Brown AND Caldwell

Prepared for 2018 Biennial Symposium on Managed Aquifer Recharge

Navigating Regulatory Hurdles for Recharge with Various Source Waters in California

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Opportunities – Big Picture

- New California groundwater management laws (SGMA)
  - Sustainability – stop ongoing overdraft (ex. 1.8M af/yr in San Joaquin Valley).
  - Direct credit for recharge
- Emphasis on greater use of recycled water (2M af by 2030)
- New reuse policy and regulations
- Ag MAR - percolation and Ag-ASR
- Funding and financing opportunities

Groundwater Reuse Replenishment Regulations (GRRR) for Indirect Potable Reuse (IPR)

- Surface Spreading
  - Minimum of tertiary treatment
  - TOC Requirement at production wellhead
  - Meet all regulated contaminant limits at production wellhead
  - Meet Basin Plan objectives
- Injection
  - Full Advanced Treatment (FAT)
- Both
  - 12 log, 3 barriers pathogen reduction
  - Min. underground retention times

GRRR Submittals

SURFACE APPLICATION	SUBSURFACE APPLICATION (INJECTION) DIFFERENCES
Planning • Site investigation • Underground retention targets (6 months+) • Dilution water 80% of total; less with advanced treatment	• Full advanced treatment, testing, performance monitoring • Indicator study, oxidation testing, continuous monitoring • Likely lower underground retention time (2 months, with adjustment) • Likely no or less dilution water needed
Engineering Report • 7 major technical sections	
Other Requirements Prior to Operation • 6 reports • Design and performance proofs • 3+ monitoring wells	
Detailed Notice and Public Hearing • Well owners within 10 years Darcy travel time	
Operation Optimization Plan • 4 reports • High frequency monitoring for TOC and N • Quarterly and annual monitoring for extremely broad range of constituents • Annual report	
General • Requirements for maintenance, records, design, alarms, etc.	

IPR Compliance Risks

Engineering Report

- Methods of compliance are open-ended ("including any other features specified by the Regulatory Agency").
- Contingent point-of-use treatment may be discouraged.
- Regulations ignore flat gradients.
- The implementation pathway for monitoring wells, engineering report, and study results approvals is iterative, not linear.

Operation

- Rapid response required and possible shutdown for exceedances
- Tracer study travel time defined at 10% of peak concentration – could change retention and control boundaries after startup

Fresno Groundwater Recharge History

Leaky Acres (Surface Water)

- Recharge with surface water
- 225 acres

Securing Our Water Future

Secondary Effluent Percolation & Recovery

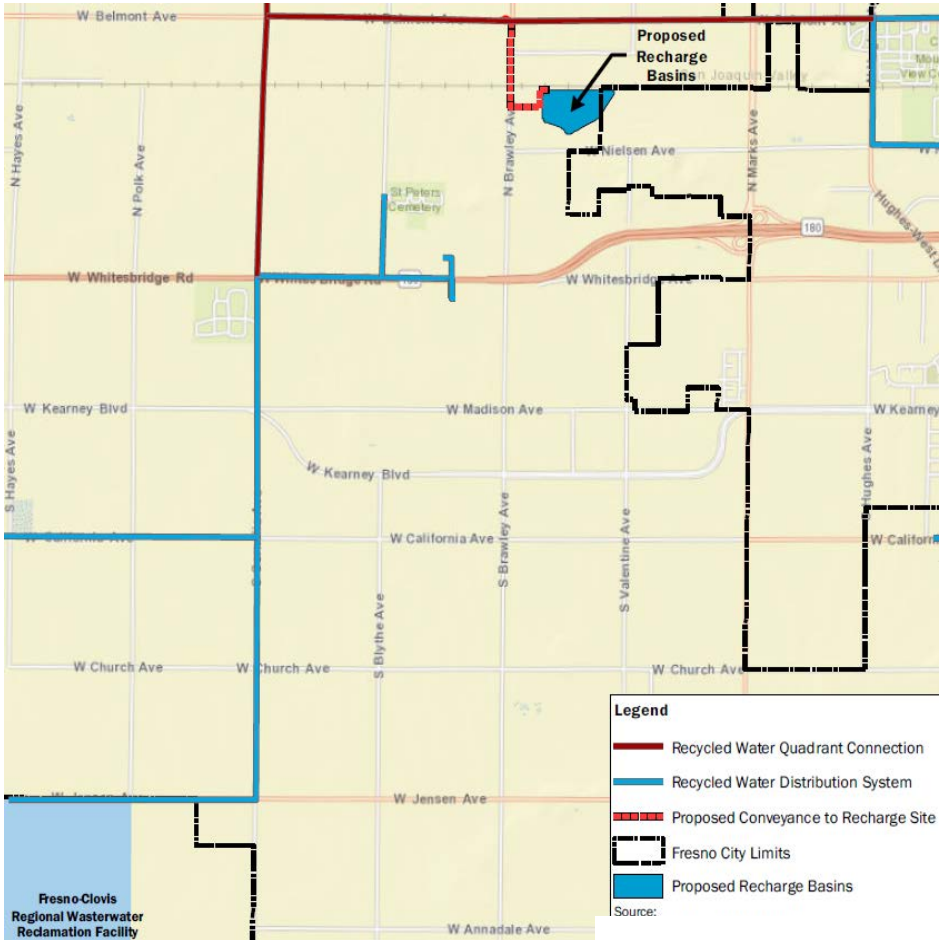
- Water recovered for ag use
- No detectable viruses in recovered water

Potential Opportunities with New Tertiary Effluent

- Landscape irrigation
- Groundwater recharge

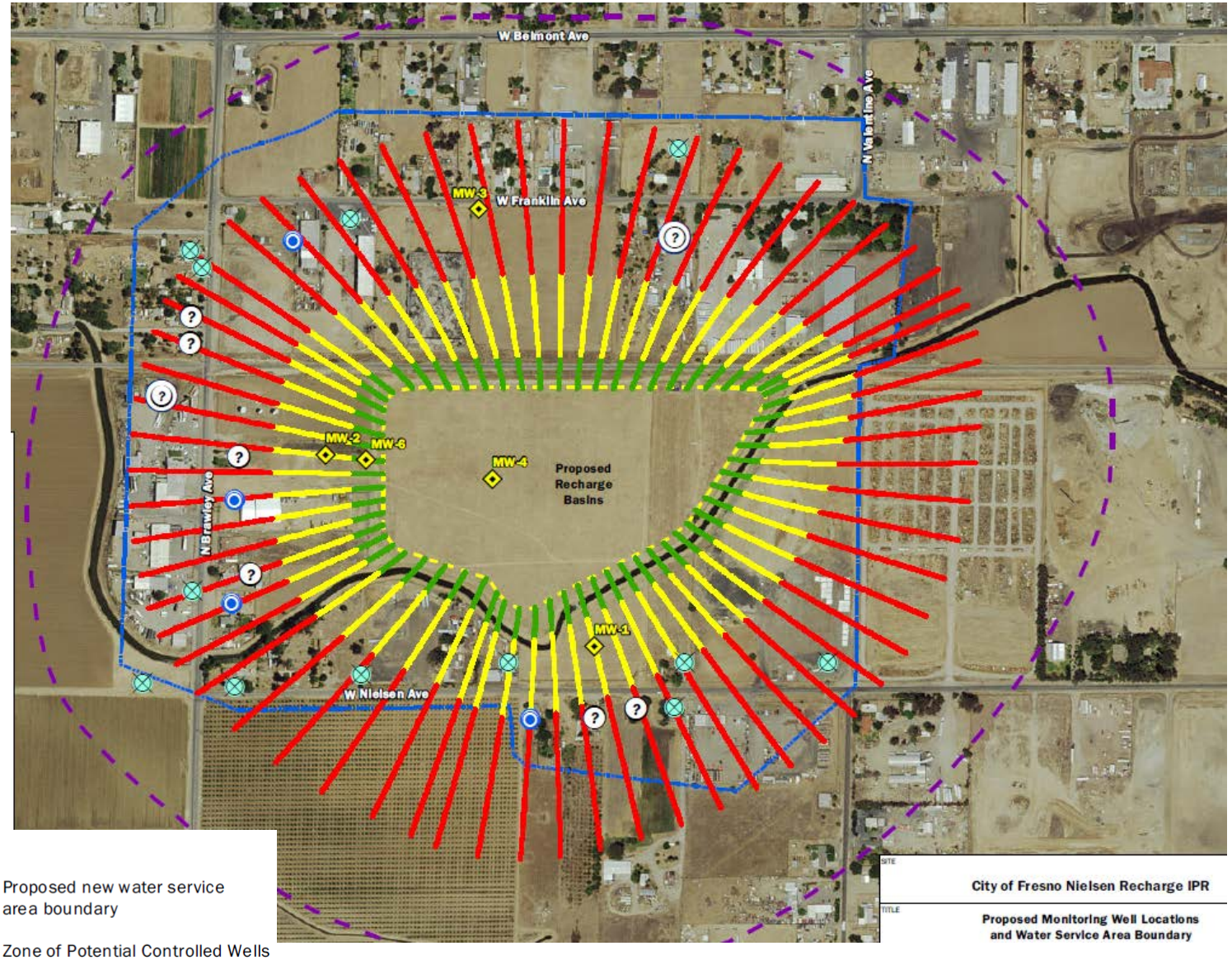
IPR Opportunity – Nielsen Site

- Designed for surface water percolation
- Irrigation district canal at site (diluent water)
- Easy access to recycled water
- Cool months excess capacity
- 400 af recycled water
- 1600 af surface water



Should be ideal, right??

Travel Time and Zone of Controlled Wells



Challenges and Lessons

Regulatory Challenges

- DDW requested everything vs. just the listed Engineering Report items
- Extension of municipal water supply to area required as contingency (~$3M)
- Flat groundwater gradient
- Getting credit for vadose zone treatment
- Many nearby domestic wells
- Monitoring, monitoring, monitoring…
- Reports, reports, reports…..

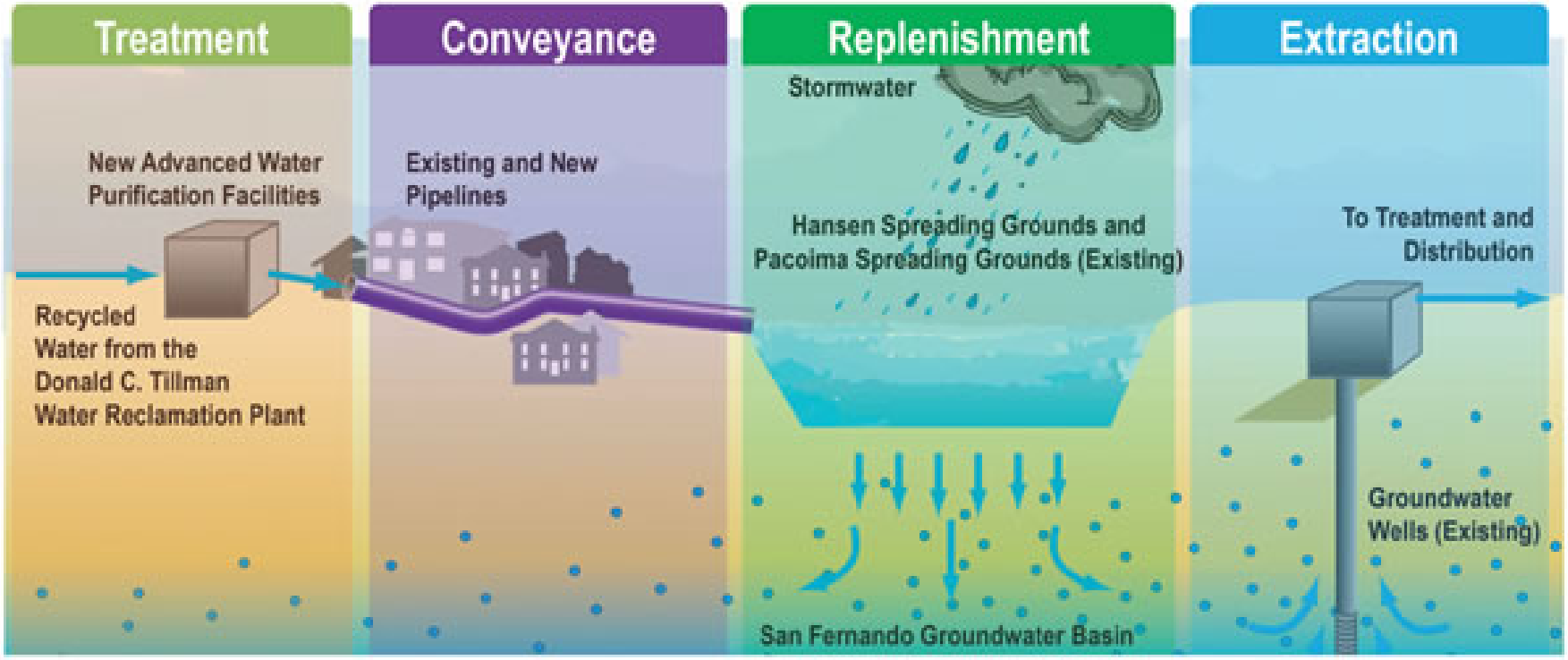
Lessons

- Inadequate scale for overhead and ancillary costs burden
- At ~ $10,000 capital cost per af/yr capacity, not cost competitive with water supply alternatives

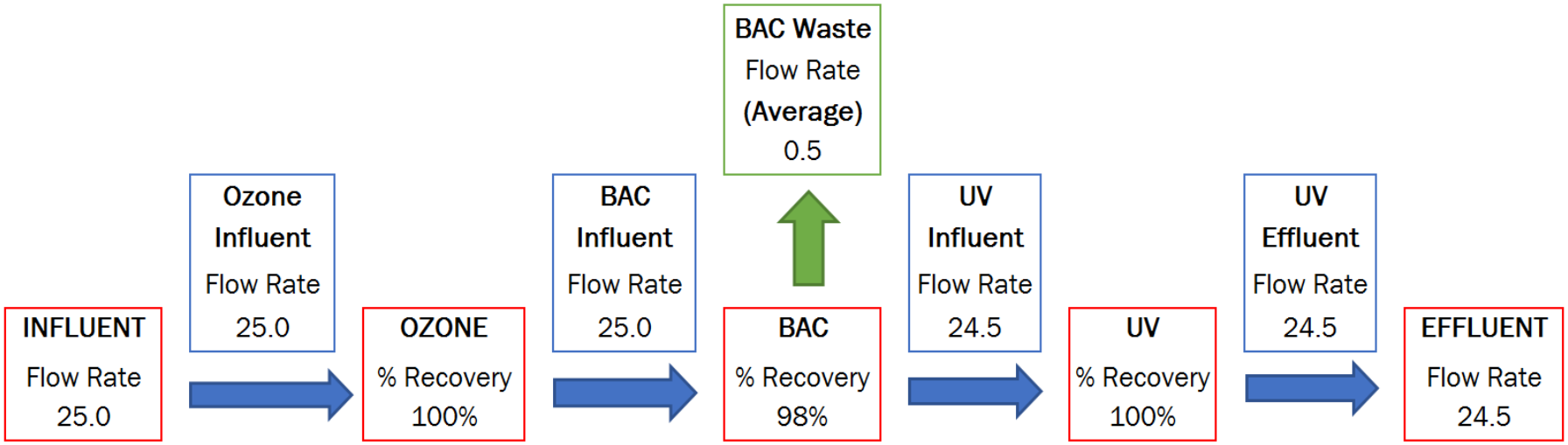
RECHARGE FRESNO
Securing Our Water Future

LADWP Groundwater Replenishment Project

- IPR project developed by the Los Angeles Department of Water and Power (LADWP) with the Los Angeles Bureau of Sanitation
- Up to 30,000 acre-feet per year to replenish the San Fernando Groundwater Basin
- Builds on history at Montebello Forebay (50 mgd), Chino (11 mgd), Orange County (100 mgd)



Recommended Process Train



- Higher recovery and production of purified water (24.5 mgd versus 16.8 mgd with reverse osmosis)
- Lower energy consumption
- Reduced waste (no brine)
- Lower capital and operating expenses
- Est. capital cost $15,000 per af/yr capacity
- Est. total cost $1,000 per af produced

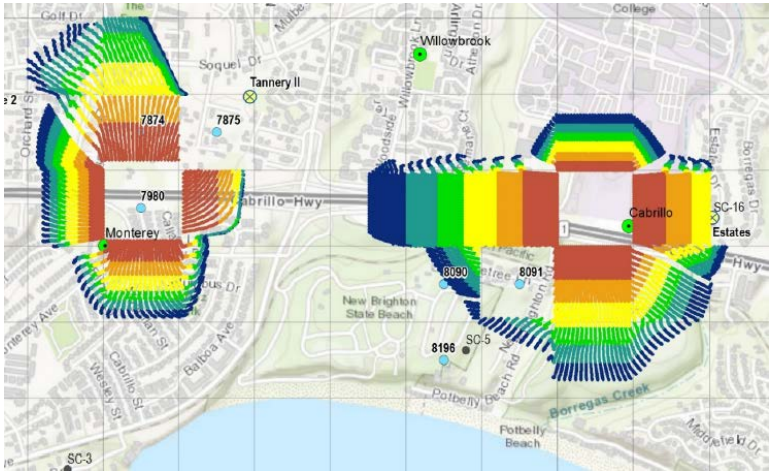
Pathways to Meet GRRR for LADWP

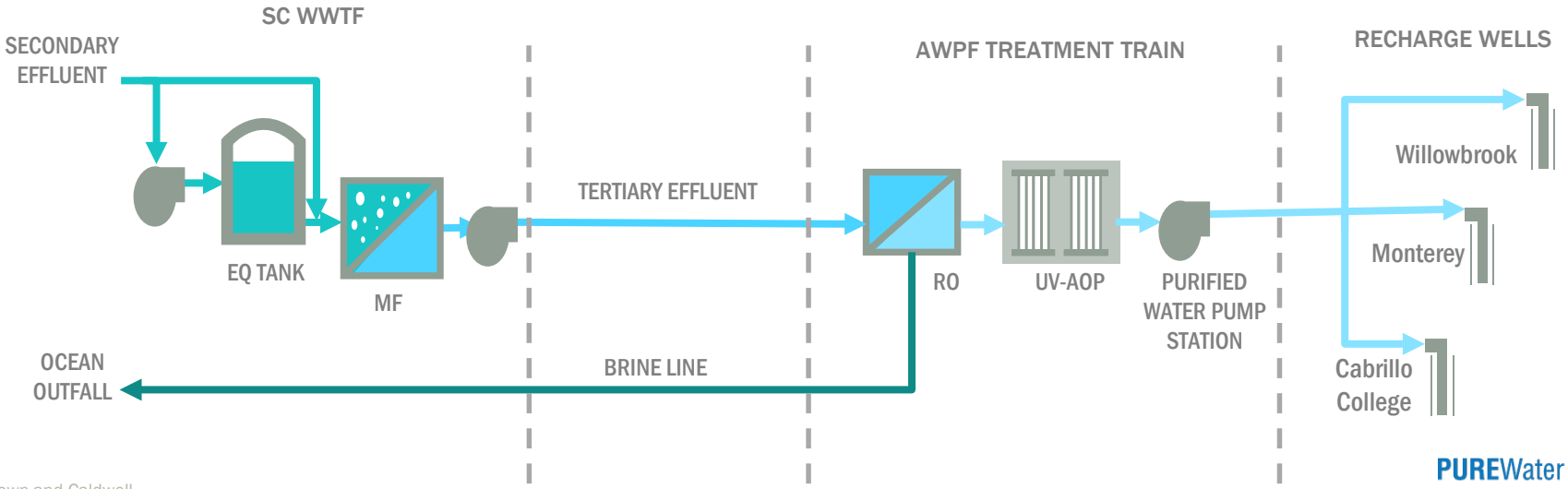
- ~~Limiting recycled water contribution %~~
- ~~FAT~~
- ~~Dilution using side stream treatment~~
- Regulatory framework for Total Organic Carbon alternative
  - Use BDOC and other constituents instead of TOC
  - Contaminants of Emerging Concern protective of public health via MCLs
  - Show removal of bulk organic matter of wastewater origin
  - Bioassays
  - Use Technical Advisory Committee, engage regulators on pilot testing

Soquel Creek – Pure Water Soquel IPR

Uses Full Advanced Treatment

- For Seawater Intrusion Barrier and Groundwater Replenishment
- No dilution requirement
- Brine not a problem
- Easier GRRR compliance
- Public acceptance critical





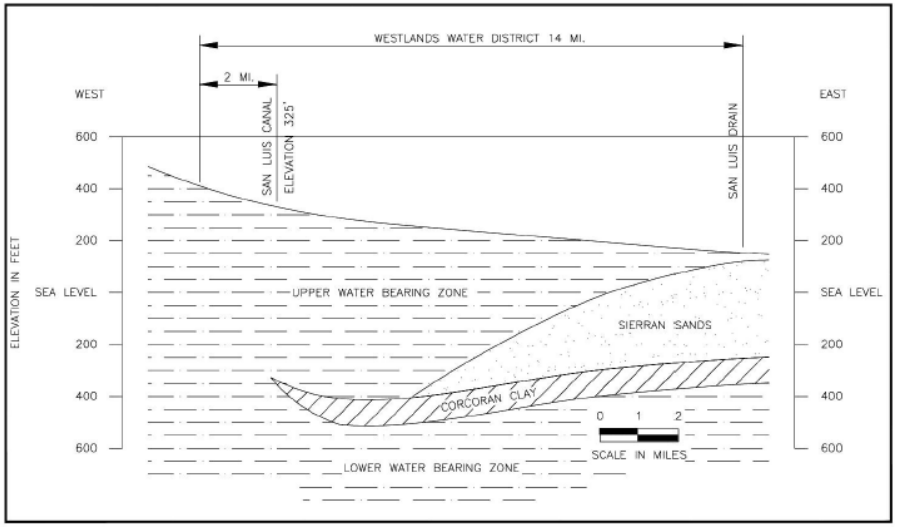
Regulatory Considerations and Hurdles

- Conditioning injectate to prevent mobilization of trace metals
- Insuring adequate groundwater travel time to nearby wells
- Producing required reports
  - Antidegradation Evaluation in-lieu of Salt Nutrient Management Plan (SNMP)
  - Environmental Impact Report (EIR)
  - Engineering Report
  - Other reports required under GRRR
- Generating/maintaining public project support
- Project Cost $60M - $70M (~$40,000 per af/yr capacity); ~$3,000/af of supplemental water supply for 20 years

Westlands Ag-ASR Pilot Study

Westlands Water District

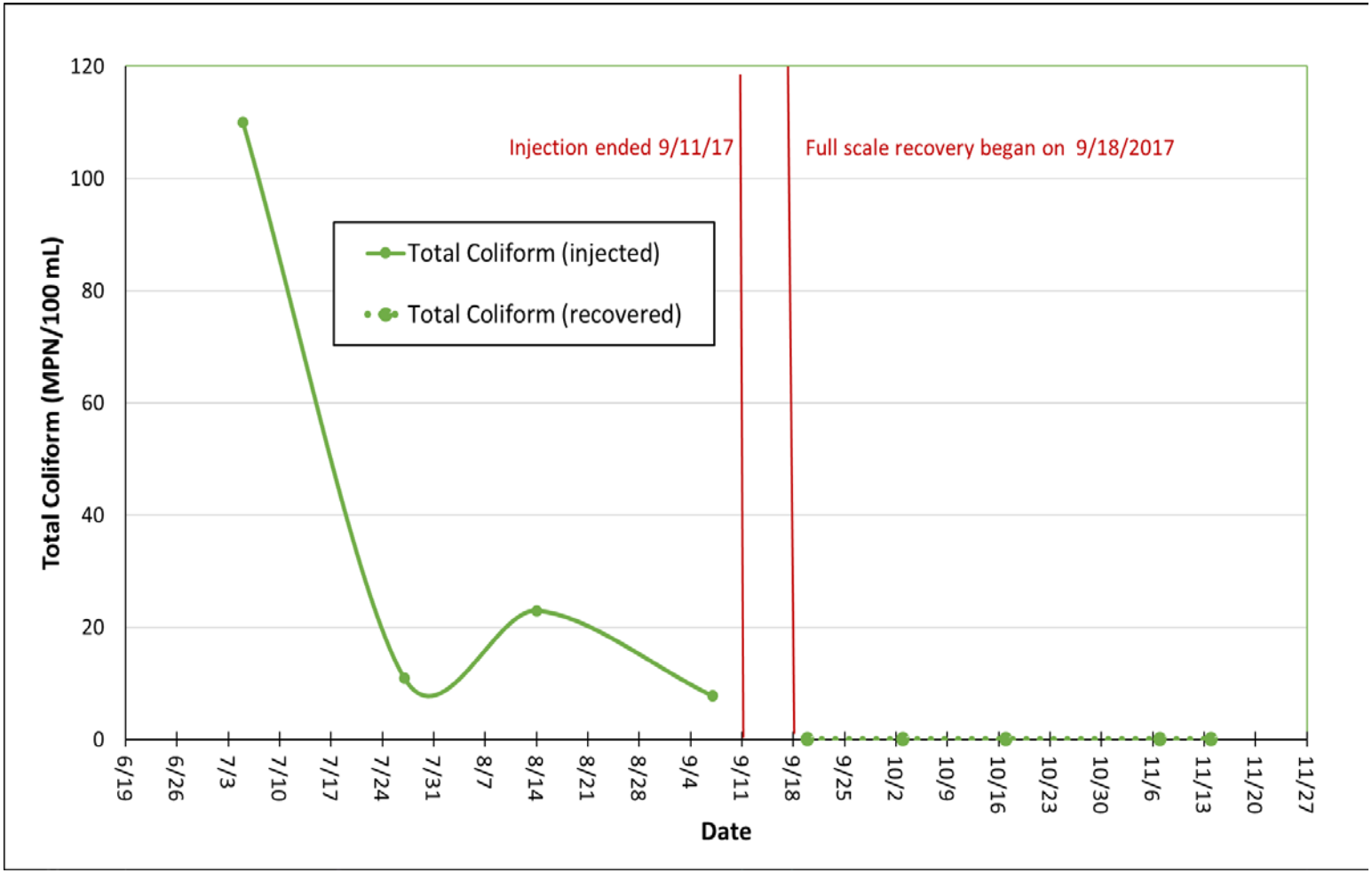
- Surface water sources; ag sand media filtration
- Occasional chlorination before backflushing
- ~ 500 gpm injection rate for 12 weeks (180 af)
- ~ 1200 gpm recovery rate weekdays for 8 weeks (180 af)
- Class V EPA permit with Regional Board and DDW approval
- Water quality and bio-indicators measured in and out



Particle Trace Model

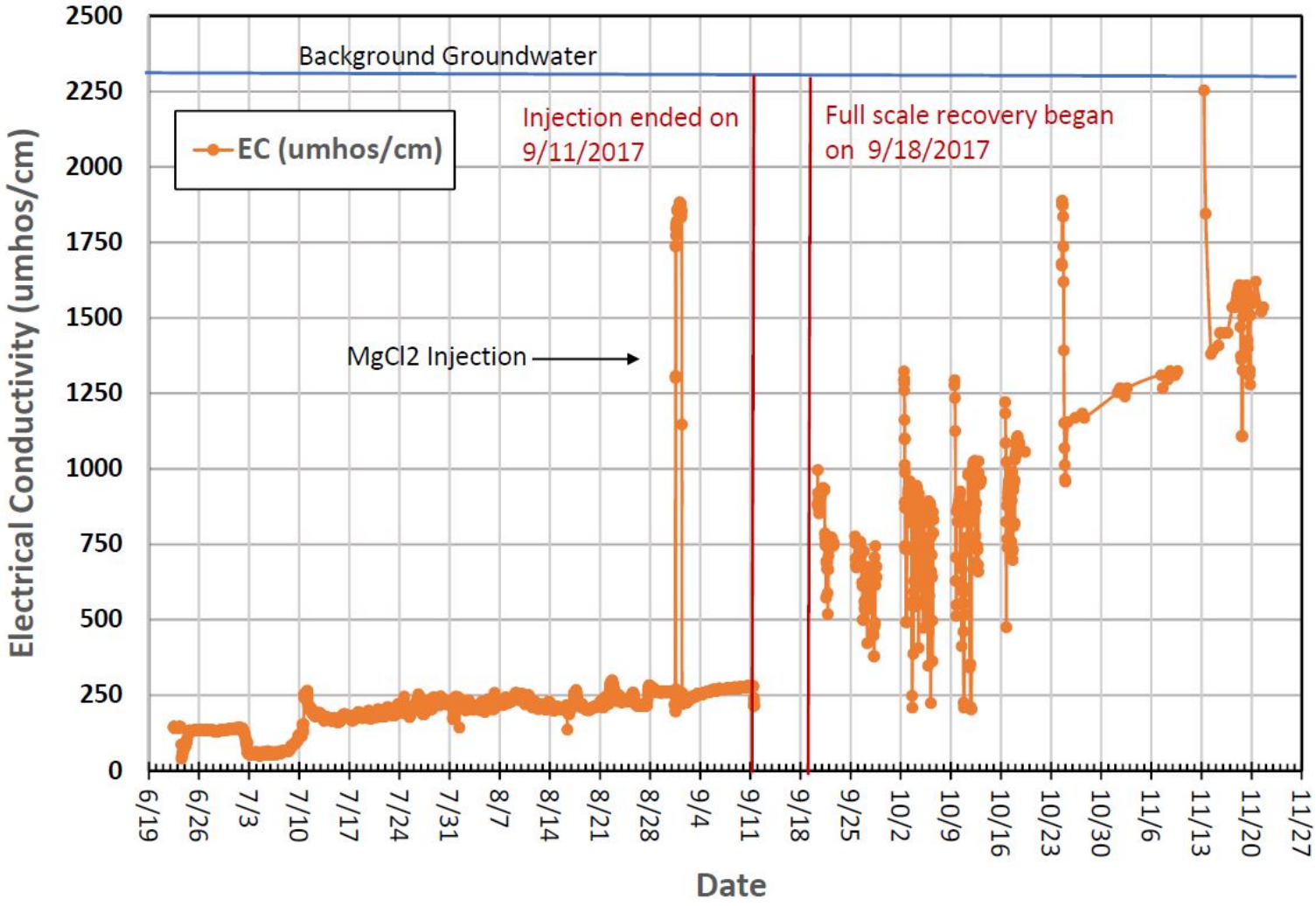
Addressing regulatory concerns about recapture and travel time to private wells

Coliform Injected and Recovered



No bio-indicators in water after first day of recovery pumping

Water Quality Results - Conductivity



Westlands Pilot Ag-ASR Water Quality Results

- Using sulfate and EC as intrinsic parameters, ~ 60% of the injected water was recovered.
- Recovered water was much higher quality than background.
- Mobilization of trace metals was not problematic.
- No disinfection byproduct issues with intermittent chlorination and backflush recovery.
- Results indicate low risk for pathogenic microbes migration.

Westlands Regulatory Issues

Westlands Water District

- Pursuing a District-wide programmatic approach for additional wells
- Regional Water Board reviewing water quality results and considering policy
- Separation to domestic wells and monitoring likely to be key issues
- Regulatory restrictions currently forcing “big gulp” approach to water supply for CVP contractors

Conclusions - Elements for Success

- Work with regulators beginning early in the process.
- Pilot tests help provide a level of assurance for regulators.
- Large scale projects and/or high water cost areas can better handle the high overhead compliance costs with recycled water.
- Avoid projects in areas with a high density of private domestic wells.
- Try to negotiate point-of-use contingency treatment up front.
- Advanced treatment can lessen the regulatory burden for recycled water.

Questions?

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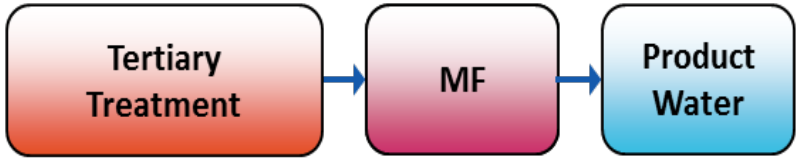
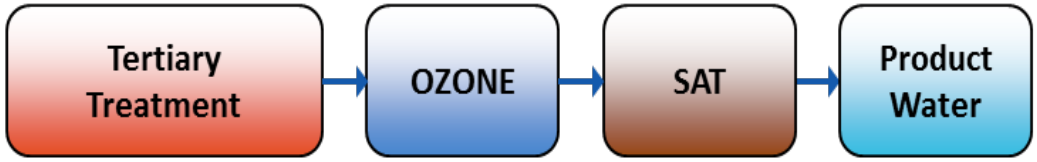
Pilot Testing Alternative Treatment Trains to Reduce Costs and Increase Recovery (vs. FAT)

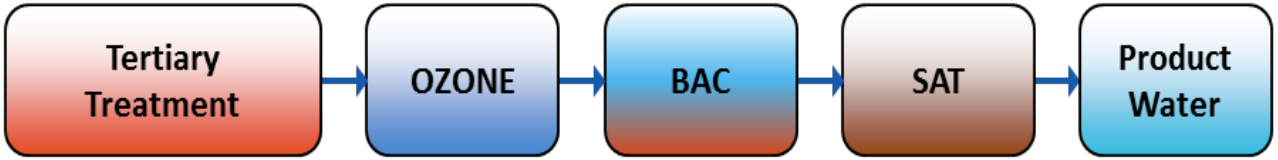
Treatment train 0 (MF prequalification)



Treatment train 1



Treatment train 2



Treatment train 3