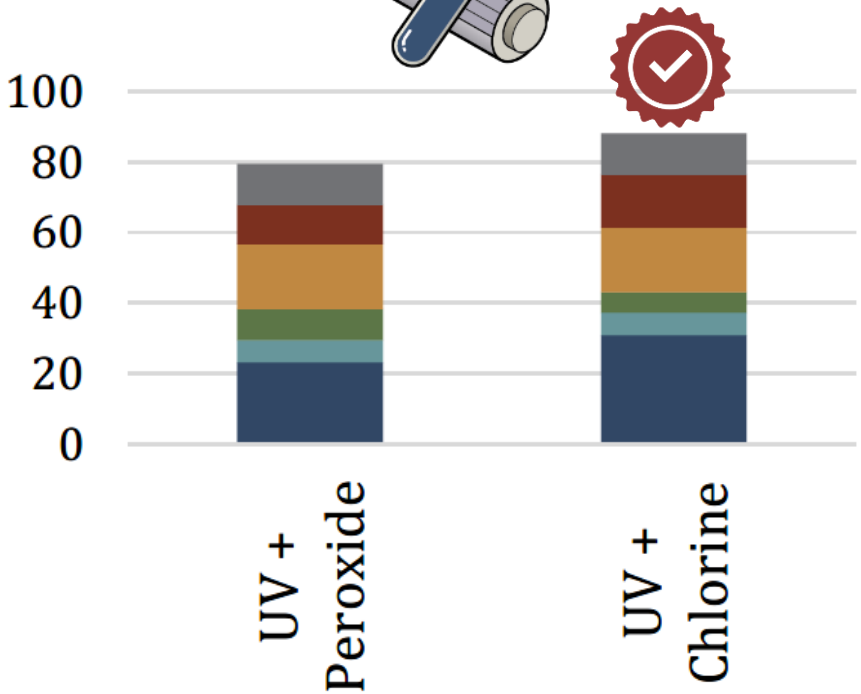


Stabilization Strategy

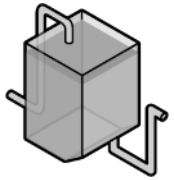
Process Selection

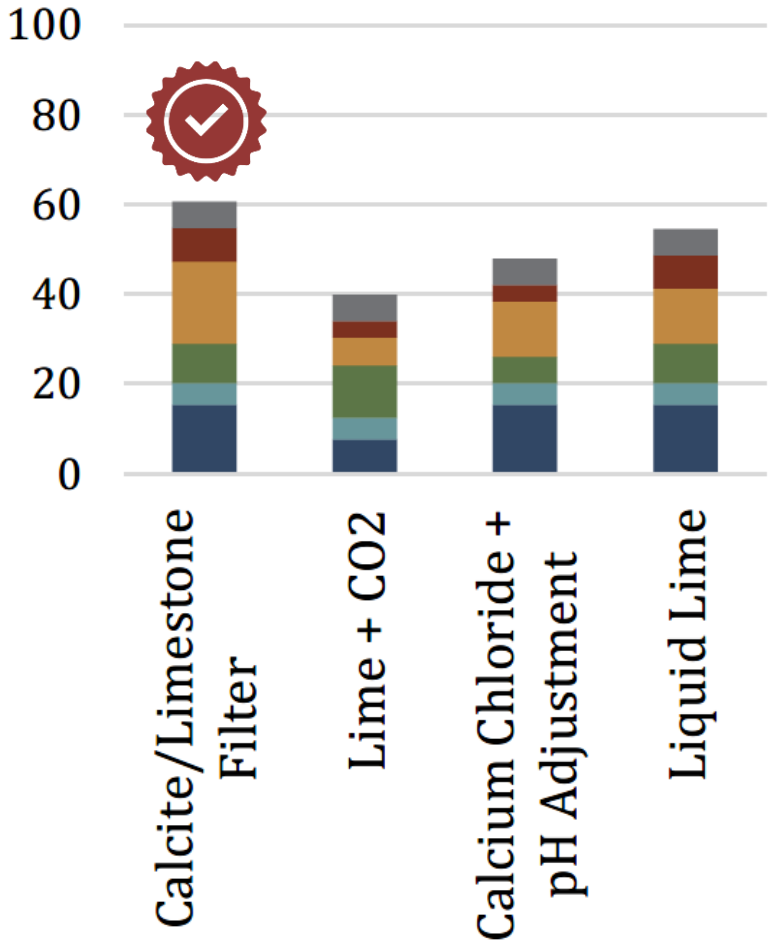
UVAOP





Stabilization



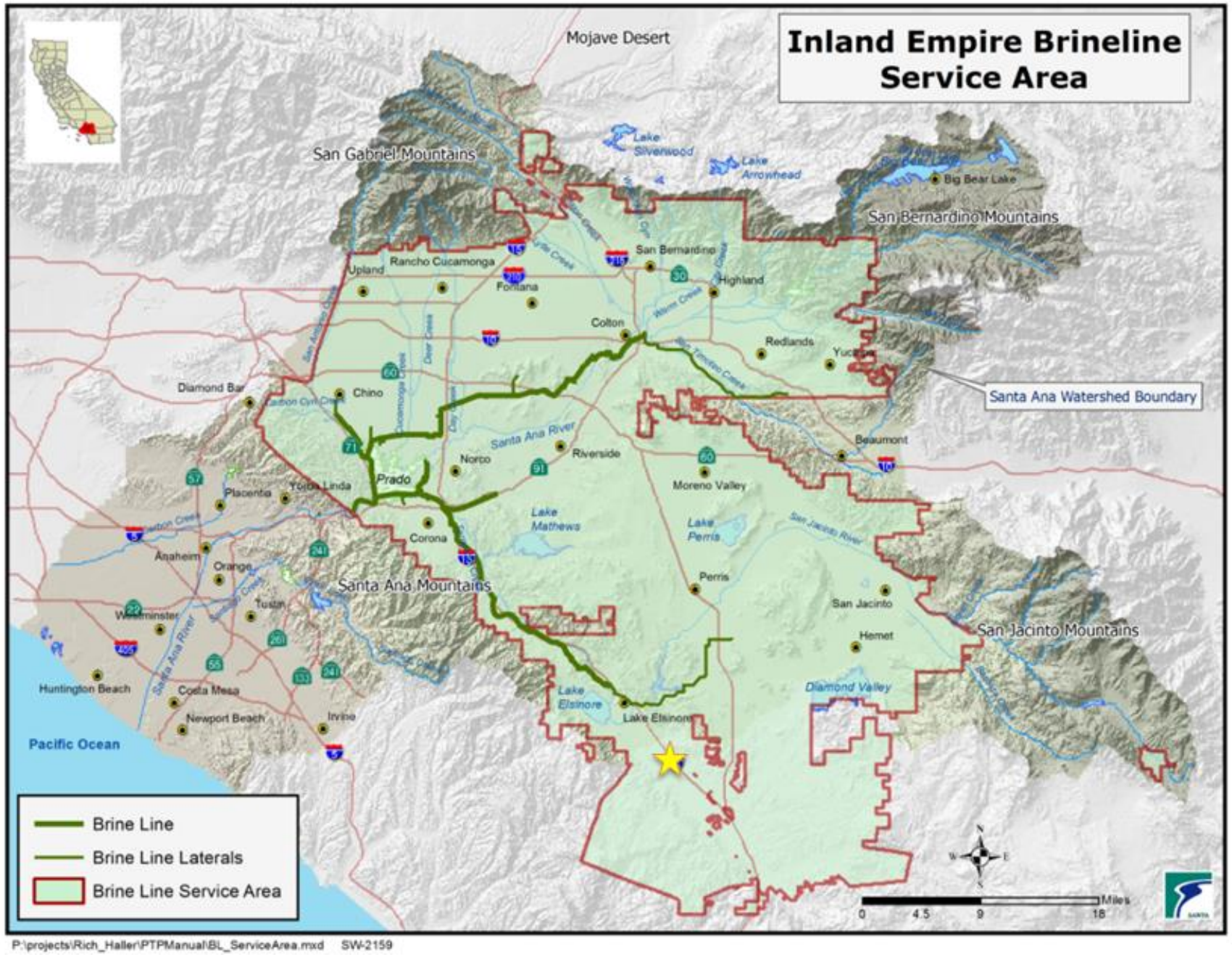


The Brine Challenge

No Convenient Brine Line

2013 study

- 4.5 MGD system
- Brine disposal through 15-mile pipeline
- Scope, costs and unknowns stopped the project

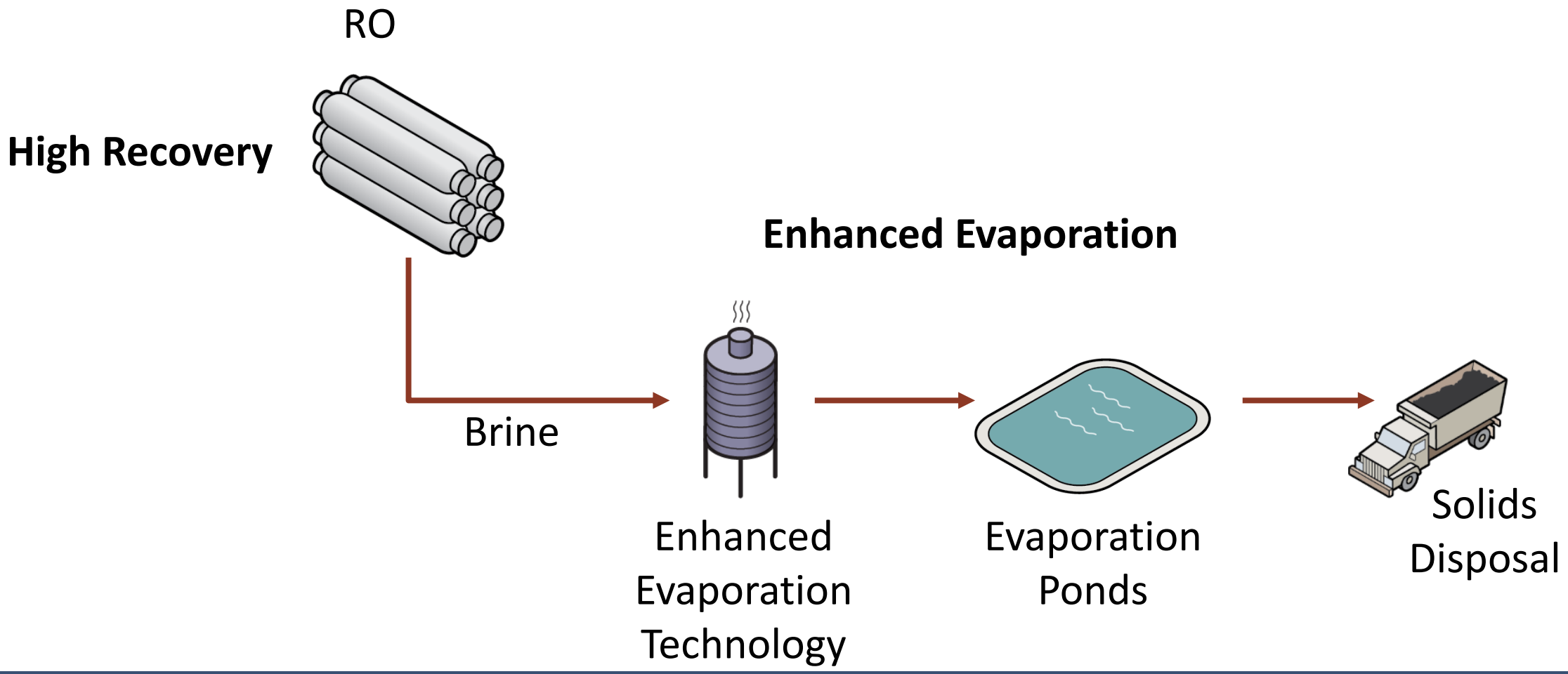


Evaporation Ponds

2018 study

- Considered evaporation ponds for RO brine disposal
- 20 acres required for 550 AFY (0.5 MGD) capacity

Minimizing Brine – Combined Approach



High Recovery RO – A World of Options

AdEdge Flow Reversal RO
Desalitech Closed-Circuit RO (CCRO)
IDE: MAX Pulse Flow RO
Controlled Scaling RO
Vibratory Shear Enhanced Process (V-SEP) RO

Short-list of
5 technologies

Saltworks Ultra High-Pressure RO (UHPRO) ✕
High Efficiency RO (HERO) ✕
Electrodialysis Reversal (EDR) ✕
Gradiant Osmotically Assisted RO (OARO) ✕
IDE MAXH2O Desalter ✕

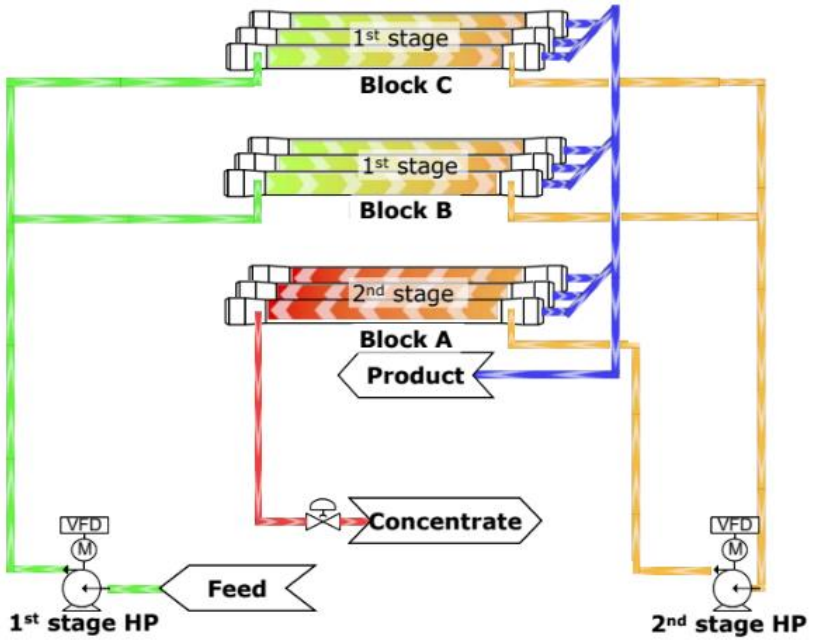
AdEdge/Rotec Flow Reversal RO

Concept

- Direction of flow periodically reversed to avoid scaling and achieve higher recovery

Benefits

- Does not require additional stages beyond that required for standard RO
- System control is similar to standard RO, but with more valves
- Up to 92-95% recovery



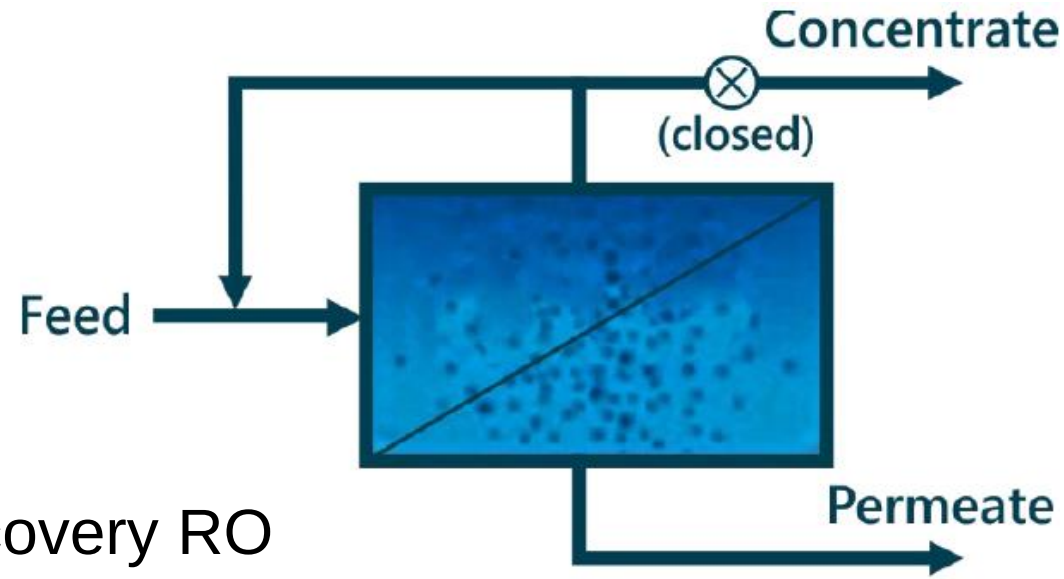
Desalitech – Closed Circuit RO (CCRO)

Concept

- Batch system that produces permeate continuously
- System flushed and refilled after reaching peak recovery

Benefits

- Achieves higher recovery than standard RO
- Better flux distribution and performance than standard RO
- More installations than other high-recovery technologies
- Tested in more IPR pilots than other high-recovery RO technologies
- Up to 92-95% recovery



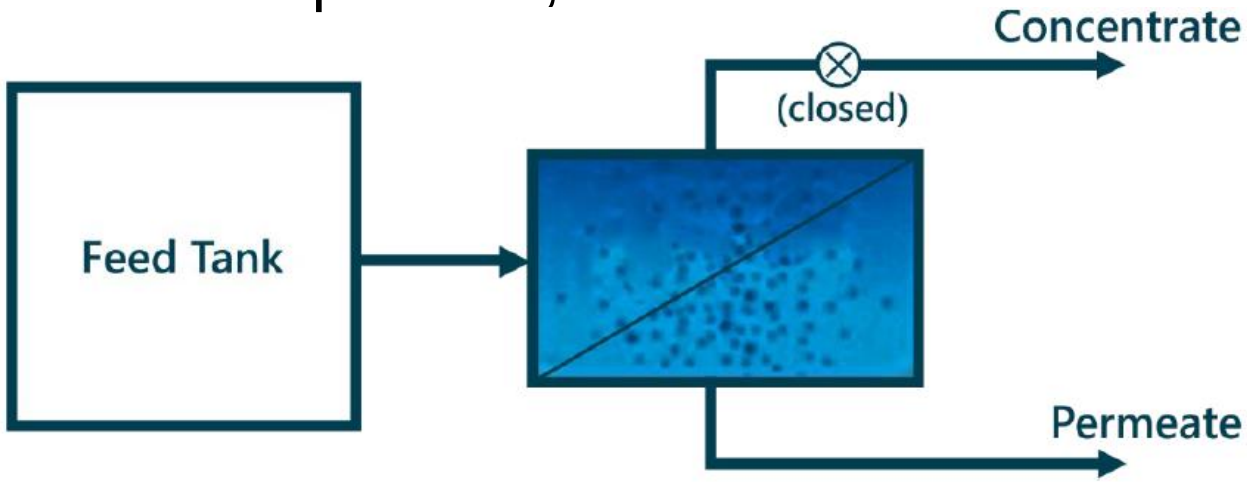
IDE MAXH2O Pulse Flow RO

Concept

- Batch system uses pulses of high pressure and cycles of concentrate flushing
- Concentrate is discharged prior to formation of scalants

Benefits

- Fouling and scaling controlled through pulse flow operation, not chemicals
- Pressure, not scaling, limits operation
- Some pilots have been used for reuse
- Up to 92-95% recovery



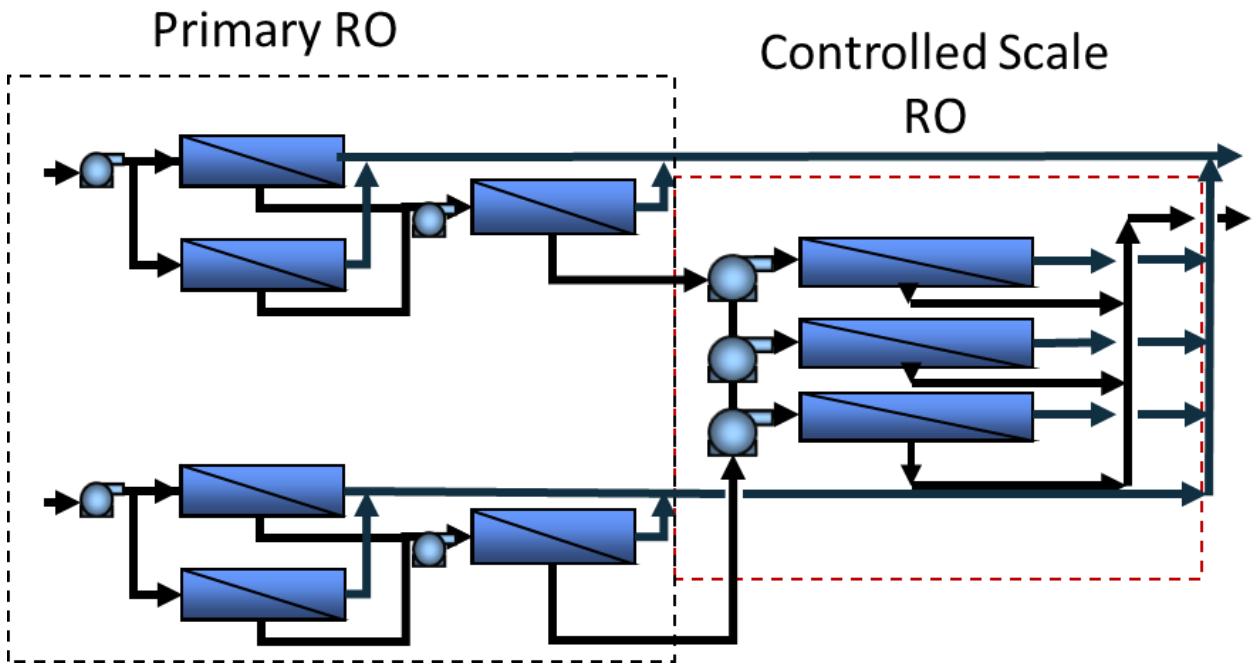
Controlled Scaling RO

Concept

- Third stage scaling is controlled by routine permeate flushing
- High cleaning frequency of third stage

Benefits

- Allows high recovery to be achieved
- Uses standard RO equipment
- Up to 92-95% recovery



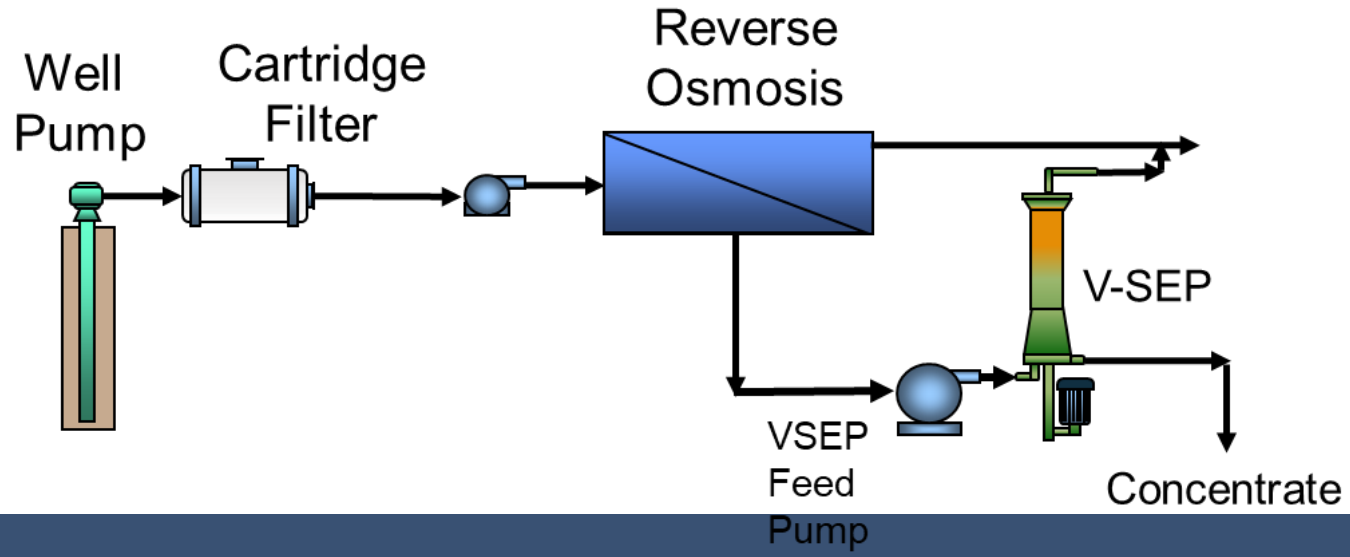
Vibratory Enhanced Shear (V-SEP) RO

Concept

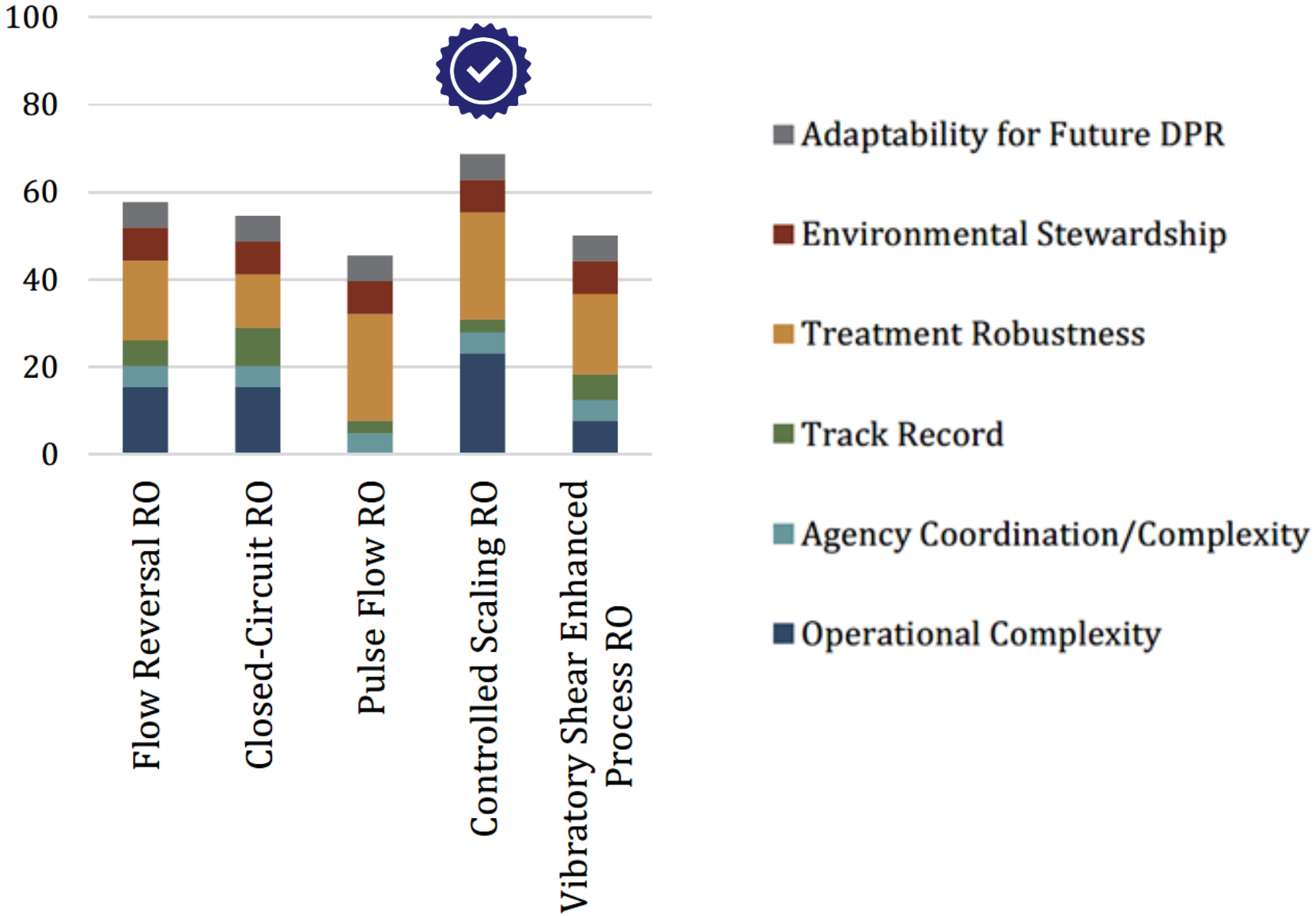
- Vibration to reduce boundary layer thickness
- Dislodges foulants and scalants

Benefits

- Less fouling and scaling, allowing for high recovery
- Allows precipitation to take place
- Up to 97% recovery



High Recovery RO Evaluation



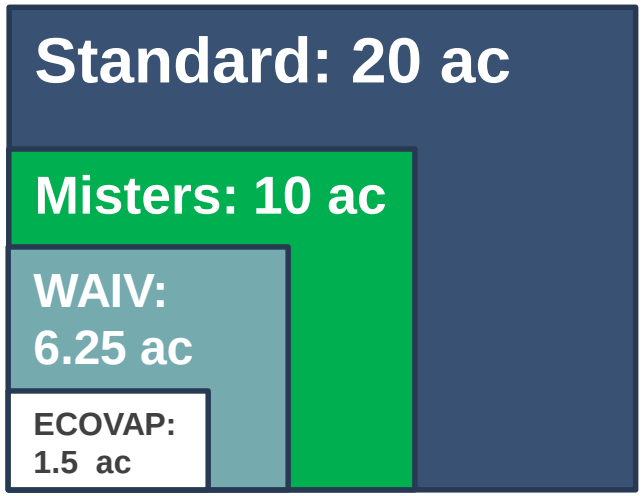
Enhanced Evaporation

Enhanced Evaporation Options

Misters
spraying water into the air to create droplets

Wind Aided Intensified Evaporation (WAIV) *– water flows down fabric exposed to wind*

ECOVAP
Water flows over structure with large surface area to volume ratio



Design basis for comparison

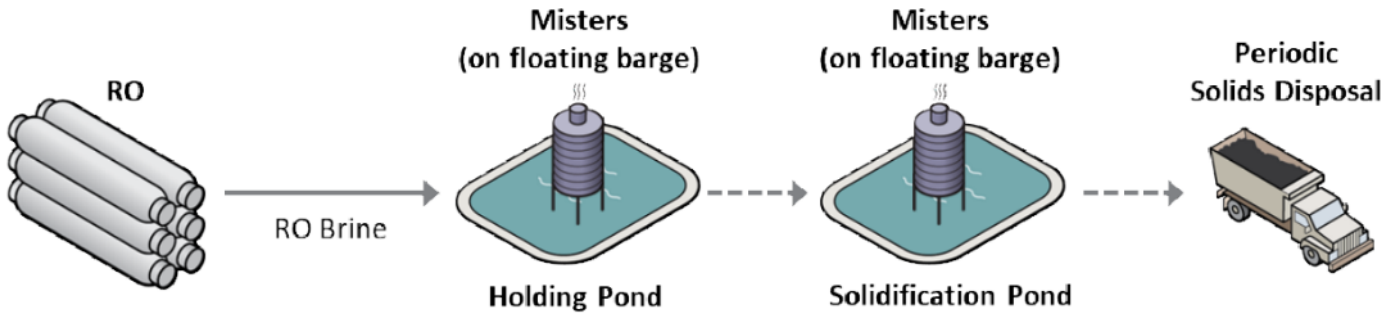
- RO at 90% recovery
- Temecula net evaporation rate
  - 56 in/yr (2.2 gpm/acre)

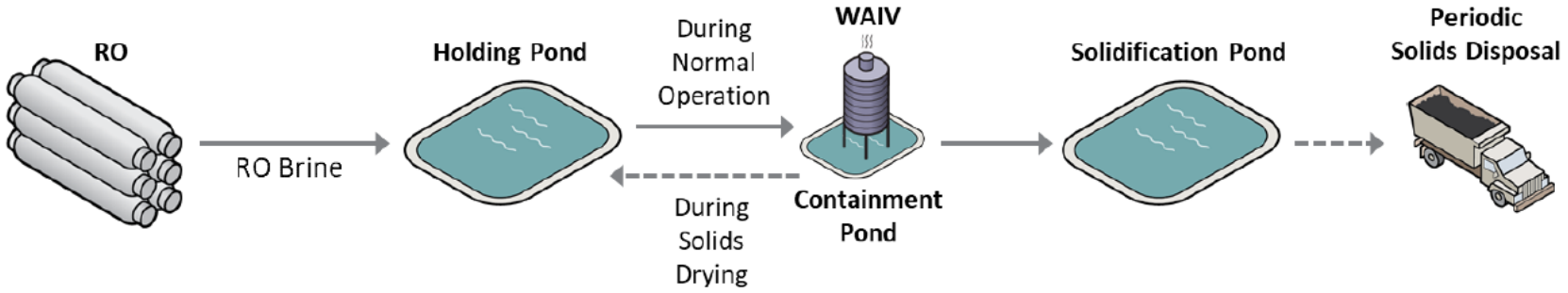
Enhanced Evaporation Options

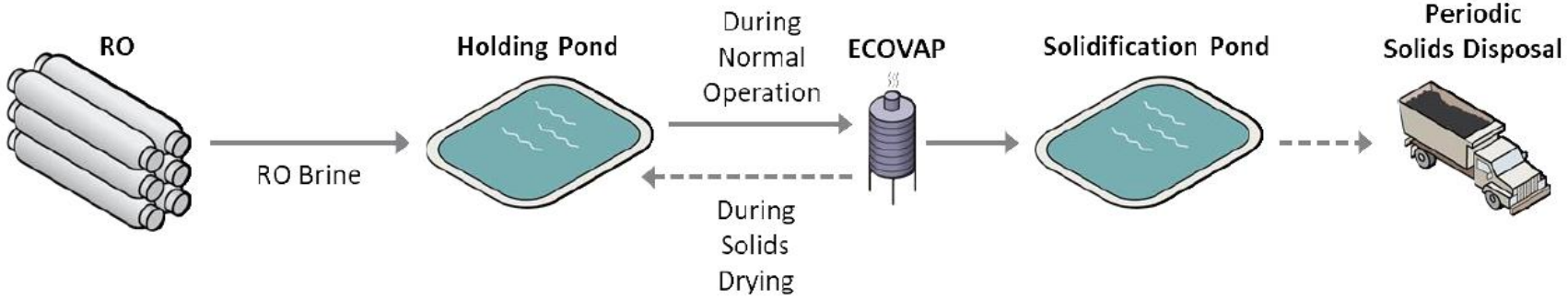
Misters

WAIV

ECOVAP





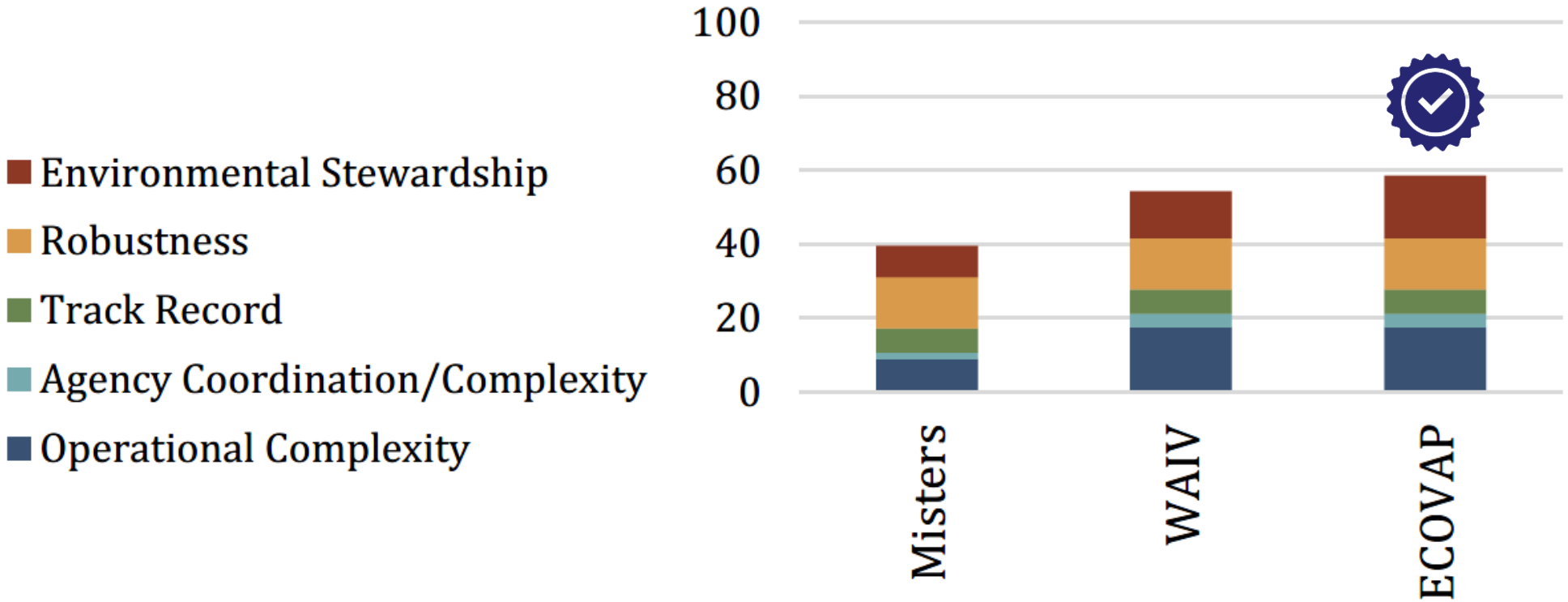


Enhanced Evaporation Options

Misters

WAIV

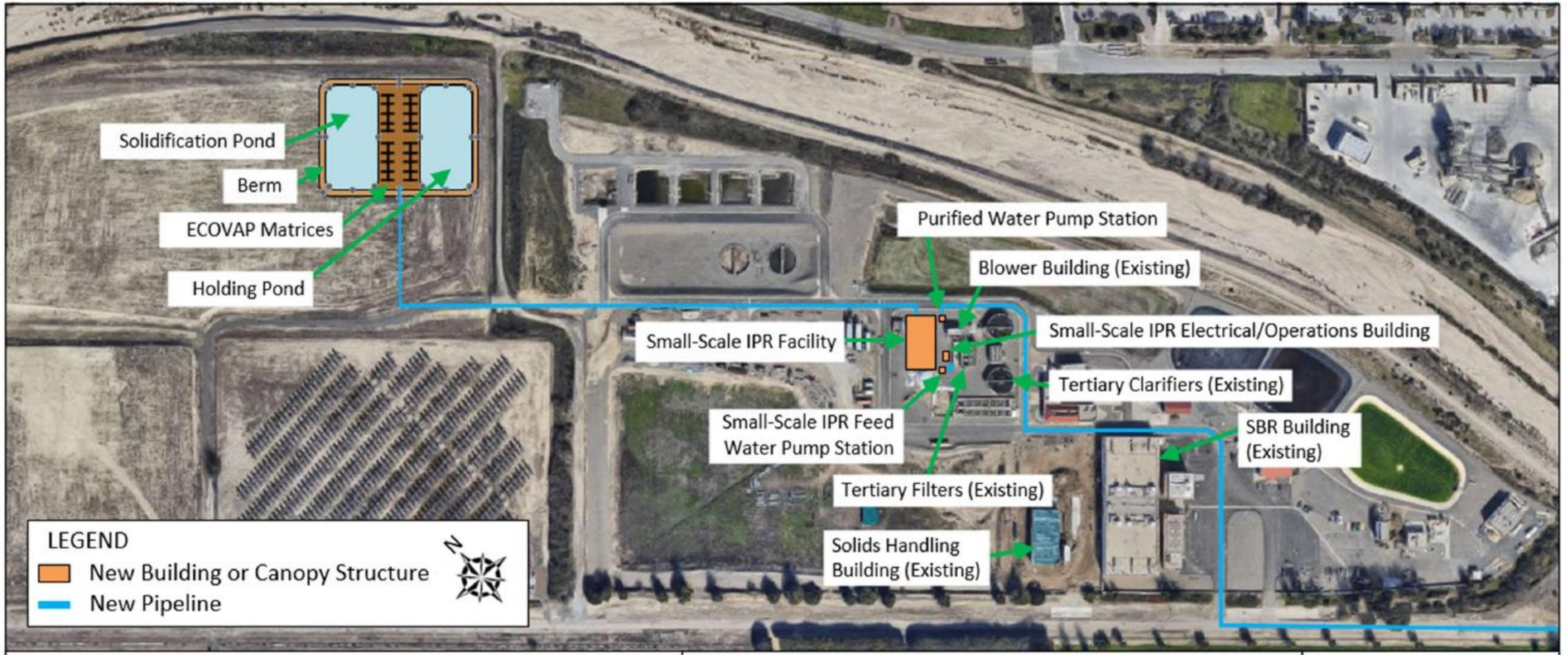
ECOVAP



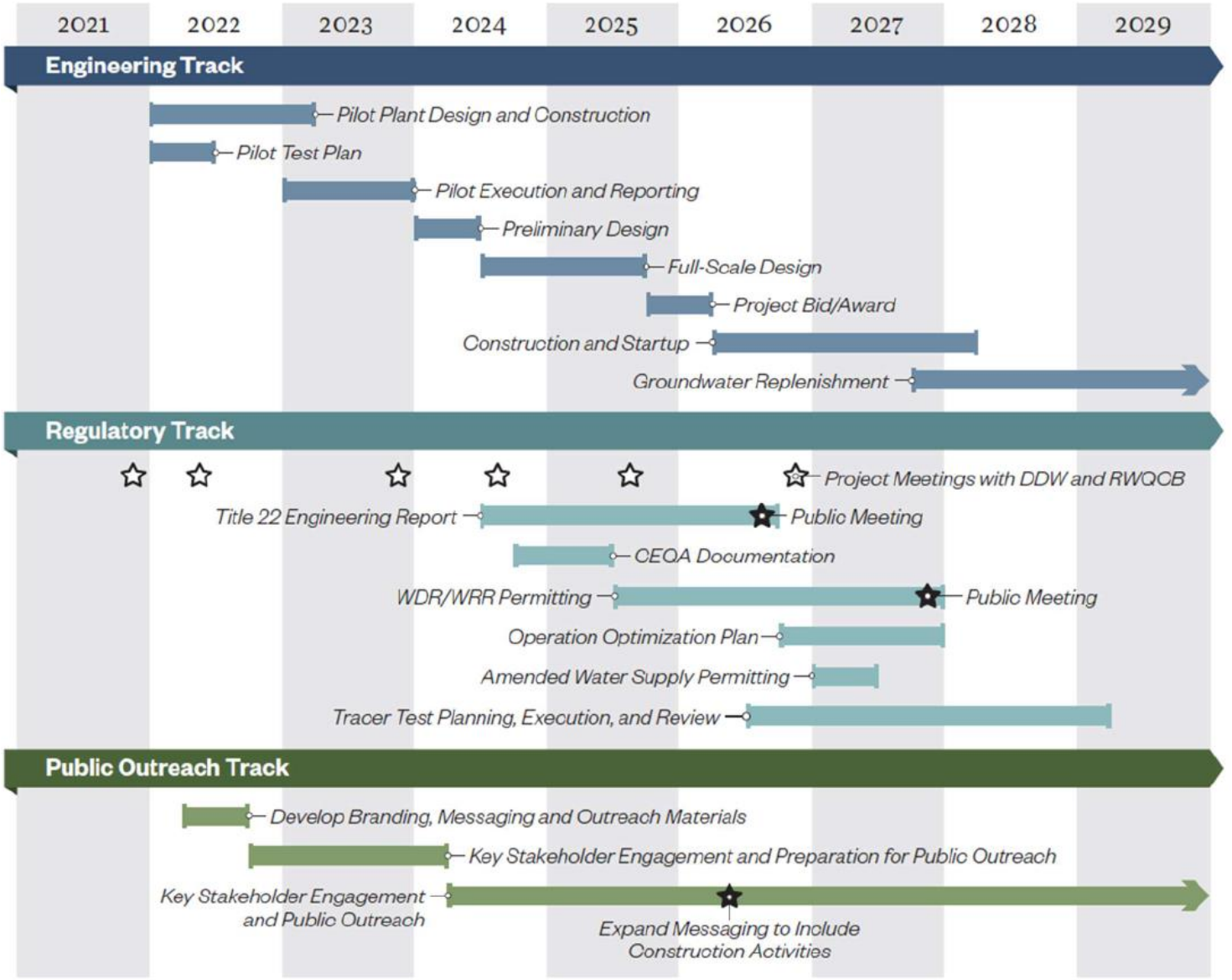
Cost Comparison of Enhanced Evaporation Options

Description	Probable Construction Cost	Probable Capital Cost	20-Year Net Present Value O&M	Total Life Cycle Cost
ECOVAP	$2,846,000	$3,614,000	$5,511,000	$9,125,000
Misters	$3,332,000	$4,231,000	$5,938,000	$10,169,000
WAIV	$4,067,000	$5,165,000	$6,079,000	$11,244,000

Future Site Plan



Next Steps


2021
2022
2023
2024
2025
2026
2027
2028
2029
Engineering Track
Pilot Plant Design and Construction
Pilot Test Plan
Pilot Execution and Reporting
Preliminary Design
Full-Scale Design
Project Bid/Award
Construction and Startup
Groundwater Replenishment
Regulatory Track
Project Meetings with DDW and RWQCB
Title 22 Engineering Report
Public Meeting
CEQA Documentation
WDR/WRR Permitting
Public Meeting
Operation Optimization Plan
Amended Water Supply Permitting
Tracer Test Planning, Execution, and Review
Public Outreach Track
Develop Branding, Messaging and Outreach Materials
Key Stakeholder Engagement and Preparation for Public Outreach
Key Stakeholder Engagement and Public Outreach
Expand Messaging to Include Construction Activities

Thank You!

Wendie Heie
Rancho California Water District
951-296-6985 (office)
heie2@ranchowater.com

Fred Gerringer, D.Env, PE, BCEE
Hazen and Sawyer
213-234-1083 (office) | 626-319-1107 (cell)
fgerringer@hazenandsawyer.com