

BACWA Nutrient Reduction Study:

City of Benicia WWTP



Nutrient Reduction and Water Reuse

Presentation to BACWA Board

June 17, 2016

Dan Jackson, Water Quality Supervisor, City of Benicia

Benicia

Historic city with 28,000 residents

Water treatment plant

Valero Benicia Refinery

Valero Benicia Refinery

2 MGD to Carquinez Strait

Wastewater treatment plant



Benicia WWTP

- Design flow of 4.5 MGD
- Secondary treatment:
 - Activated sludge system during dry weather
 - RBC secondary treatment to treat wet weather flows
- Anaerobic digester dewatering filtrate
- Ammonia in effluent typically 20 – 30 mg-N/L

Nutrient Reduction Study

Optimization and Sidestream Treatment

- Optimization
 - Nitrogen: cost exceeds optimization
 - Phosphorus: Ferric addition
- Sidestream Treatment
 - 11% Total N reduction at cost of \$3.3M
 - \$6.50 per pound of N

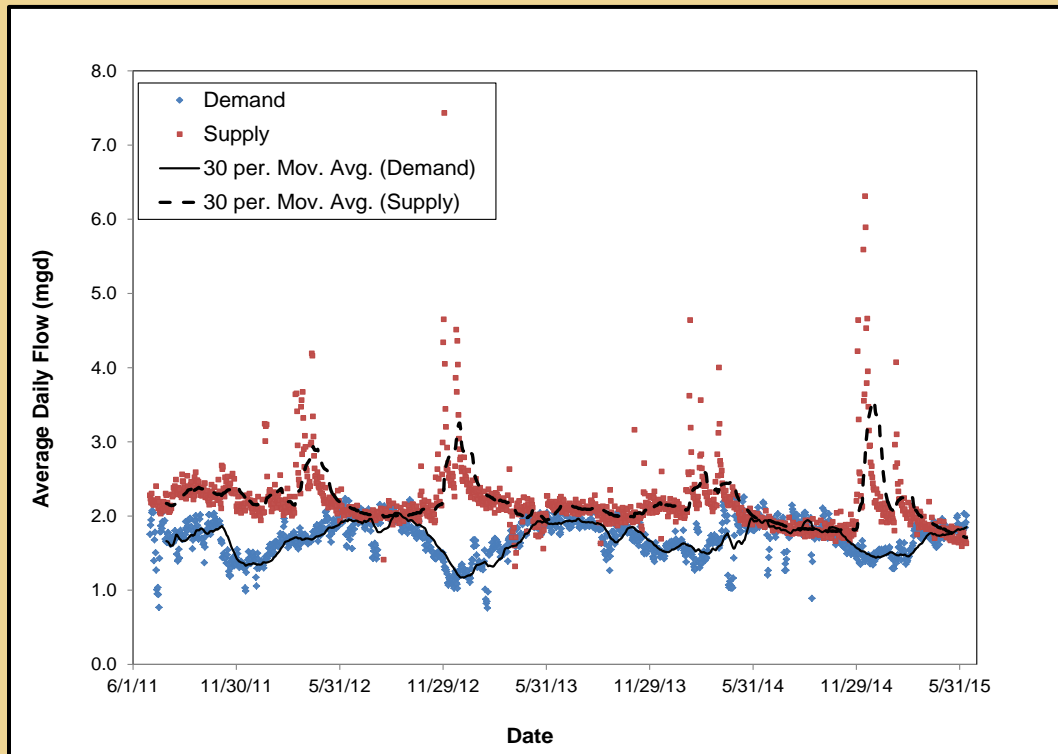
Nutrient Reduction Study

Upgrades

- Level 2: MLE process (Capital cost \$24.1 M)
 - 2 new aeration basins
 - 3rd clarifier
 - Chemical addition (alum and caustic)
- Level 3: Bardenpho (Capital cost \$33.7 M)
 - 2 new basins, larger clarifier, chemicals
 - Tertiary filtration

Benicia Water Reuse Project

- BC Feasibility Study nearly complete
- Goal: 2 MGD of recycled water to Valero for use in cooling towers.
- Reduce City's raw water demand by 20 -25%.



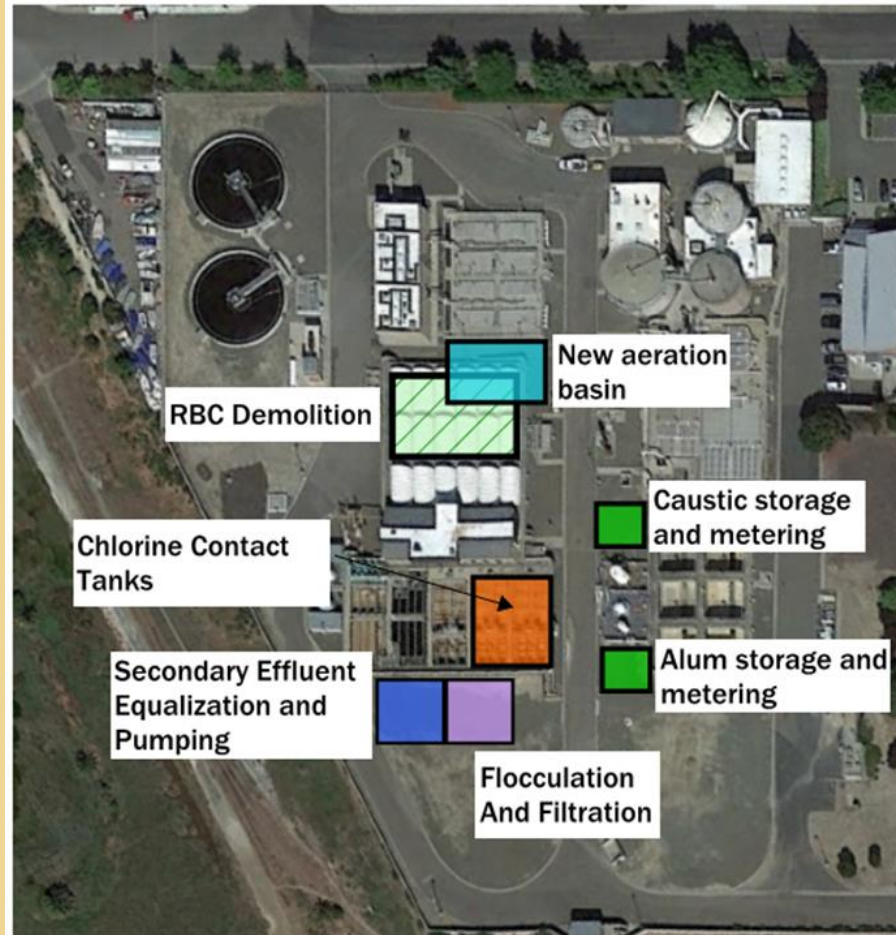
Good match
between supply and
demand.

Water Quality Objectives

Parameter	Criteria	Notes
Turbidity	All solid particles removed	State requirement for recycled water for unrestricted reuse.
Disinfection	Chlorine contact time, bacteria limits	
Ammonia	Complete removal (< 1 mg/L remaining)	Cooling tower target to prevent corrosion of brass heat exchangers and reduce biofouling
Phosphate	Partial removal	Cooling towers need some, but not too much
Suspended Solids	< 5 mg/L; will be met by turbidity removal	Needed to meet State turbidity requirements; important for cooling tower operation to reduce corrosion due to solids deposition in heat exchangers
Chloride	< 180 mg/L	Cooling tower target to prevent corrosion of stainless steel components. Blending with low-chloride water is acceptable.

Feasibility Study

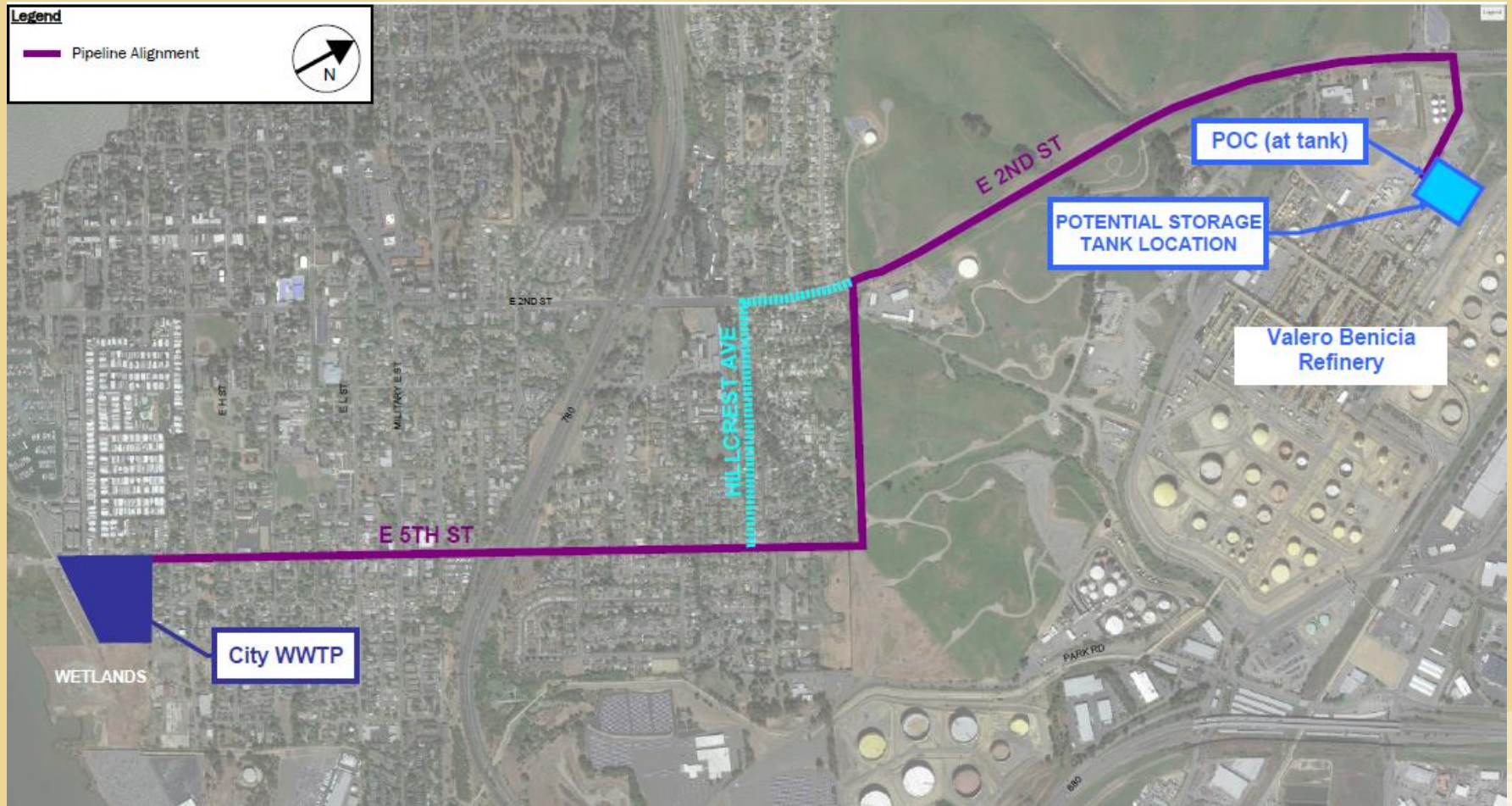
Wastewater Treatment Upgrades



- New third Aeration Basin
- Additional aeration blowers
- Internal Mixed Liquor Pumps and Anoxic Mixers
- Cloth Filters
- Alkalinity and Alum Chemical Facilities

Feasibility Study

Recycled Water Conveyance



Cost Estimates

Capital costs

Description	Construction Costs	Capital Costs (35% contingency)
Treatment (Nitrifying activated sludge, cloth filtration media, chlorination)	\$12,189,400	\$16,455,690
Conveyance (w/ 0.5 MG storage at Refinery)	\$7,922,300	\$10,774,328
Total Construction	\$20,111,700	\$27,230,018

Operating costs

- Estimated annual operations cost of \$700,000 for chemicals, power, equipment replacement, etc.
- Cost of potable water for blending (due to high chlorides).
- Making up lost revenue to the water fund.

Conclusion

- Benicia Water Reuse Project would result in nutrient reductions (N, P, NH₃).
- Include in BACWA report under “Nutrient Removal by Other Means”
- Should be eligible for “credit for early actions” if constructed.

Questions?