Water System Revenue Bonds, Series 2024A and 2024B

Wastewater System Revenue Bonds, Series 2024A

Board of Directors

January 23, 2024

Water and Wastewater Plan of Finance

Water Revenue Bonds, not to exceed $525 million, for the following purposes:

- $275 million in funding for capital projects
- Refund callable Water 2014A, 2014B and 2014C bonds for debt service savings

Wastewater Revenue Bonds, not to exceed $30 million, for the following purpose:

- $25 million in funding for capital projects

New Money Bonds will be Issued as Green Bonds

- Water and Wastewater new money bonds will be labeled “Green Bonds”
  - Fifth time for Water System since 2015
  - Second time for Wastewater System
- Proceeds from issues will be used for environmentally beneficial projects
- Applying “Guidance for Issuing Green Bonds” adopted by the Board in March 2022

Refunding for Debt Service Savings

- Water, Series 2024B
  - Refunding $213 million callable Water Series 2014A, 2014B and 2414C bonds
  - Projected debt service savings of 17.3% of refunded par amount

Proposed Indenture Amendments

- Amended and restated indenture:
  - Remove the label “subordinated” from the definition of pledged revenues
  - Incorporate amendments made to the Indenture by the Sixteenth Supplemental Indenture
- Indenture modifications:
  - Clarify the District’s rate covenant
  - Revise the provisions allowing for the District to issue additional bonds or incur other Parity Debt
  - Update the timing requirement for the District to furnish its audited financial statements to the Trustee

Recommended Actions for the Authorization of 2024 Water Bond Issues

- Authorize and approve the issuance of the EBMUD Water System Revenue Bonds, Series 2024A and 2024B
- Approve execution of bond documents
- Aggregate principal amount not to exceed $525 million
- True interest cost not to exceed 5.75%
- Negotiated sale

Recommended Actions for the Authorization of 2024 Wastewater Bond Issues

- Authorize and approve the issuance of the EBMUD Wastewater System Revenue Bonds, Series 2024A
- Approve execution of bond documents
- Aggregate principal amount not to exceed $30 million
- True interest cost not to exceed 5.75%
- Negotiated sale

Questions?

FLOWING INTO THE FUTURE

Water Supply Update

Board of Directors

January 23, 2024

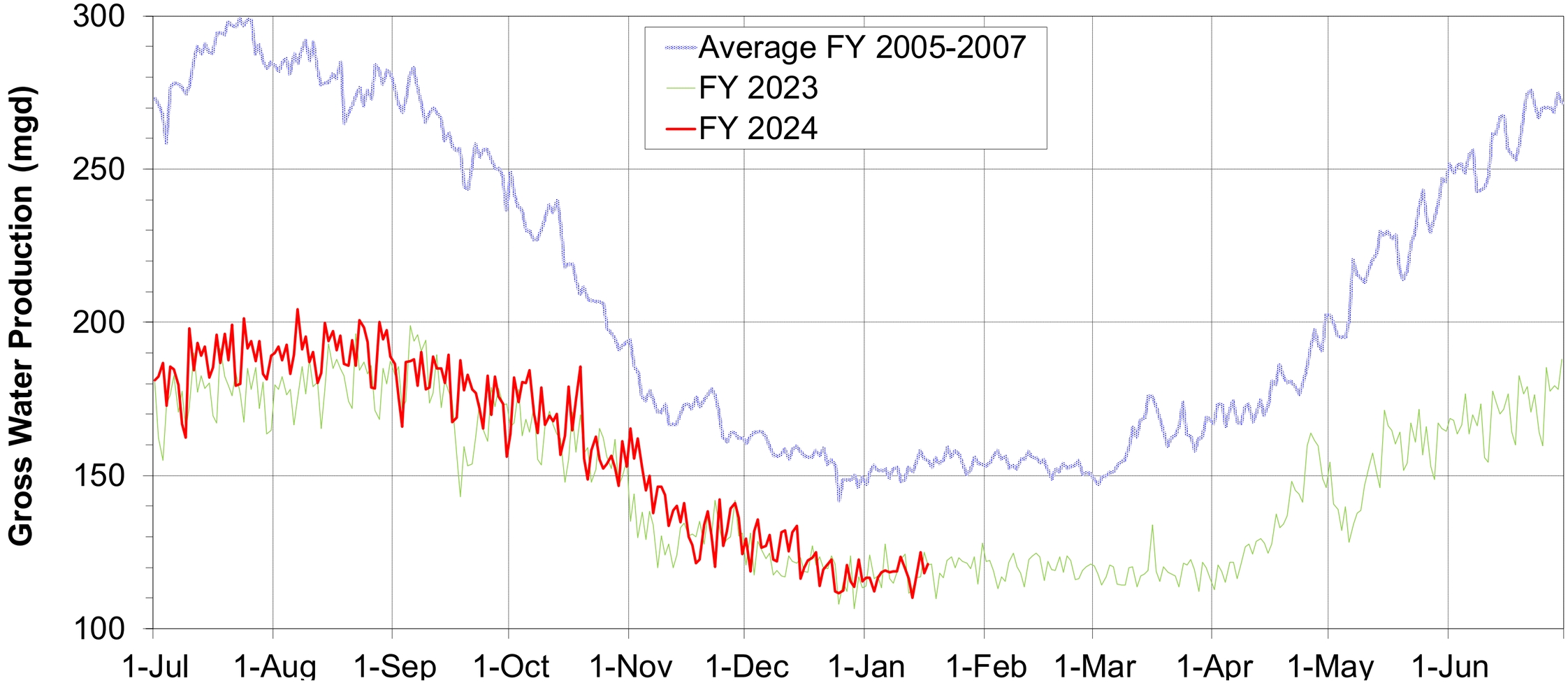
Water Supply Briefing

- Current Water Supply
- California Water Supply
- Water Supply Projections

Chabot Reservoir, J. Toone March 2023

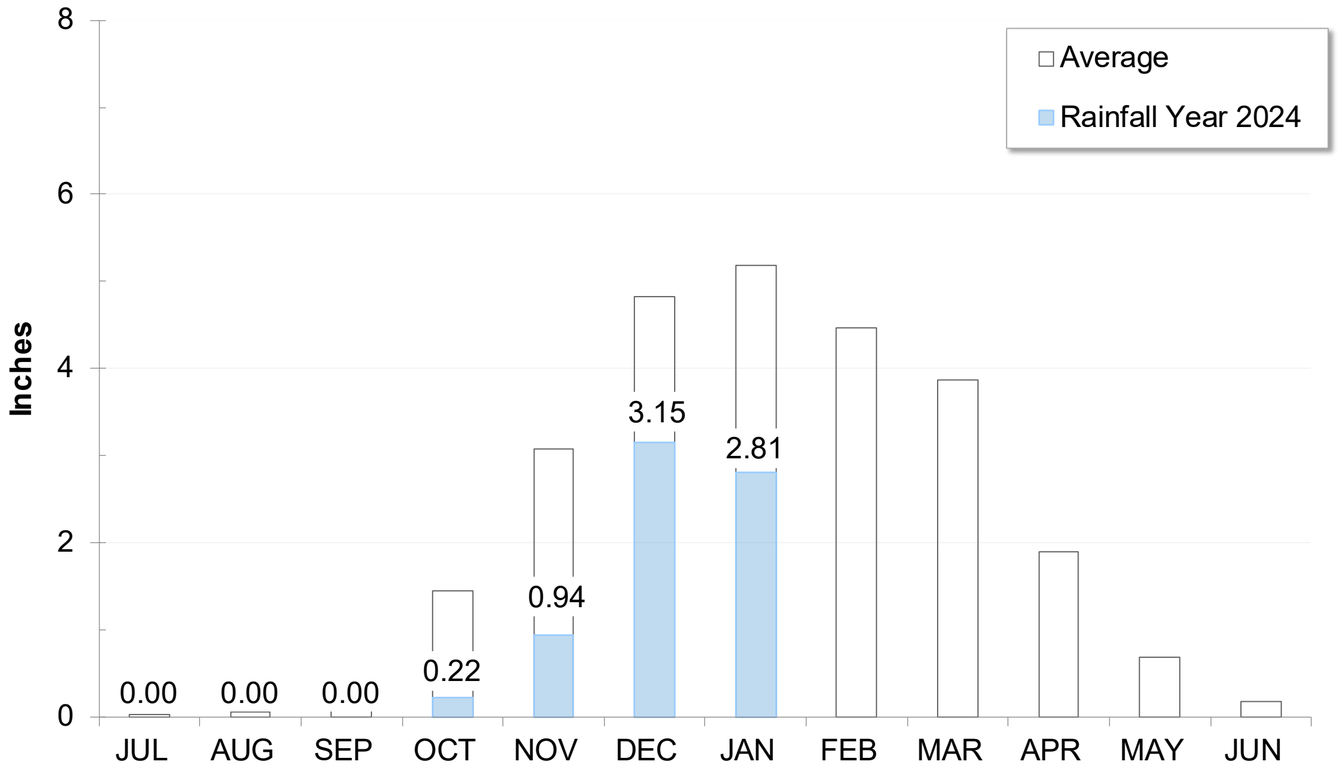
Current Water Supply

Gross Water Production



Precipitation as of January 17

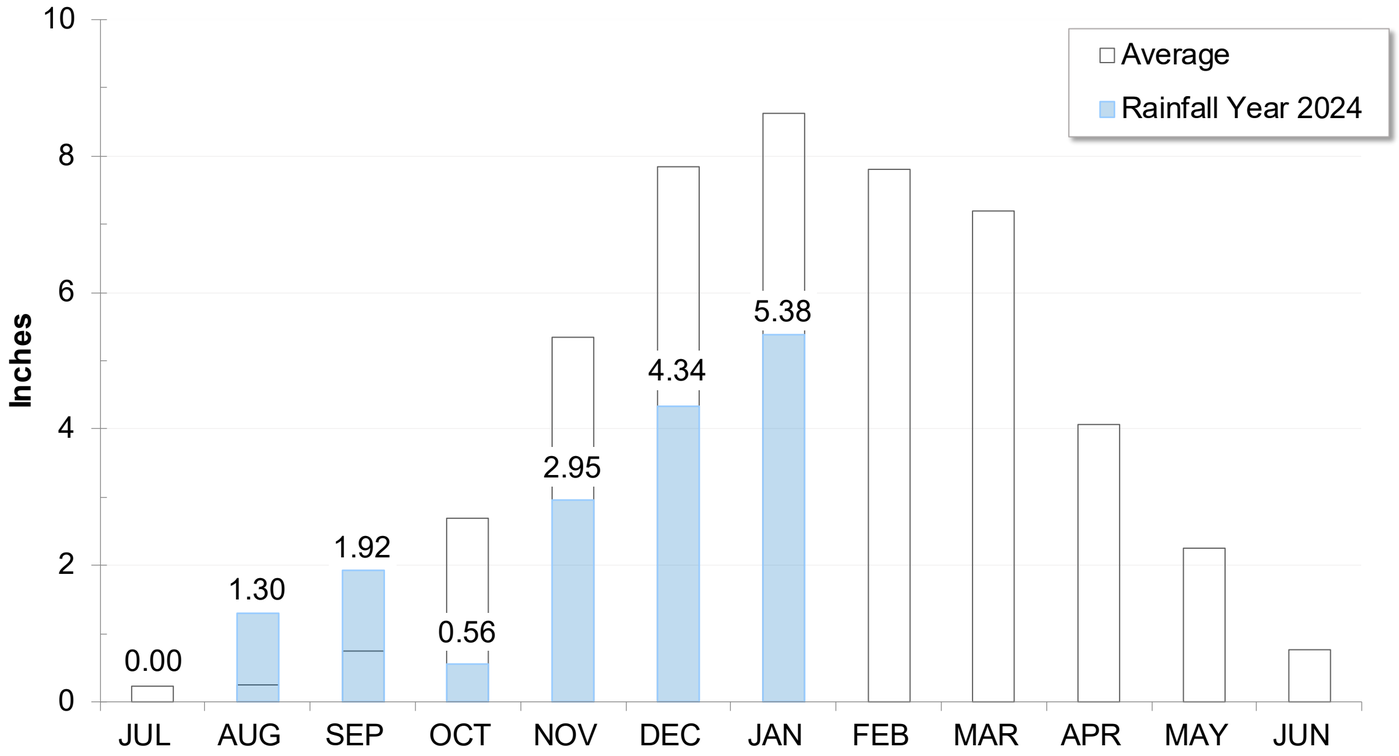
East Bay: 7.12” (55% of average)

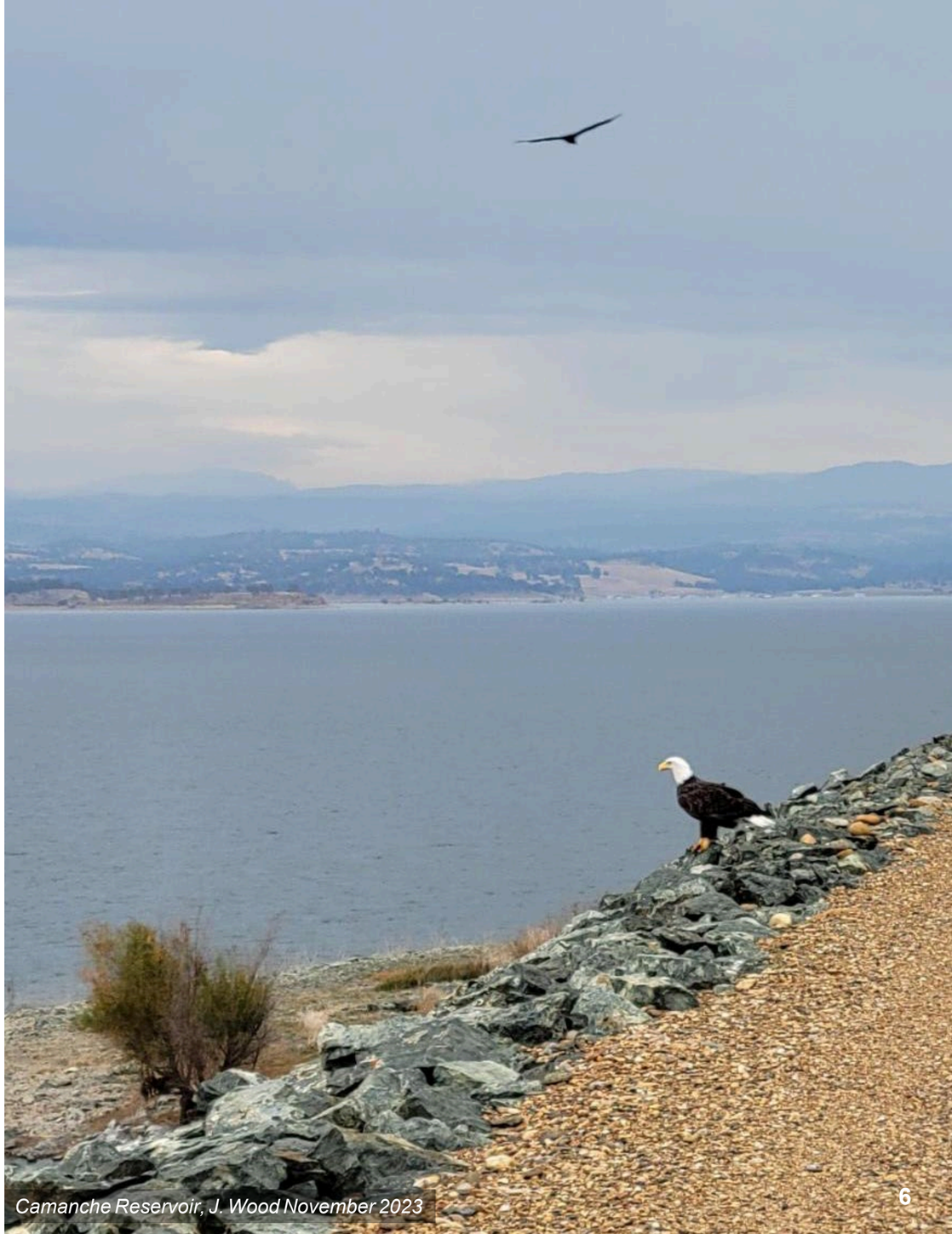


San Pablo Reservoir, J. Urness March 2023

Precipitation as of January 17

Mokelumne: 16.45” (74% of Average)





Camanche Reservoir, J. Wood November 2023

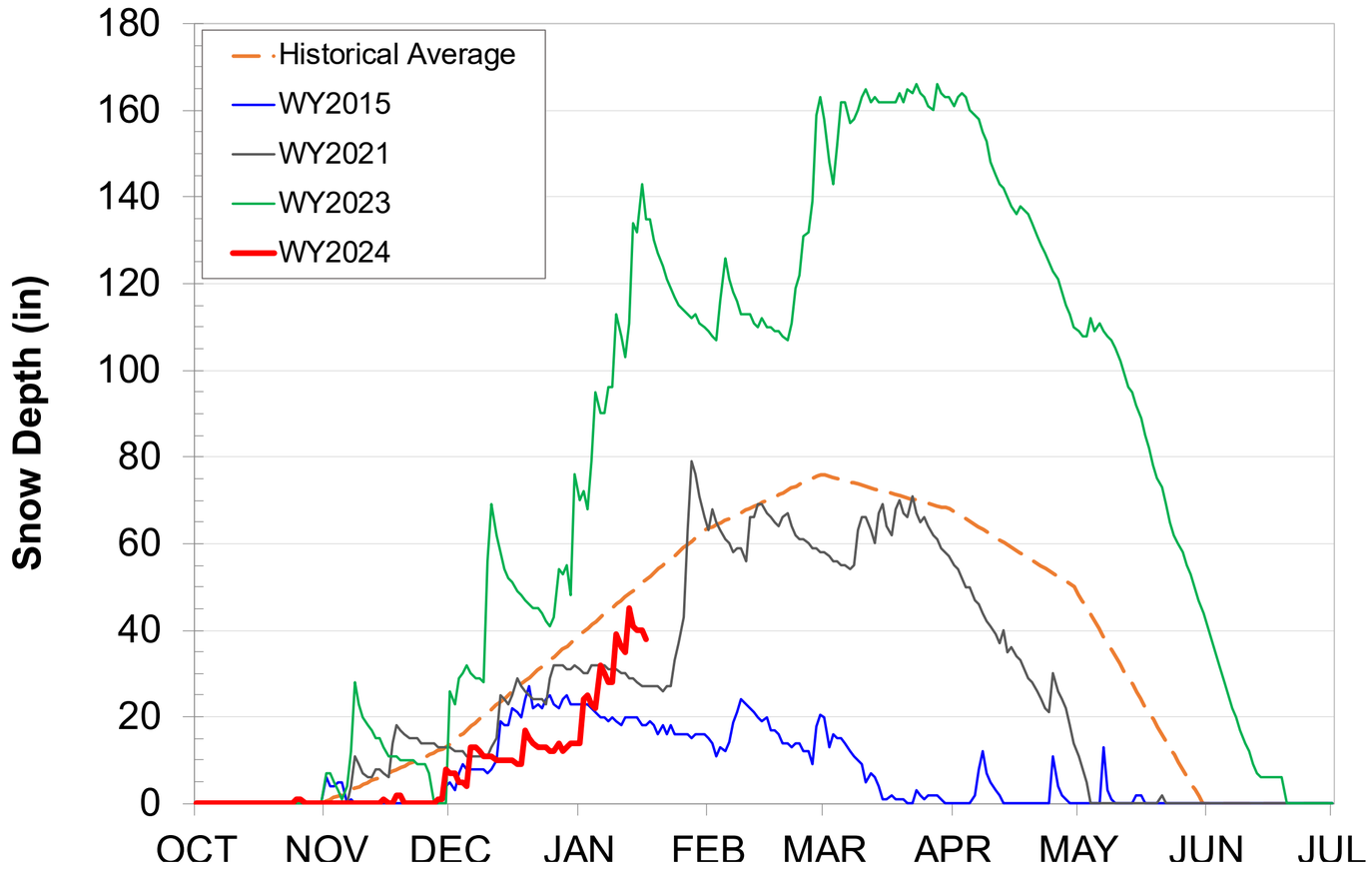
Caples Lake Snow as of January 17

Snow Depth

38” (73% of average)

Snow Water Content

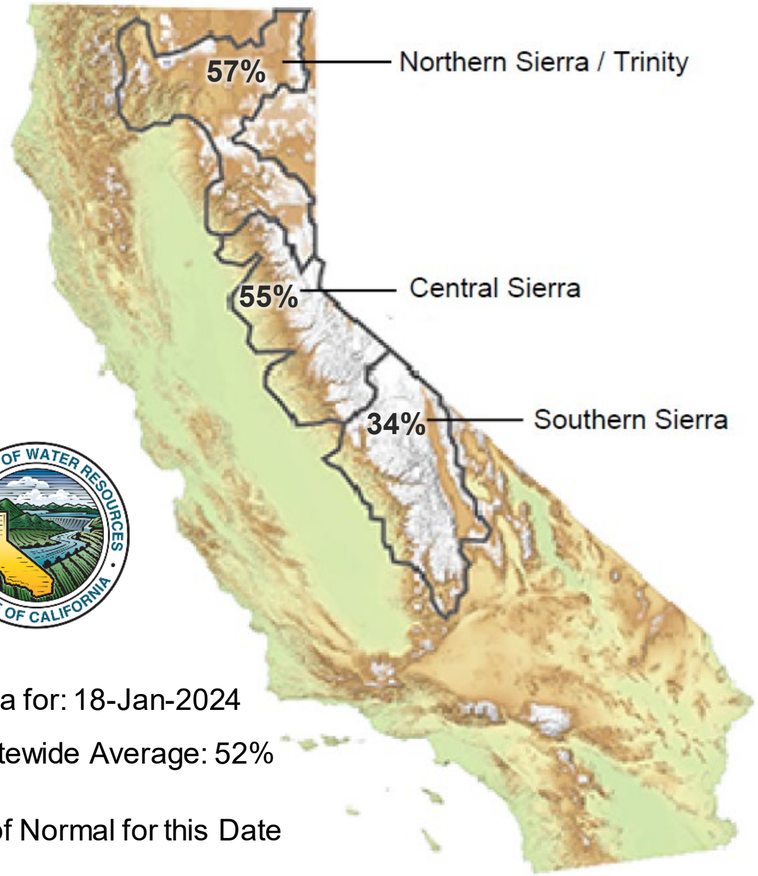
6.27” (39% of average)



California Water Supply

Snowpack as of January 18

Snow Water Equivalent: 55% in Central Sierra



Data for: 18-Jan-2024

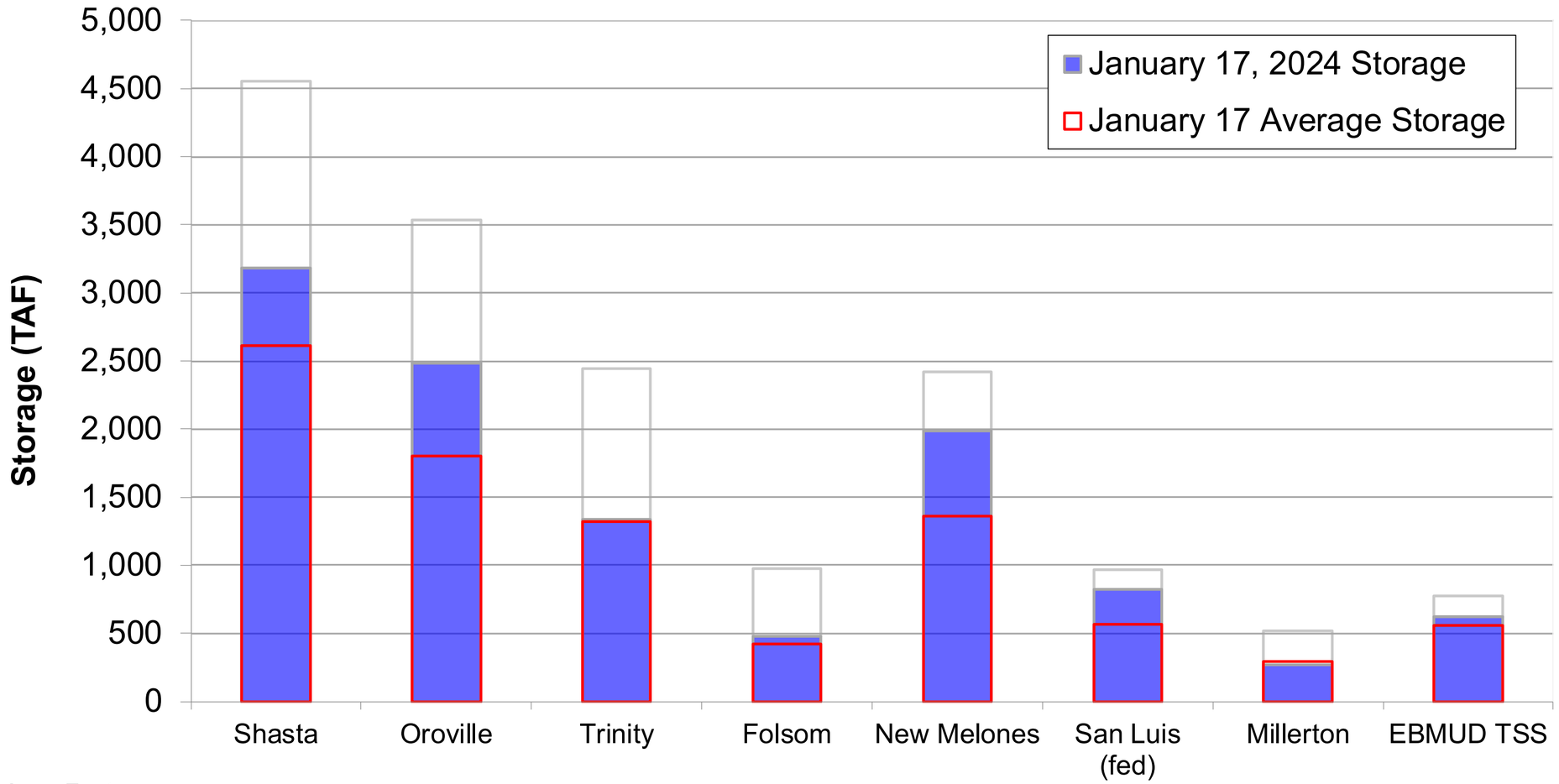
Statewide Average: 52%

% of Normal for this Date

Bear Valley, D. Briggs - January 2024

Northern California Water Supply

Current vs. Average Storage



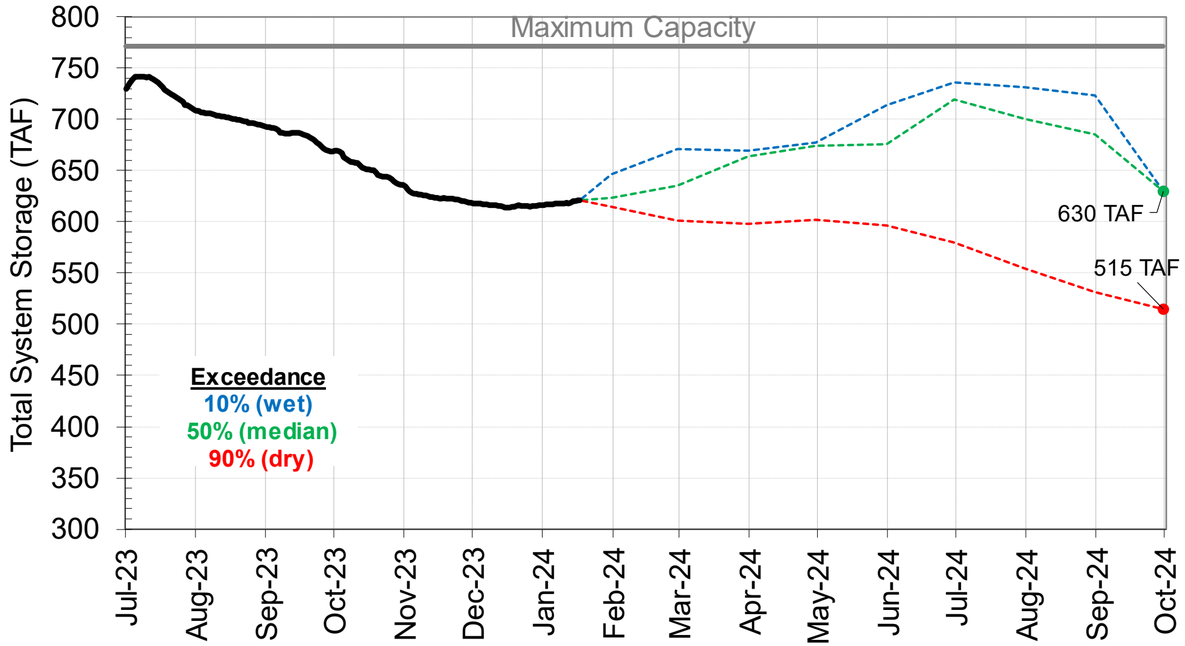
TAF: Thousand Acre-Feet

Water Supply Projections

Total System Storage as of Jan 17

Current: 621 TAF (111% of Average)

Reservoir	Current Storage, TAF	Percent of Average	Percent of Capacity
Pardee	176	99%	87%
Camanche	313	121%	75%
East Bay	132	106%	87%
Total System	621	111%	80%



TAF: Thousand Acre-Feet

Questions?

Camanche Reservoir Release , J. Toone – March 2023

FLOWING INTO THE FUTURE

Wastewater Nutrient Compliance Update

Board of Directors

January 23, 2024

POTW Discharge ~2/3 of Annual Nitrogen Loads to SF Bay

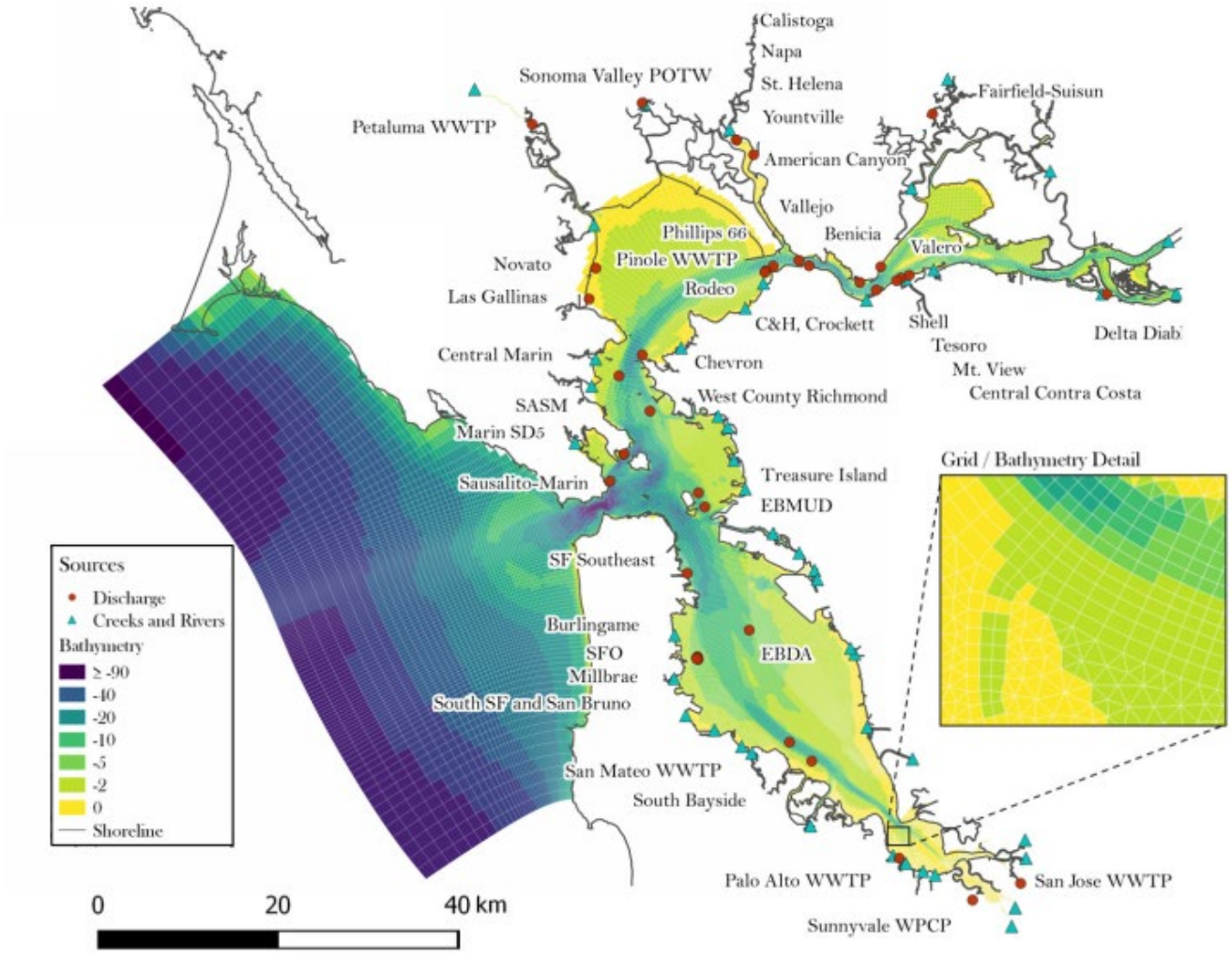
- 37 POTWs
- 7.1M service population
- Many different treatment technologies
- Individual permitted flows from **0.03 mgd** to **120 mgd**
- Individual dry season nitrogen loads from **0 kg N/day** to **10,000+ kg N/day**

SF Bay = San Francisco Bay; POTW = Publicly Owned Treatment Works

SF Bay Stakeholders Value Decision-Making Based on Science

BACWA has contributed > $16M to the scientific study of nutrients

- Monitoring
- Modeling
- Special Studies



Baywide Model Developed by SFEI for Advancing the Science

BACWA = Bay Area Clean Water Agencies

The Limiting Nutrient in the SF Bay is Nitrogen

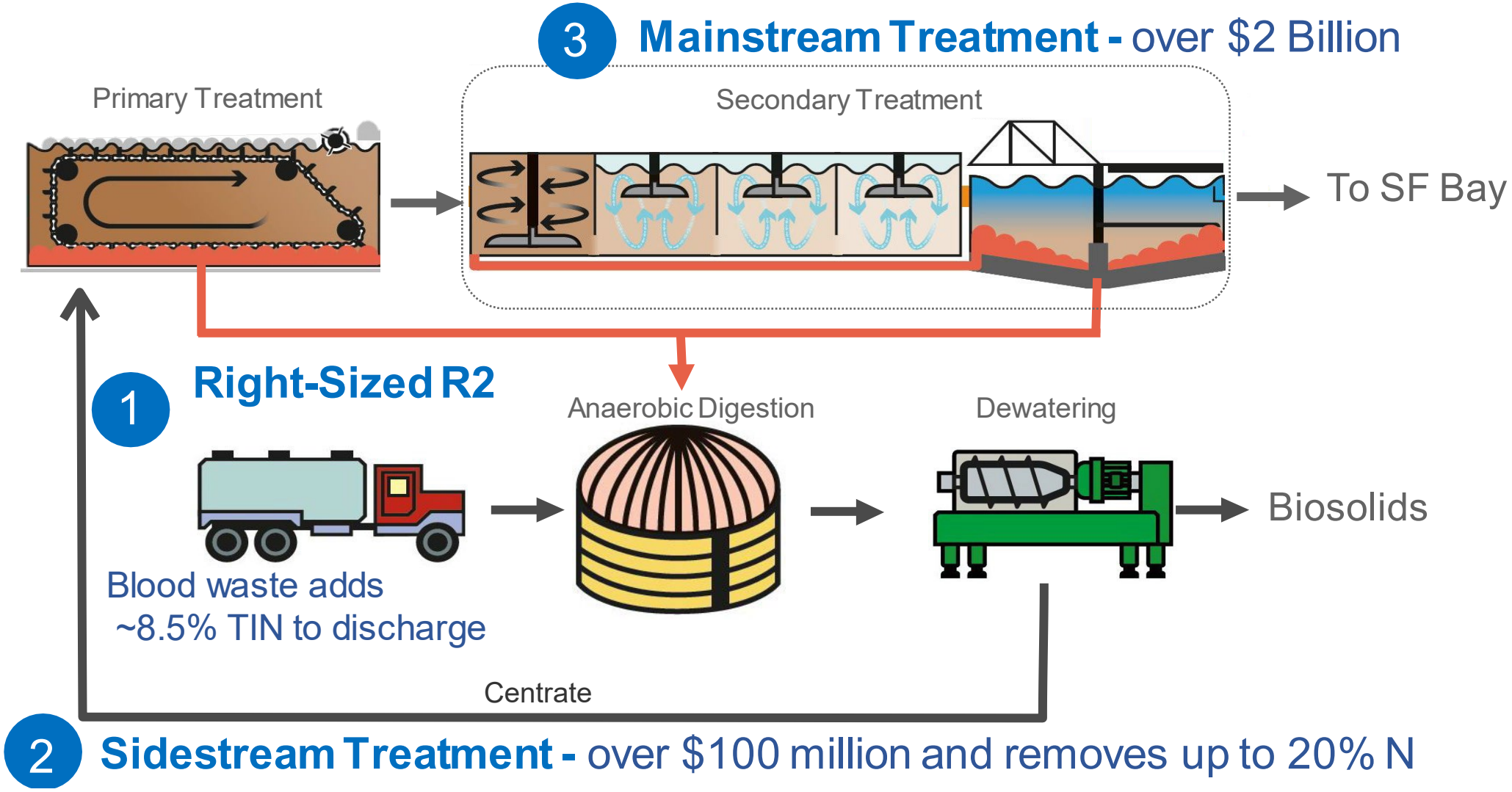
- Just as plants need nitrogen to grow, so do algae
- Most plant fertilizers use **ammonia**, **nitrite**, and/or **nitrate** to supply nitrogen to plants
- These 3 nitrogen compounds are collectively called: Total Inorganic Nitrogen or TIN
- Nitrogen discharges from wastewater treatment plants are regulated based on TIN

Prior to 2022 HAB in SF Bay Only a Nitrogen Discharge Cap Was Expected

- No adverse impacts to the SF Bay due to excess nitrogen
- Regional Water Board Planned to cap TIN discharges to the SF Bay to prevent future nutrient impacts
- No nitrogen treatment was expected until growth-driven nitrogen increases exceeded the nitrogen discharge cap

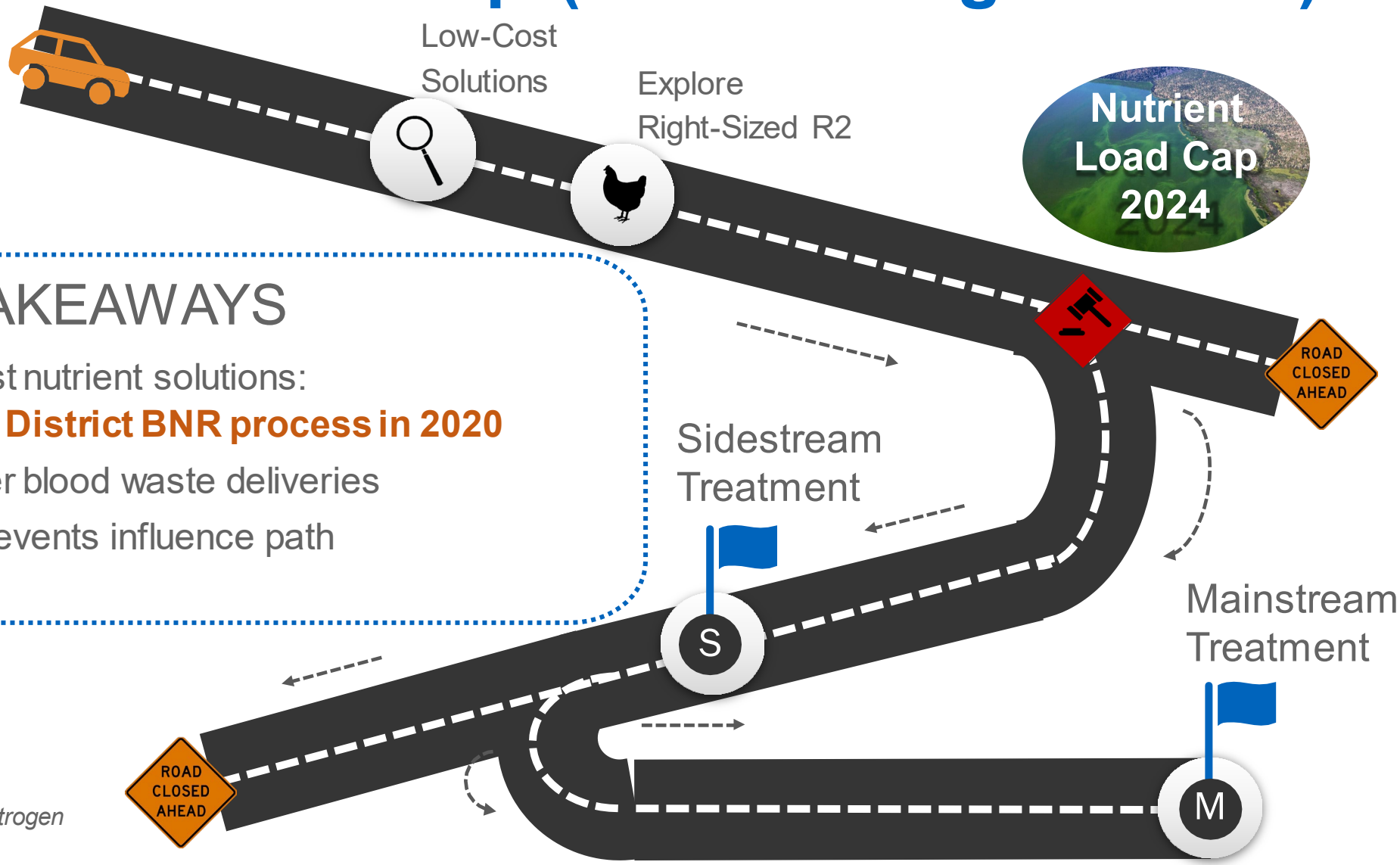
HAB = Harmful Algal Bloom

Sidestream and Mainstream



R2 = Resource Recovery

Nutrient Roadmap (Prior to August 2022)

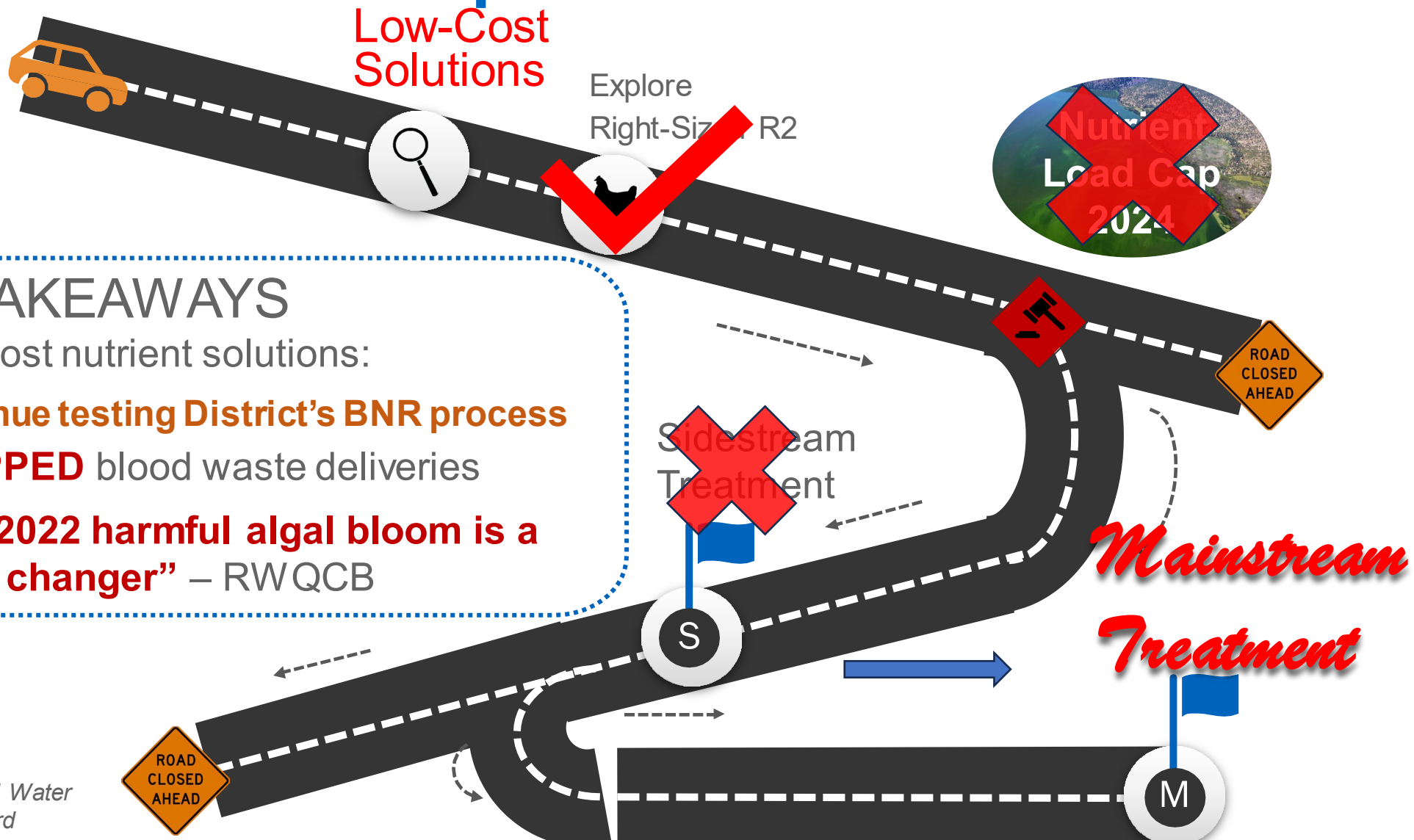


KEY TAKEAWAYS

- Low-cost nutrient solutions:
  Testing District BNR process in 2020
- Consider blood waste deliveries
- Recent events influence path

BNR = Biological Nitrogen Removal

Nutrient Roadmap – After 2022 Bloom



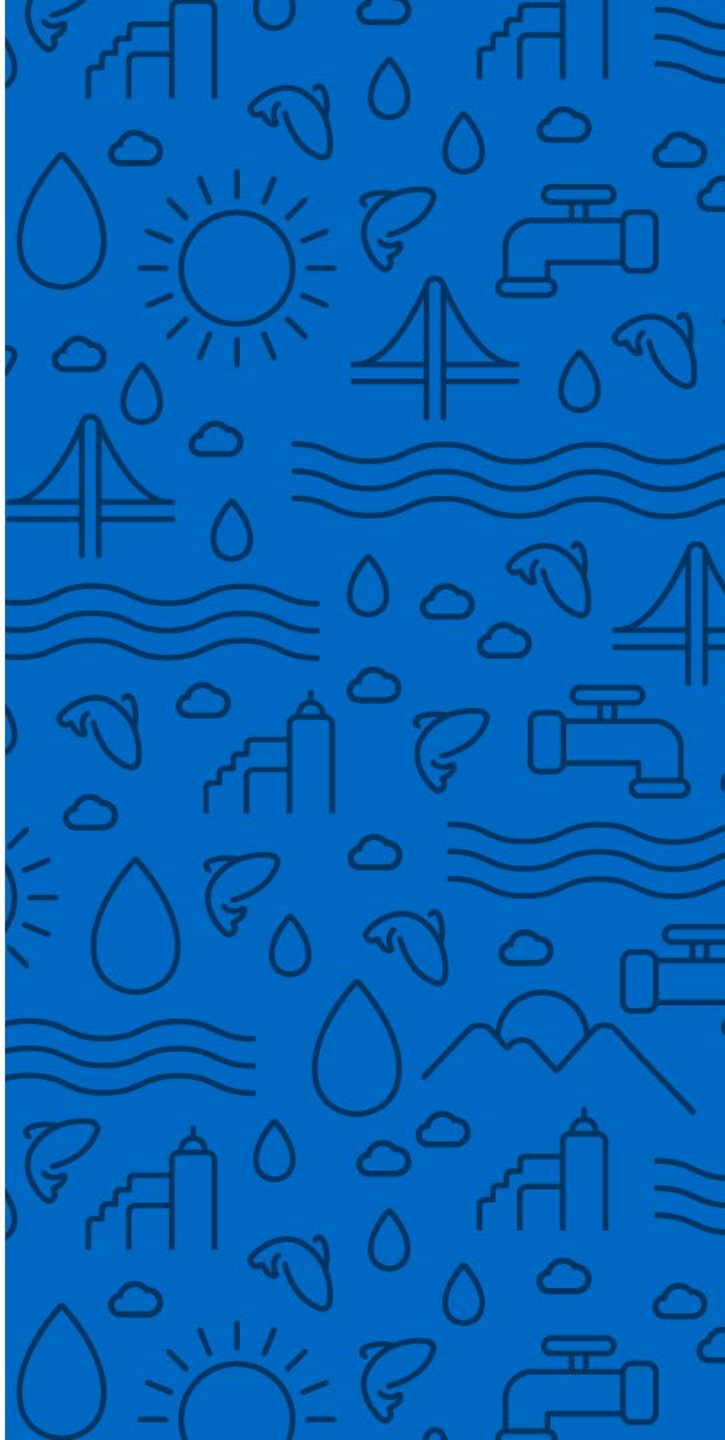
KEY TAKEAWAYS

- Low-cost nutrient solutions:

  Continue testing District's BNR process
- **STOPPED** blood waste deliveries
- **"The 2022 harmful algal bloom is a game changer"** – RWQCB

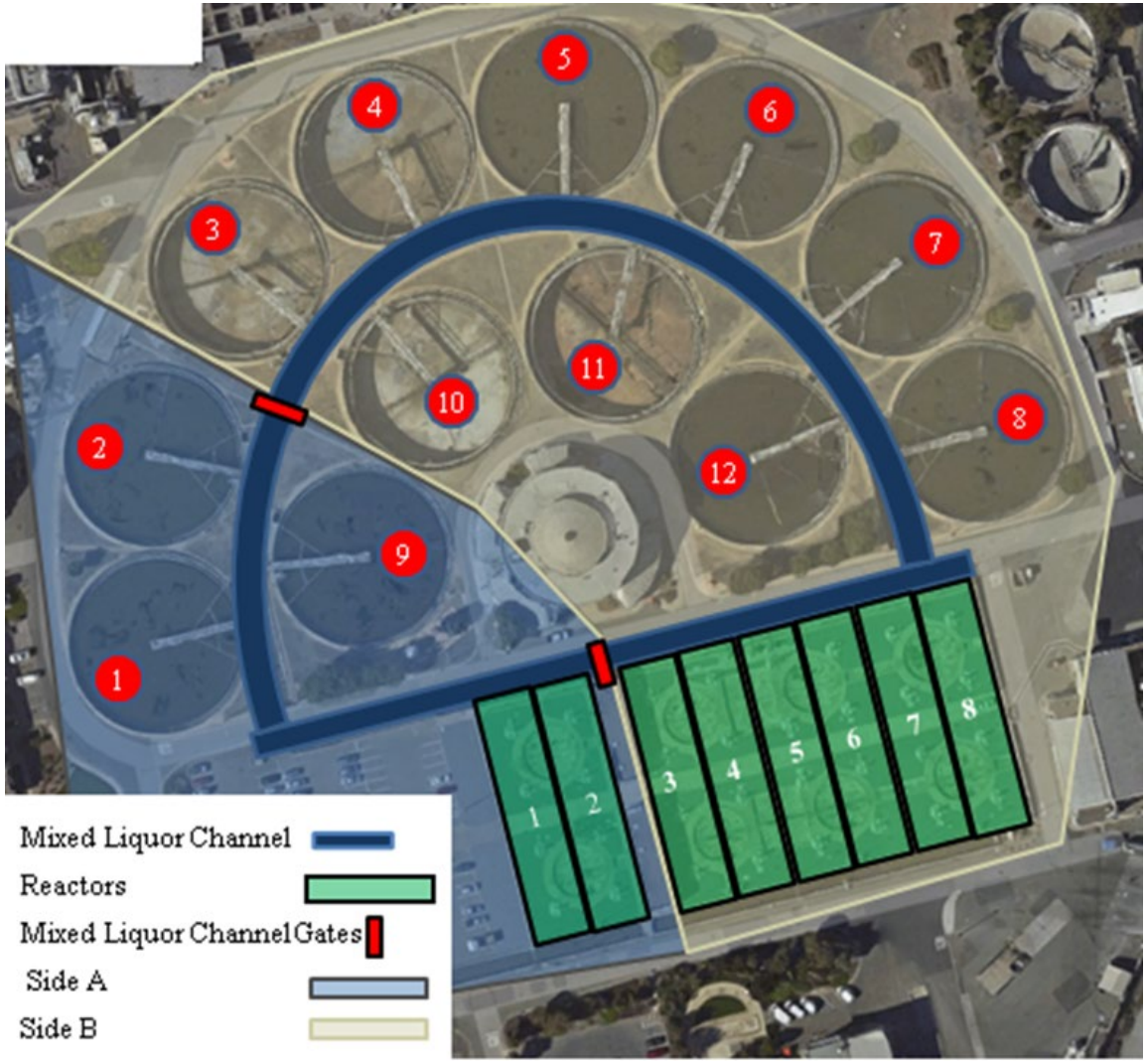
RWQCB = Regional Water Quality Control Board

Biological Nitrogen Removal (BNR) Process Full-Scale Testing



Splitting Secondary Process into Sides A and B

- Side A: BNR Test
- Side B: Control
- In 2022, 25% flow was going to Side A and 75% was going to Side B
- In 2023, 50% of the flow was going to Side A, 50% of the flow to Side B



District BNR Process: 5+ Years in the Making

YEAR	MILESTONE
2018 to 2019	Preparation for full-scale plant split
2020	Nitrification in a full-scale Oxygen Activated Sludge Plant
2021	73% TIN Removal in a full-scale Oxygen Activated Sludge Plant
2022	Treating very high ammonia load
2023	65% TIN removal from 50% of flow discharged

District's BNR Process Published in California Water Environment Association Magazine in 2022

Full-Scale Nitrogen Removal
in a High-Purity Oxygen Activated Sludge Process

By EBMUD staff Donald Gray (Gabb), Rogelio Zuniga-Montanez, Justin Shih, Kristine Yung, Robert Starke, Brian Dunstan, Christopher Aman, Kevin Dickison, William Loconte, Rochelle Verspui, Joseph Barge, Ryan Quezada, Sue Berg and the rest of the EBMUD Laboratory

Nitrogen, a nutrient present in wastewater, can have detrimental impacts when discharged into receiving water bodies. East Bay Municipal Utility District (EBMUD) has explored both sidestream and mainstream nutrient removal approaches through its recently completed Master Plan. The agency is also working on a parallel effort to characterize the ability to remove total inorganic nitrogen (TIN) using the existing high-purity oxygen-activated sludge (HPOAS) system. Utilizing HPOAS for nitrogen removal poses several challenges, and the available literature at full scale is sparse.

EBMUD provides wastewater treatment services to 740,000 residents in California's east San Francisco Bay Area. The District's Main Wastewater Treatment Plant (MWWTP) treats approximately 60 million gallons per day (MGD) of wastewater during the dry weather months – April to October – and has used HPOAS for secondary treatment since the 1970s.

The system consists of eight reactor trains (with four stages each) and twelve secondary clarifiers (Figure A), with a rated capacity of 168 MGD during wet weather. High-purity oxygen is generated from an on-site cryogenic oxygen air separation plant (Figure B).

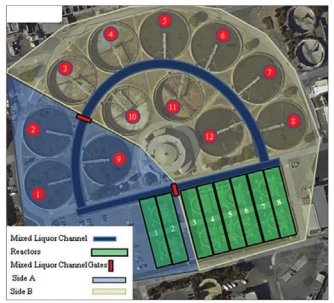


Figure A: East Bay Municipal Utility District Main Wastewater Treatment Plant layout and split-plant configuration. Side A and Side B operate at high and low mean cell residence times, respectively, during split-plant testing.

Figure B: Cryogenic oxygen generation plant for high-purity oxygen activated sludge process.

In the early 2000s, the first stage of each reactor was converted to an anaerobic selector to control sludge bulking. The EBMUD's MWWTP has been in perfect compliance with effluent limits in its National Pollutant Discharge Elimination System (NPDES) discharge permit for the last twenty-two consecutive years.

In 2014, the San Francisco Bay Regional Water Quality Control Board issued its first regional order (referred to as the San Francisco Bay Nutrients Watershed Permit) to address the potential impacts of nutrient discharges on the San Francisco Bay. The second Nutrients Watershed Permit issued in 2019 included estimated TIN load targets for each wastewater agency. EBMUD is planning to meet TIN effluent discharge limitations required by the third Nutrient Watershed Permit to be issued in 2024.

"While the MWWTP typically operates at a mean cell residence time (MCRT) of 1-1.5 days, much longer MCRTs are needed to support nitrifying bacteria – the main microorganisms that oxidize inorganic nitrogen," said Donald Gray, EBMUD's Manager of Wastewater Technical and Emerging Issues. "The subsequent increase in solids inventory can present challenges to the existing infrastructure, including a much higher solids load to the clarifiers."

There are additional concerns with insufficient alkalinity for complete nitrification – oxidation of ammonia to nitrite, and then to nitrate, the lack of internal recycle for denitrification – reduction of nitrate and nitrite to nitrogen gas, the potential for rising sludge blankets in the clarifiers from the gas formed from denitrification or nitrite impacts on hypochlorite disinfection.

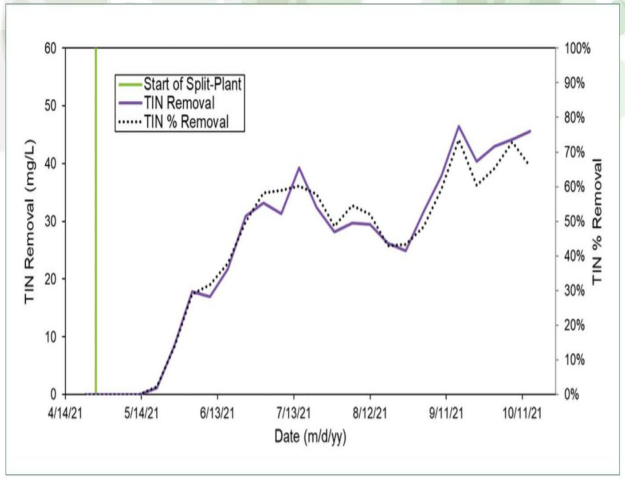


Figure C: Total inorganic nitrogen (TIN) removal in full-scale high-purity oxygen activated sludge process.

"EBMUD has performed full-scale TIN removal testing during dry weather for the past three years using its existing HPOAS process," Justin Shih, senior civil engineer for EBMUD said.

Through a series of valves, gates, and pumps, the existing HPOAS reactor and clarifier configuration can be physically split into two parallel processes with entirely separate biomass (Figure A). This allows for full-scale testing of higher MCRTs to treat up to 25% of the secondary influent flow (Side A) while maintaining the existing process for regular treatment (Side B).

"There is also the ability to configure a 50/50 split. Both sides' effluent combines before disinfection, dechlorination, and discharge," he said. "The 'split-plant' testing can run for approximately four to six months during dry weather and depending on plant conditions."

Each split-plant season has provided additional evidence towards both the benefits and challenges of operating an HPOAS system for nitrogen removal. In 2021, up to 74% TIN removal was demonstrated for flows up to 5 MGD (Figure C).

On average, the nitrite concentrations in the secondary effluent were more than six times higher than those of nitrate, suggesting a nitritation/denitritation process.

'This year's focus is to increase effluent flows, evaluate the

Why this is Extraordinary

- District staff operated the first known full-scale pure oxygen activated sludge process to substantially remove nitrogen
- In summer 2023
  - Staff's BNR process treated 50% of the District's MWWTP flow and removed 30% TIN from the total discharge to the SF Bay
  - Stopped blood wastes for another 8% reduction from District's MWWTP discharge
  - Combined TIN reduction was almost 45% from the MWWTP discharge to the SF Bay last summer
- Staff will continue to treat more of the MWWTP flow with its BNR process this summer and next summer to further reduce the District's TIN discharge
- This in-house treatment process could save the District over $2 billion

MWWTP = Main Wastewater Treatment Plant

Next Steps

- Meet District BNR process goals:
  - 75% of flow treated in 2024
  - 100% of flow treated in 2025
  - Transfer BNR process to Operations staff
- Continue to work with the Regional Water Board to adopt fair nitrogen limits
- Continue to study alga responsible for the 2022 harmful bloom to support science-based nitrogen limits
- Continue to evaluate near-term alternatives to control HABs

Questions?