The future of nutrient management in the San Francisco Bay

Lorien Fono, BACWA

April 18, 2023

East Bay Leadership Council

OVERVIEW

1. Background
2. What are the alternatives for reducing nutrients to the San Francisco Bay?
3. Benefits of a strategic regional approach to nutrient reduction
4. What are agencies planning to reduce nutrients?
5. Are there other actions to support a resilient San Francisco Bay?

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Background

Nutrient discharges are of concern all over the world

- Nutrients of concern in water bodies are nitrogen and phosphorus.
  - In San Francisco Bay, nitrogen is the element that controls growth.
- Nutrient over-abundance is linked to phytoplankton (algae) over-growth, leading to low dissolved oxygen in water bodies, which suffocates wildlife.
  - This process is called “eutrophication”.
- Some phytoplankton species can generate harmful chemicals that are toxic to wildlife, humans, or pets.

Why has San Francisco Bay been resilient to nutrients?

1. High turbidity blocks the light phytoplankton needs to grow

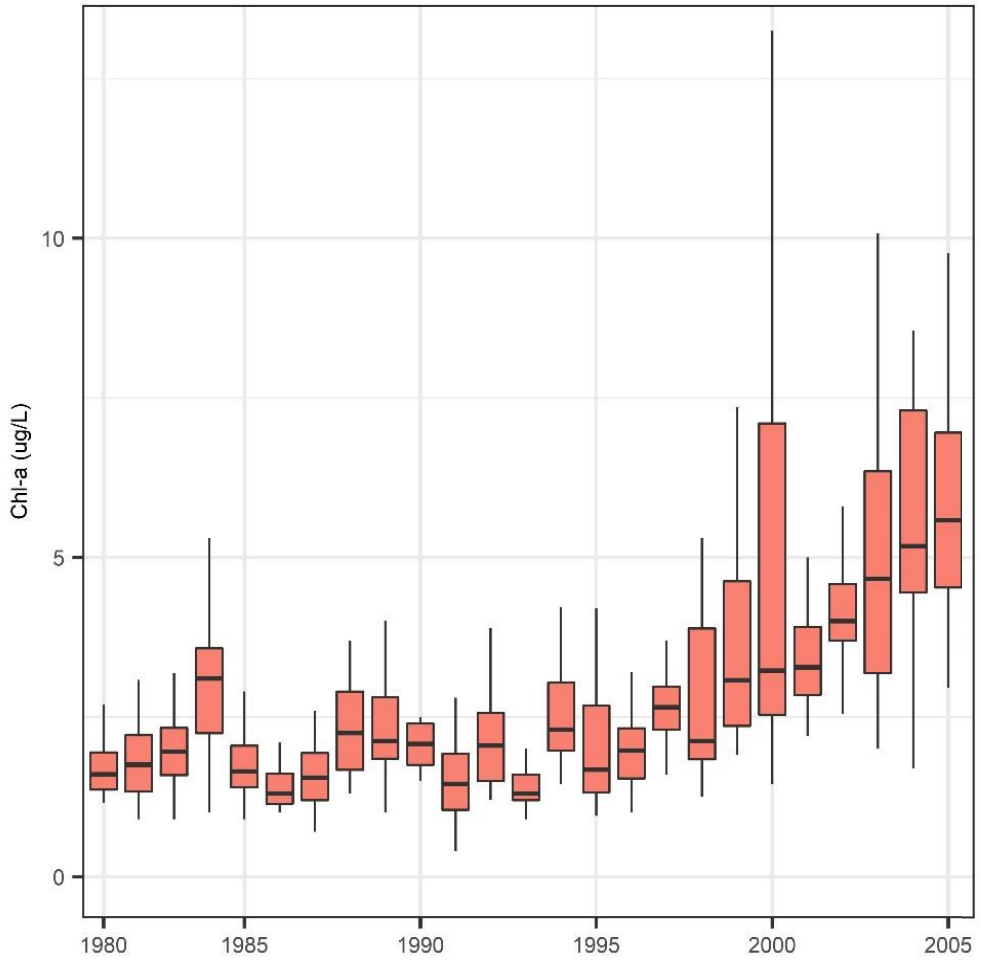
2. Strong tidal mixing reduces nutrient concentrations

3. Filter-feeding clams reduces phytoplankton concentrations

Increased chlorophyll concentrations in the 2000s led to BACWA and the Water Board taking a closer look

- Chlorophyll a (Chl-a) is how algae concentrations are measured
- In the late 1990s-early-2000s, chl-a concentrations in the South Bay increased substantially.

Cloern et al 2007



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Collaboration: The key to practical nutrient regulation

Watershed Approach → Stakeholders → Science → Practical Regulation

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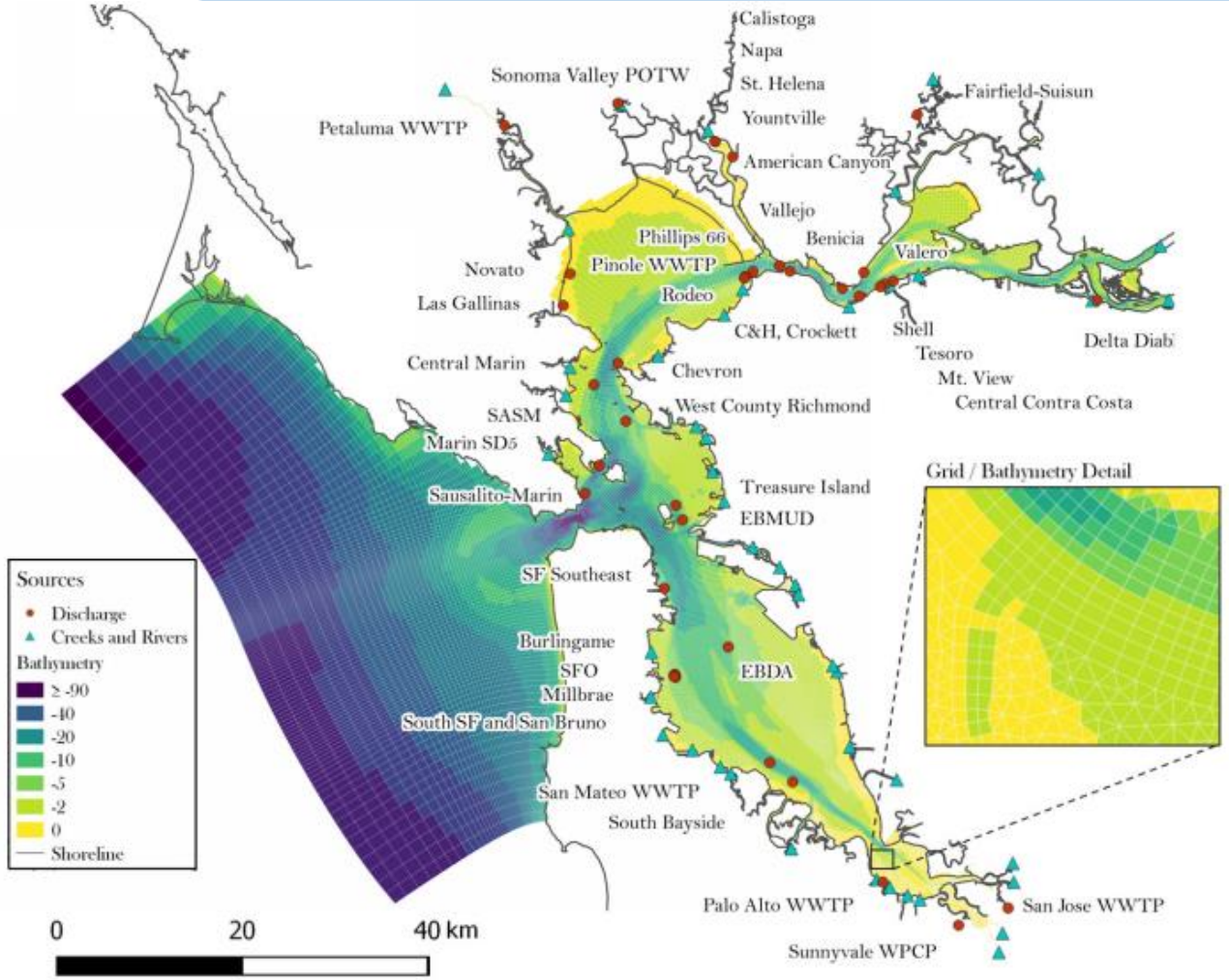
SF Bay stakeholders value decision-making based on science



Baywide Model Developed by SFEI for Advancing the Science

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

- Monitoring
- Modeling
- Special studies

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Working Together for Practical Regulation

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BACWA
(wastewater utilities)

California
Water Boards

Regional Water Board
(regulatory)

SFEI | AQUATIC SCIENCE CENTER
SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER

San Francisco Estuarine Institute
(science)

SAN FRANCISCO
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Non-Govt Organizations
(NGOs)

The approach in the Bay Area for managing nutrients has received national attention and lauded for its collaboration, as evidenced by receipt of a National Environmental Achievement Award in 2019 from the National Association of Clean Water Agencies (NACWA). NACWA is the nationally recognized leader in legislative, regulatory, and legal clean water advocacy.

NATIONAL Environmental Achievement AWARDS

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POTWs 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/d** to **10K+ kg N/d**

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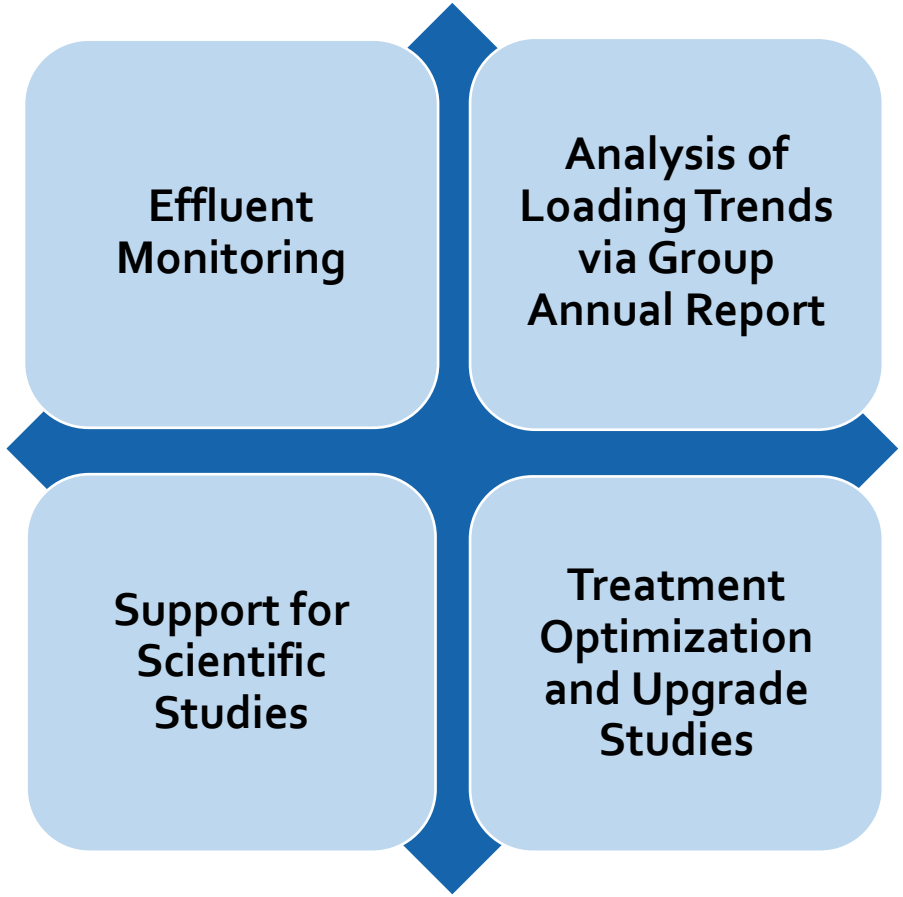
Nutrient Watershed Permit

Watershed Permit 1: 2014 – 2019

Regional management of nutrients



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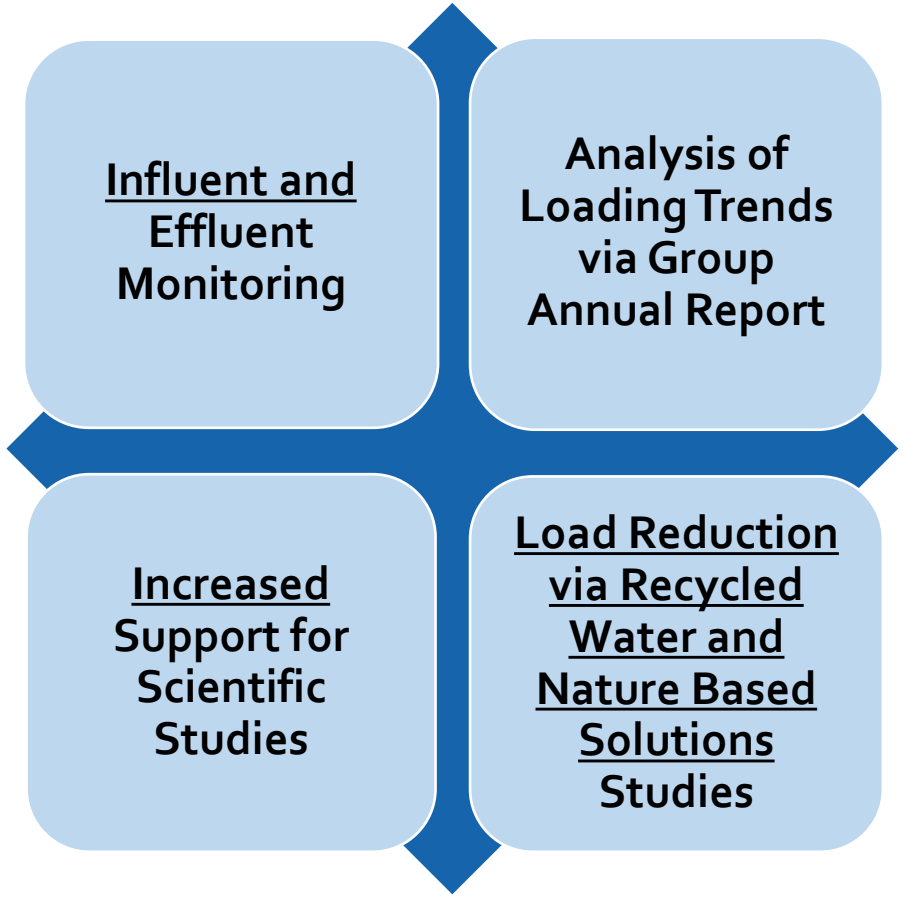
Nutrient Watershed Permit

Watershed Permit 2: 2019 – 2024

Regional management of nutrients



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The "Game-Changer"

San Francisco Chronicle

Poop and pee fueled the huge algae bloom in San Francisco Bay. Fixing the problem could cost $14 billion

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What are the alternatives for reducing nutrient loads to the SF Bay?

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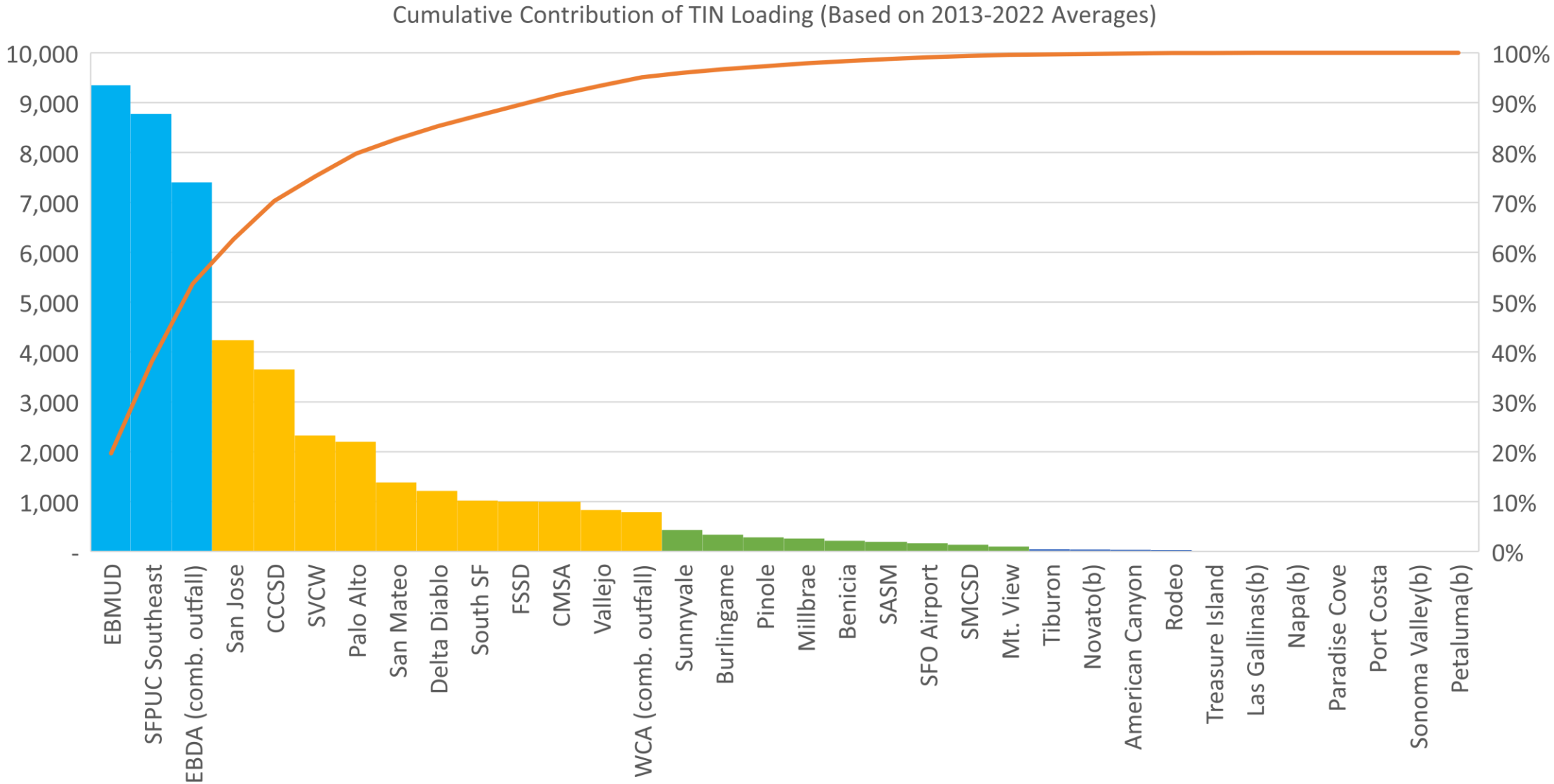
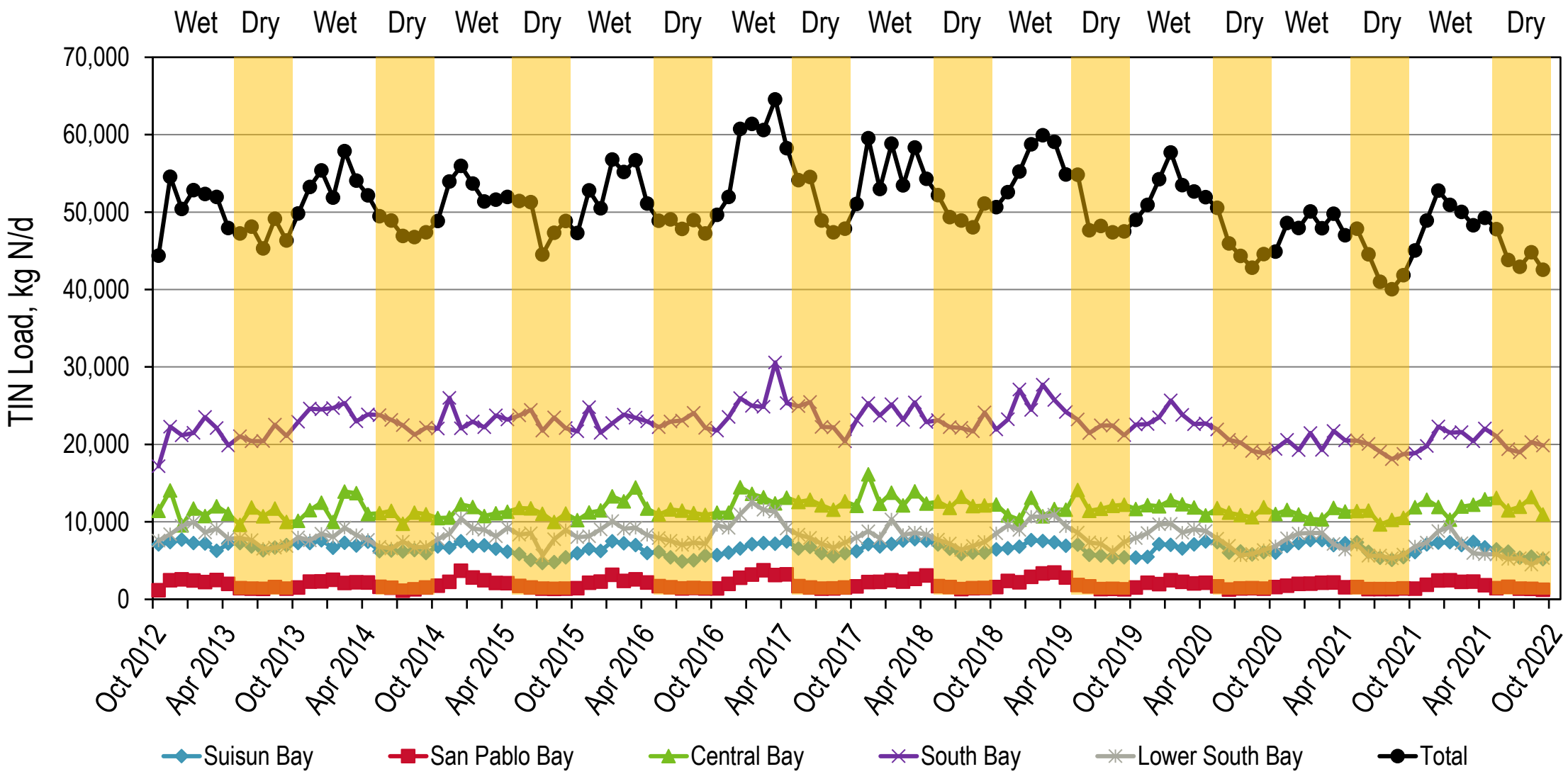
Nutrient reduction will be a regional effort

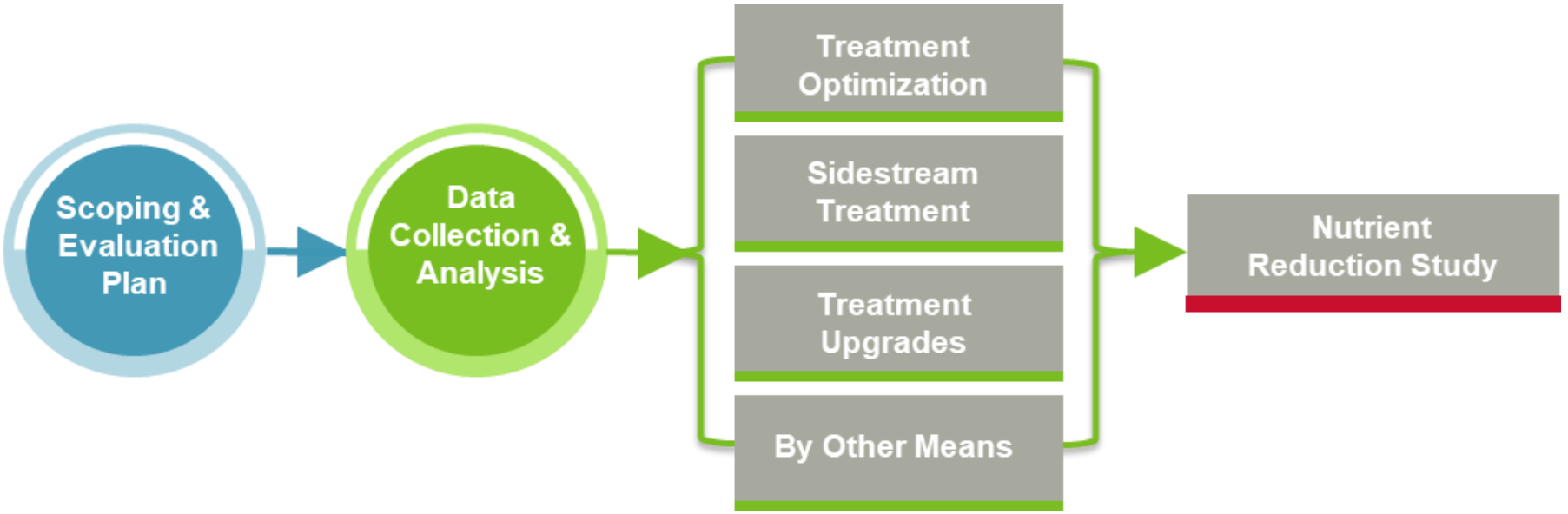


2022 Group Annual Report: Total Inorganic Nitrogen (TIN)

The dry season average monthly loads are ~7 percent less than the 10-year average



Approach to 1st Watershed Permit

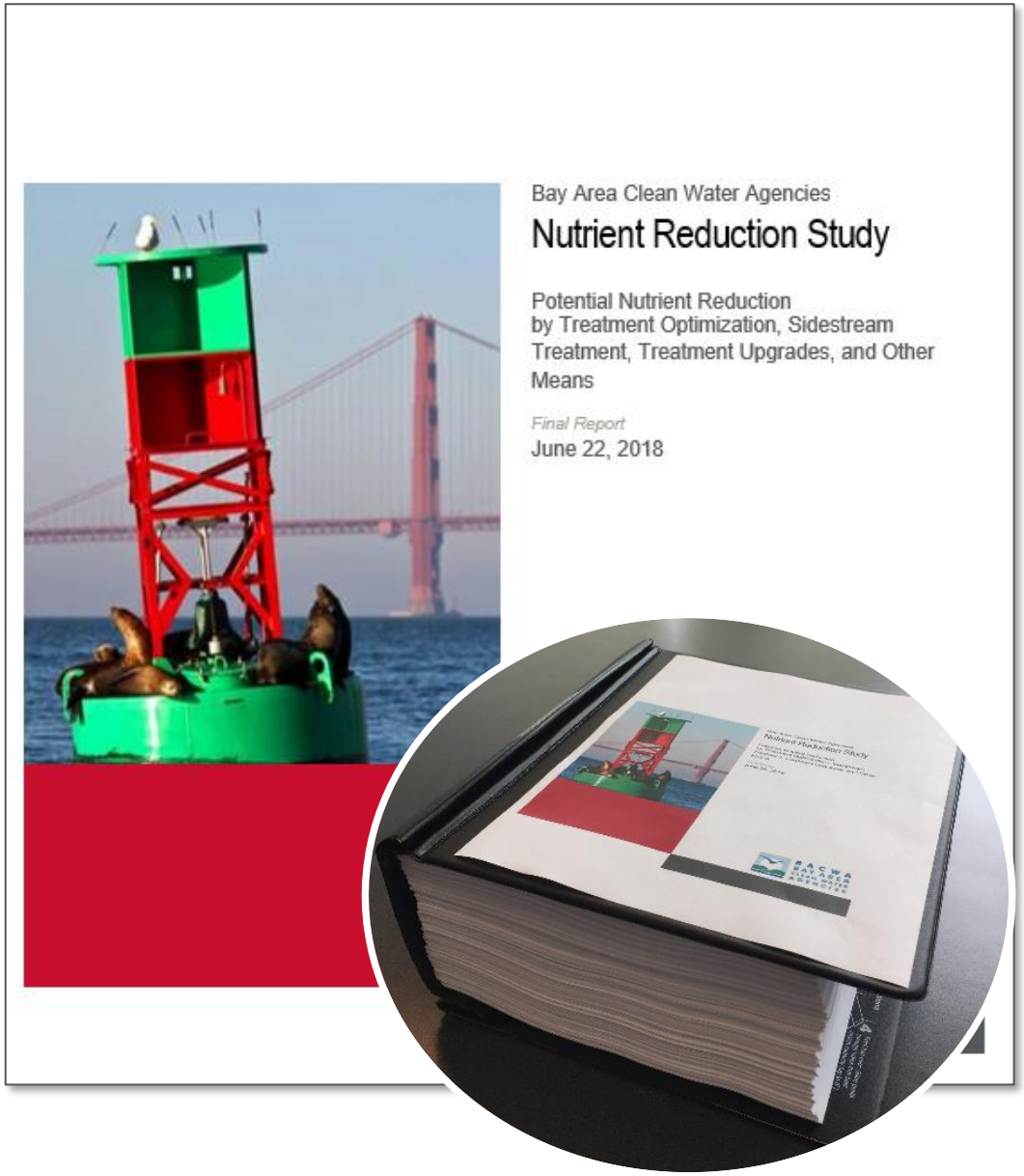


Approved in Feb 2015

Data Collection: Spring 2015
Site Visits: Spring – Fall 2015
Final Plant Reports: 2017/2018

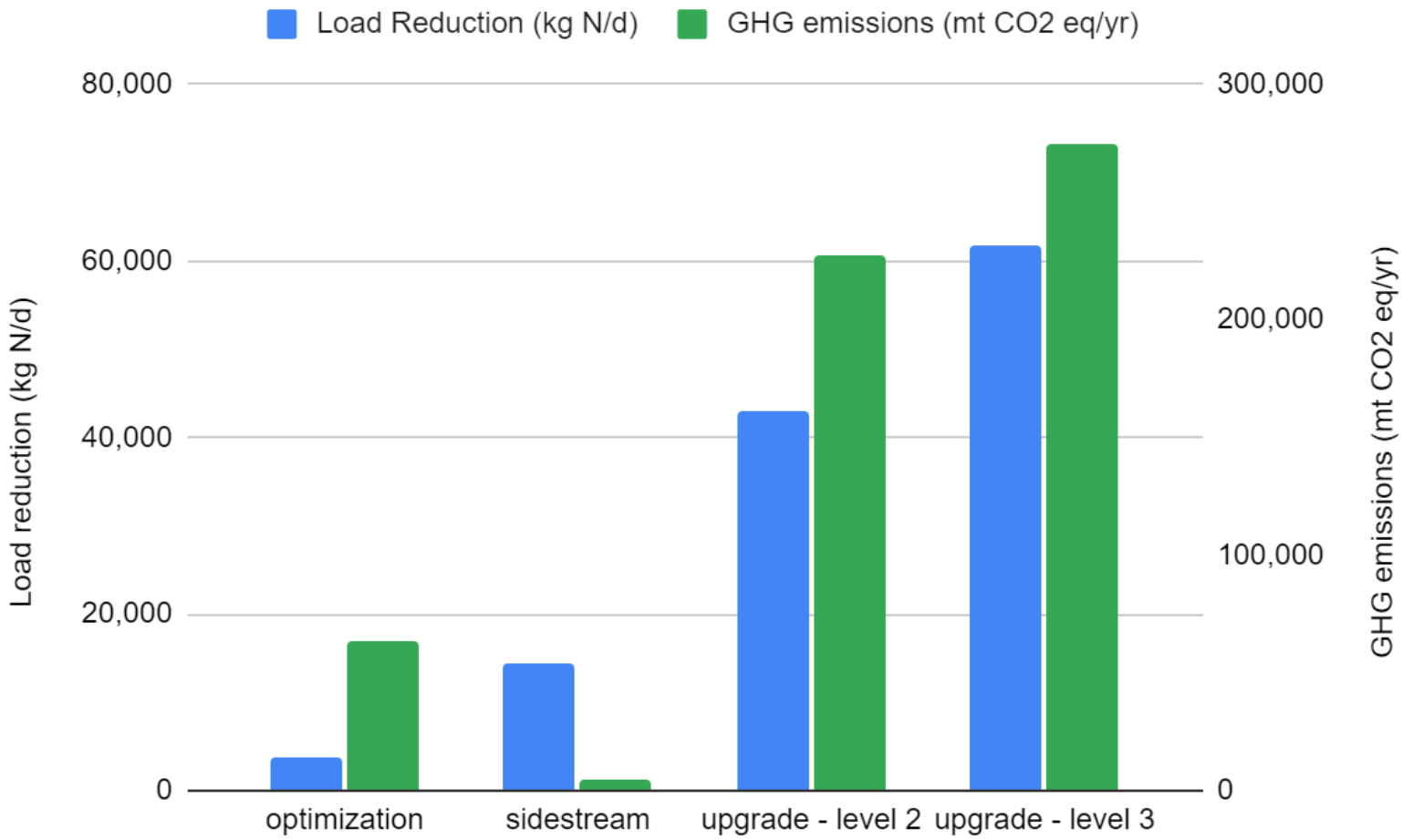
Summer 2018

1st Watershed Permit: Key Outcomes



Strategy	Total N Load Reduction to the Bay	Total Present Value for Total N Load Reduction to the Bay ($ Mil in 2018 $)
Optimization	**7%**	**$174 M**
Sidestream Treatment	**19%**	**$694 M**
Upgrade Level 2 (15 mg N/L)	**57%**	**$9.0 B**
Upgrade Level 3 (6 mg N/L)	**82%**	**$11.5 B**

GHG emissions increase with increased treatment



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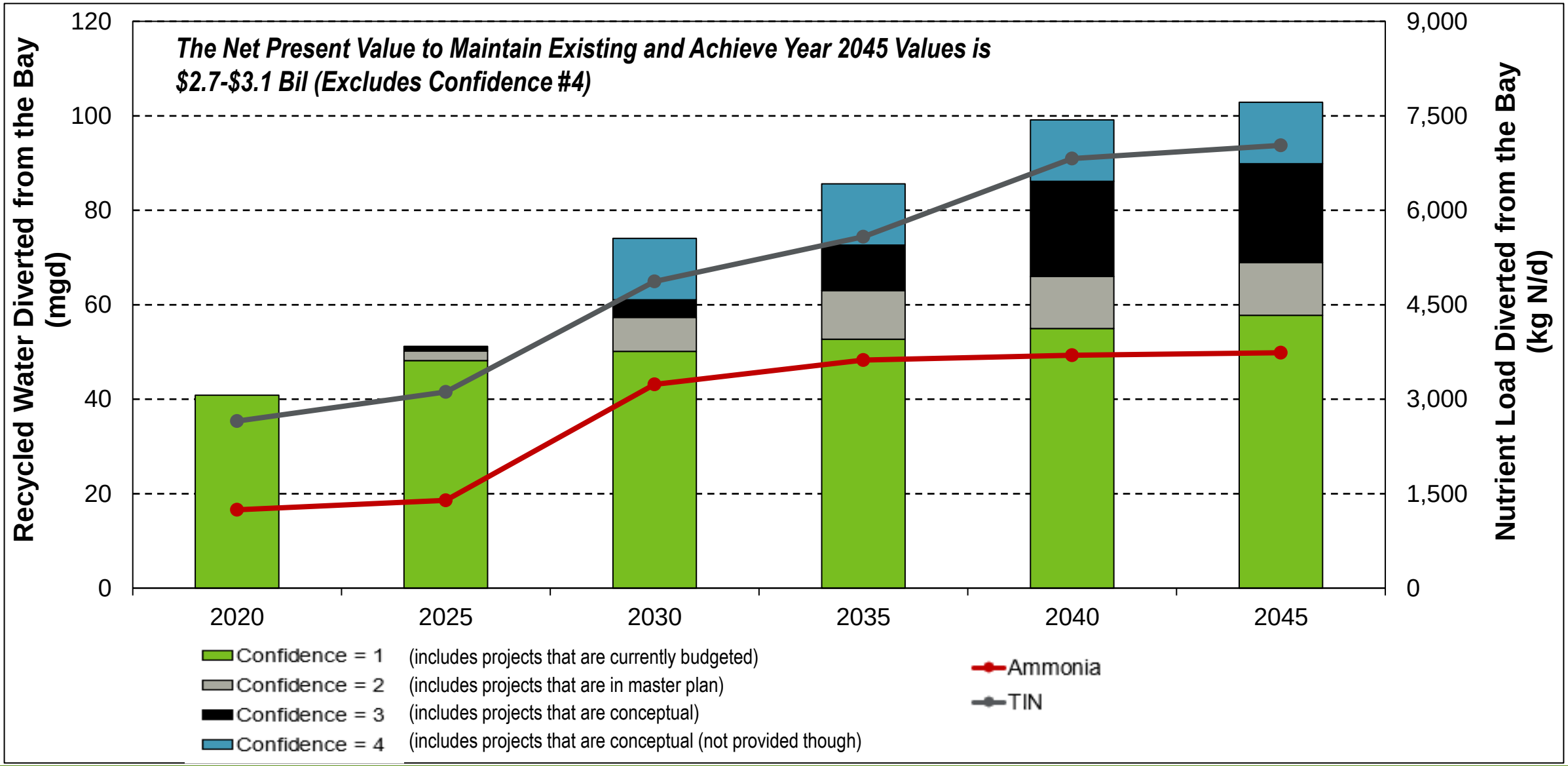
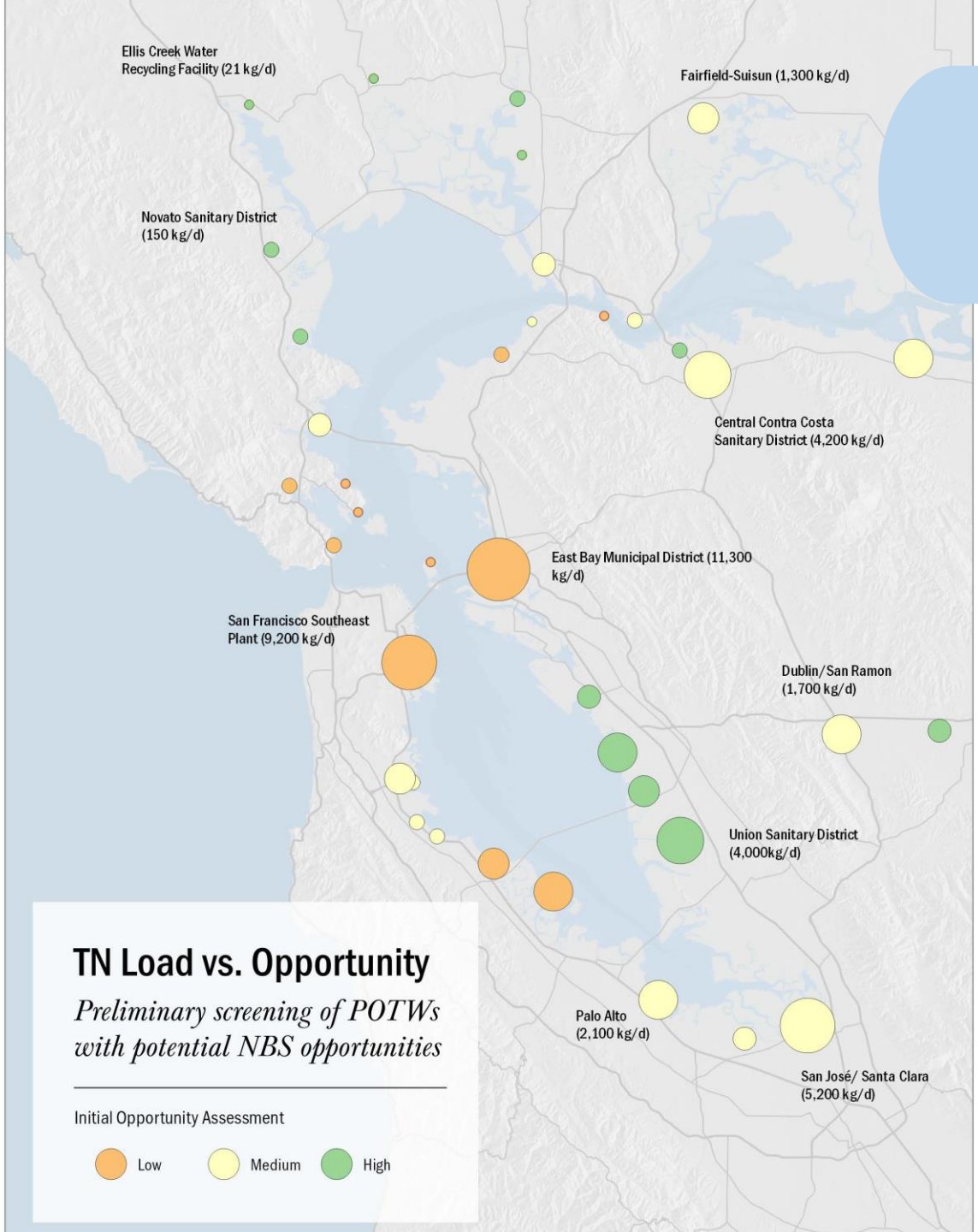
GHG emissions estimates include energy and chemicals, but not process emissions of methane and nitrous oxide.

DRAFT Recycled Water Flows Diverted from Bay Projected into the Future (Year-Round)



For Perspective: the Current Discharge Flows to the Bay are Approximately 400 mgd (about 9% of Effluent is Currently Recycled)

2nd Watershed Permit NBS Screening Results



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Benefits of a strategic regional approach to nutrient reduction

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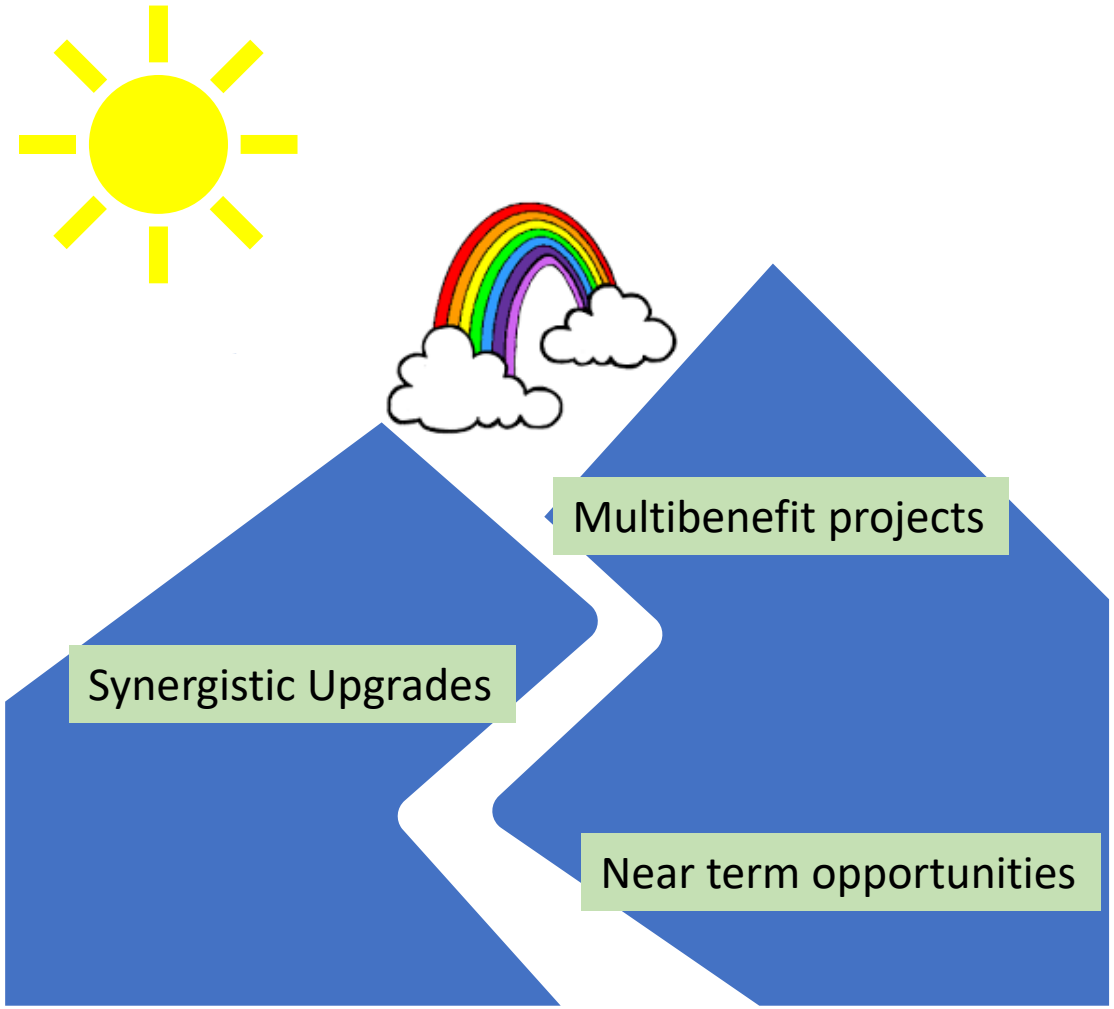
Should our region pursue aggressive or strategic nutrient reductions?

- Reduced nutrient loads in 10 years
- Maximized cost to ratepayers due to competition between agencies for funding and contractors
- Stranded assets

- Reduced nutrient loads over 0-25 years (near term opportunistic to long term re-envisioning of water management)
- Eventual load targets driven by science
- Balanced environmental priorities
- Multi-benefit projects for climate change resilience
- Emerging technologies to minimize energy, costs, footprint, etc.
- Nutrient trading for maximum efficiency
- Synergy with existing capital priorities and funding

What we gain from a phased regional approach



Our vision is to reduce nutrients substantially on a regional basis while implementing projects that maximize benefits and balance competing priorities

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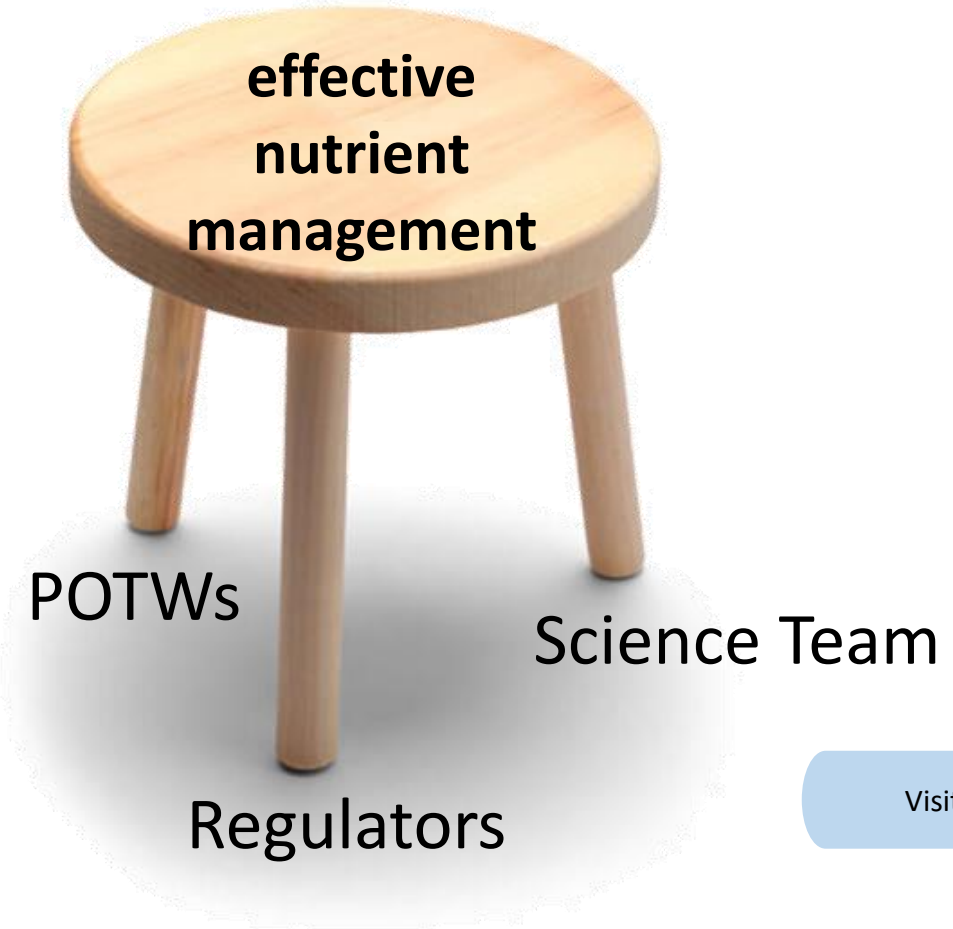
How will the science inform this approach?

1. Inform “how much” and “how fast”
2. Support understanding of boundary conditions
3. Weigh the importance of nutrients vs. non-anthropogenic factors
4. Support management goals with ratepayers and elected officials
5. Help us understand uncertainties



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What are the specific plans to further reduce nutrients?

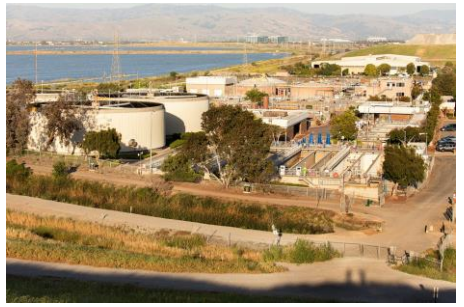
Several agencies already reduce nutrients substantially

- Most agencies get some nutrient removal via existing secondary processes and recycled water
- Several agencies have implemented upgrades to further reduce nutrients
- Existing recycled water programs reduce nutrients to the Bay
- Some examples:

DSRSD
>80% dry season TIN diverted via RW

Oro Loma SD
>80% TIN removal from influent

San Jose/Santa Clara RWF
85% TIN removal from influent



Sunnyvale
80% TIN removal from influent

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What's coming next?

2023 opportunities

- EBMUD – split stream treatment
- SFPUC – split stream treatment
- City of Richmond – optimization

Near-term opportunities 2024+

- SFPUC – Temporary sidestream treatment
- FSSD – Optimization
- City of San Leandro – Treatment Wetland
- Delta Diablo – Secondary improvements
- Silicon Valley Clean Water (sidestream to offset codigestion)
- EBMUD – "Right-size" resource recovery program

In-progress upgrades complete by 2029

- Union Sanitary District
- City of Hayward
- City of San Mateo
- City of Palo Alto
- City of Sunnyvale
- City of Pinole

Non-potable RW expansion by 2029

- American Canyon
- Central San
- Hayward
- Palo Alto
- San Mateo
- SFO
- Treasure Island

Multi-benefit project concepts – 2029+

- Central San – Potable Recycled Water
- Silicon Valley Clean Water – Potable Recycled Water
- FSSD – Nature Based Solution
- City of Hayward – Nature Based Solution
- San Jose – Upgrade to compensate for solids handling

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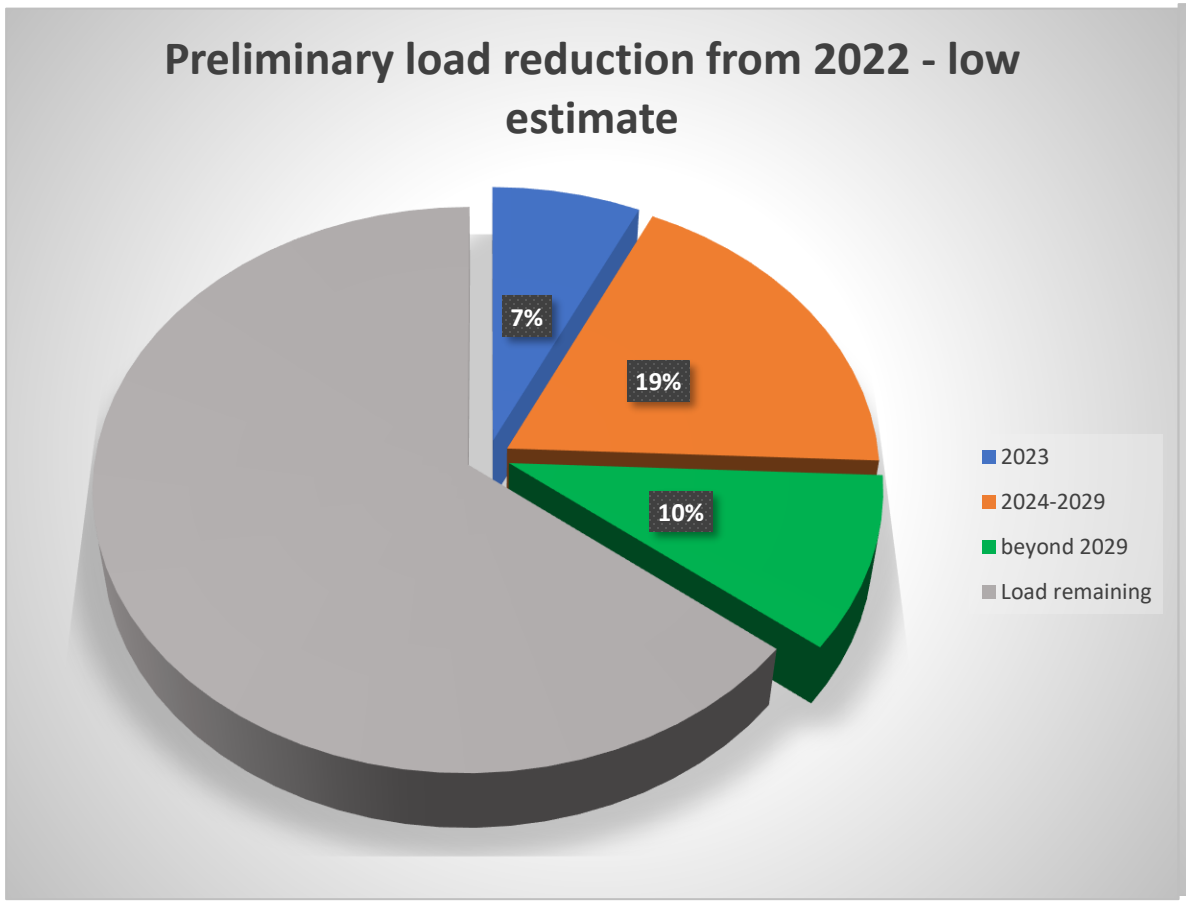
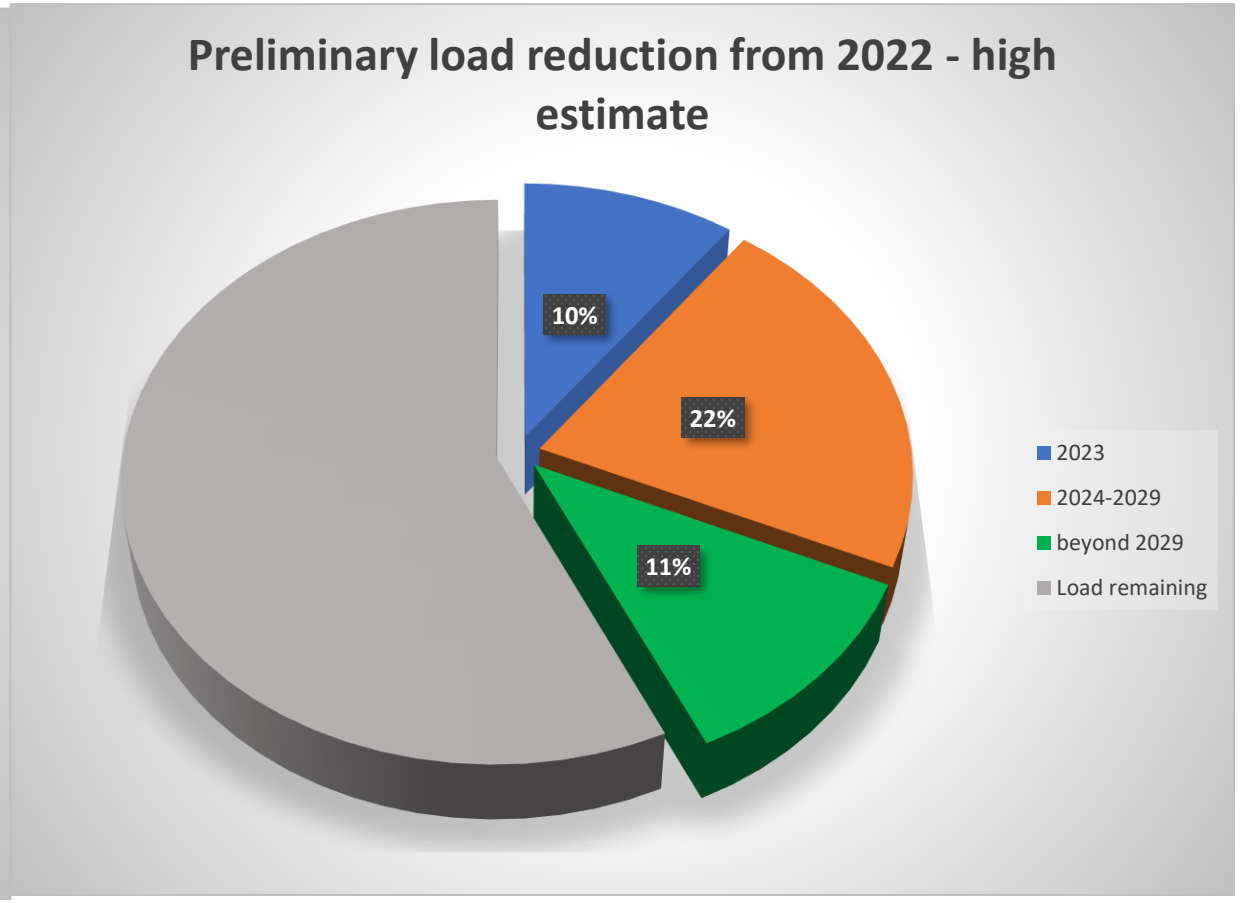
MORE TO COME

Preliminary difference in nitrogen compared to 2022





36 to 43% reduction from 2022

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Are there other opportunities to support a resilient Bay?

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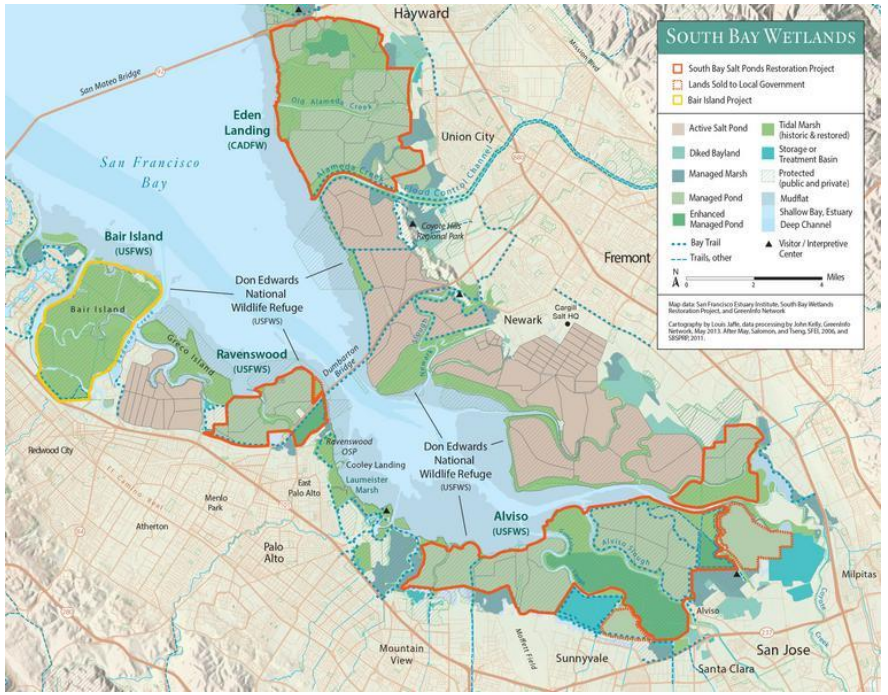
In addition to reducing nutrients, we can…

- Reorient the science program to:
  - Consider the impact of "green engineering" such as the use of oyster beds to increase grazing
  - Estimate the impacts South Bay salt pond management alternatives
- Explore the utility of restoration measures in suppressing harmful algal species
- Plan aerated refugia for fish during low DO events



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Thank You

Do you have any questions?

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