Nature-based Solutions for Nutrient Management

BACWA Annual Meeting // Feb 19, 2021

BACWA BAY AREA CLEAN WATER AGENCIES

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

The Project

- Requirement of Provision VI.C of the 2019 Nutrient Watershed Permit
- Estimate nutrient reduction potential, on a regional scale, via Nature-based Solutions
- Identify viable alternatives for further evaluation & implementation
- Secondary objective to address barriers to implementation and encourage multi-agency coordination

Project Elements

1. Data Collection & Screening

2. Site Specific Evaluation

3. Barriers & Coordination

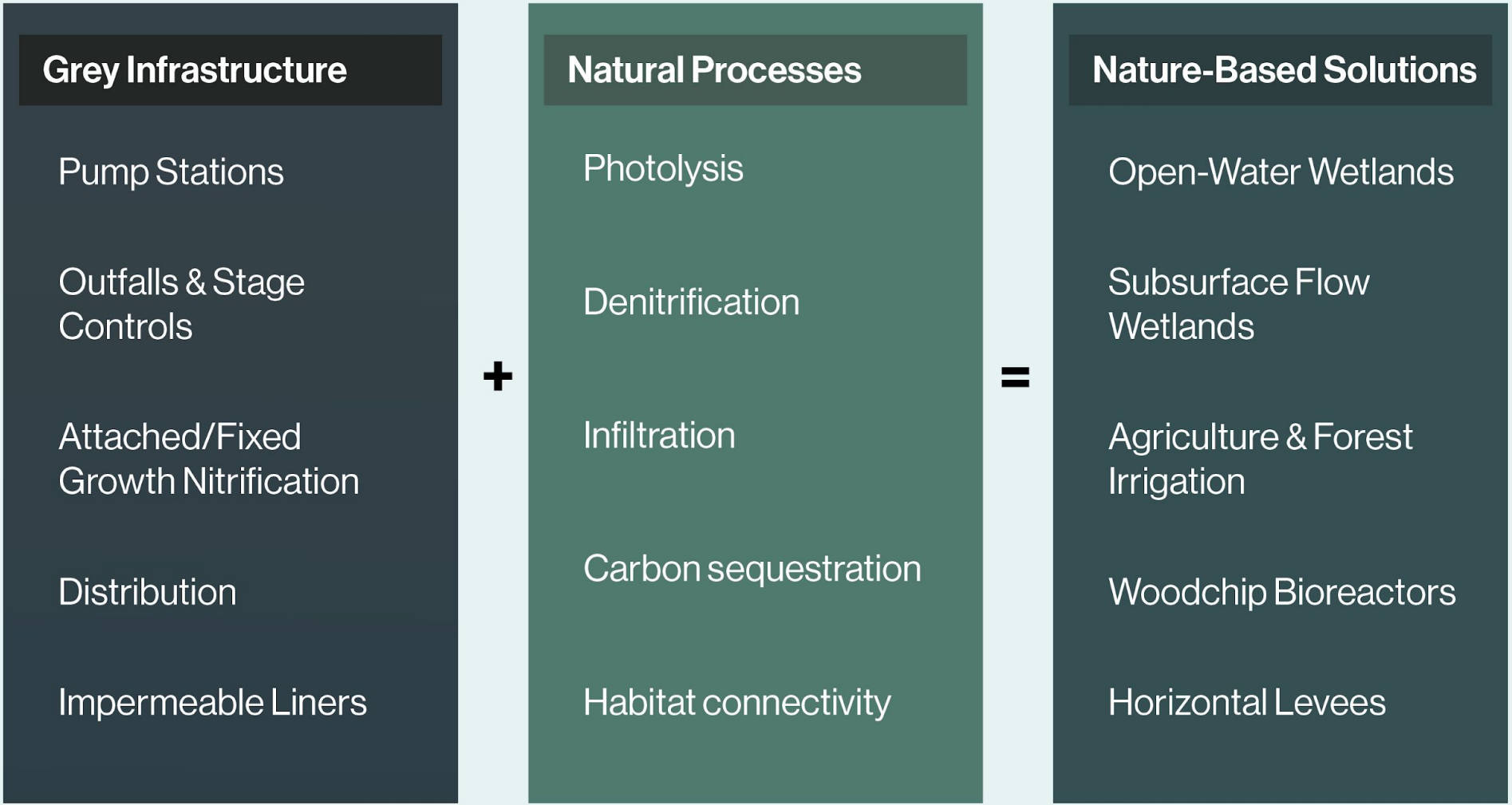
Current Status

1. Scoping & Evaluation Plan - **complete**
2. Surveys and desktop study - **complete**
3. Undergoing site-specific outreach to verify desktop results and narrow the range of candidate sites - **mid-2021**
4. Develop planning-level evaluation & design for subset of sites selected in coordination with project CMG - **mid-2022**
5. Coordination with aligned projects to advance regional progress of nature-based treatment & shoreline adaptation - **ongoing**

What are Nature-based Solutions?

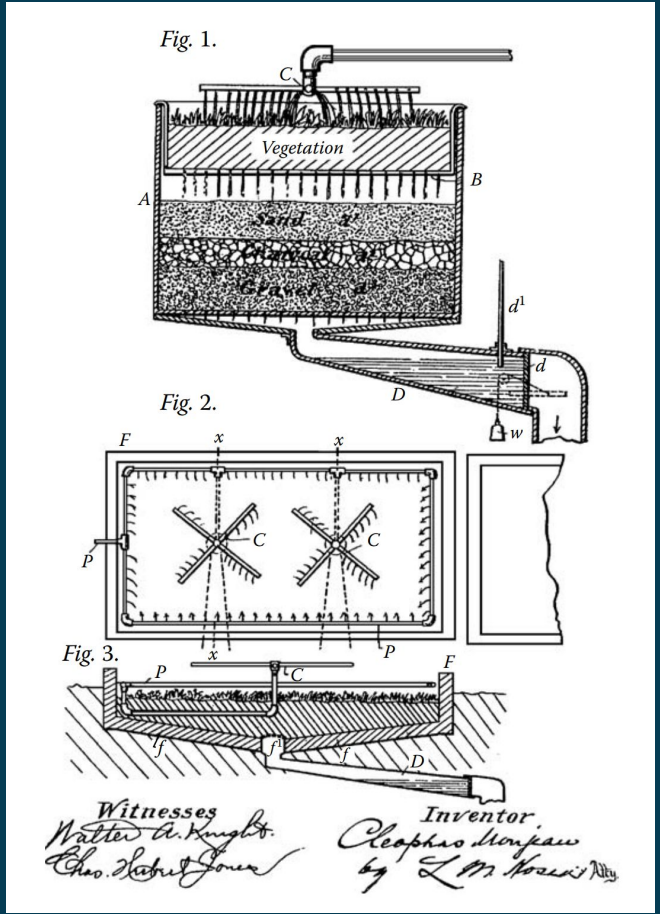
Engineered interventions that exploit natural processes to foster urban resilience and sustainability.

- Variant of several definitions


Grey Infrastructure
Pump Stations
Outfalls & Stage Controls
Attached/Fixed Growth Nitrification
Distribution
Impermeable Liners
+
Natural Processes
Photolysis
Denitrification
Infiltration
Carbon sequestration
Habitat connectivity
=
Nature-Based Solutions
Open-Water Wetlands
Subsurface Flow Wetlands
Agriculture & Forest Irrigation
Woodchip Bioreactors
Horizontal Levees

Back to the Future

Wastewater treatment evolved from natural systems and is constantly iterating



1901 U.S. patent for a treatment wetland system. (From U.S. Patent 681,884.) Courtesy Kadlec and Wallace 2009.

Horizontal Levees

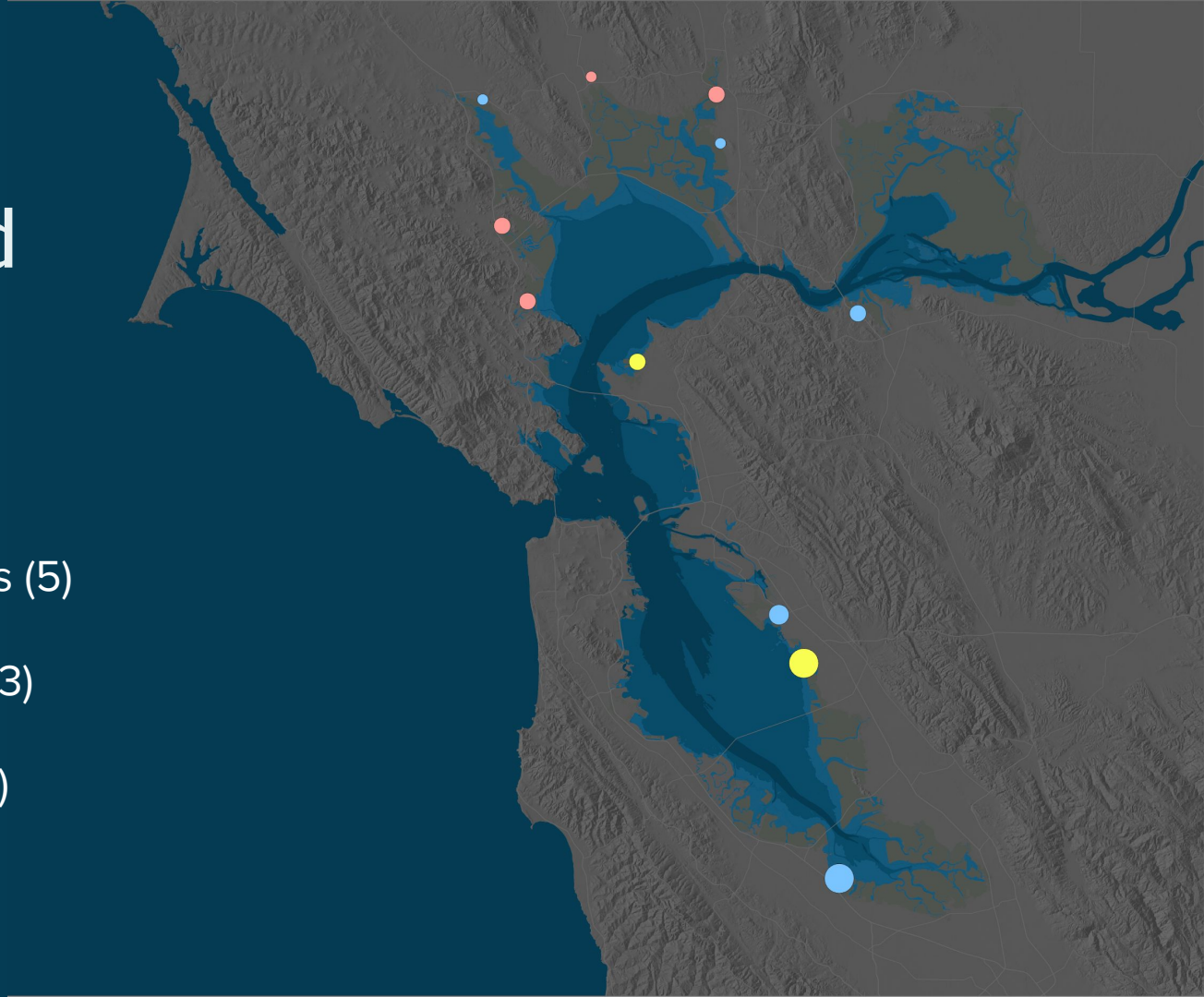
Oro Loma horizontal levee. Photo: SFEP

Unit-Cell Open Water Wetlands

Photo: David Sedlak

Existing or Planned NbS Facilities

- Treatment Wetlands (5)
- Horizontal Levees (3)
- Land Application (4)



Nutrient Watershed Permittee Survey

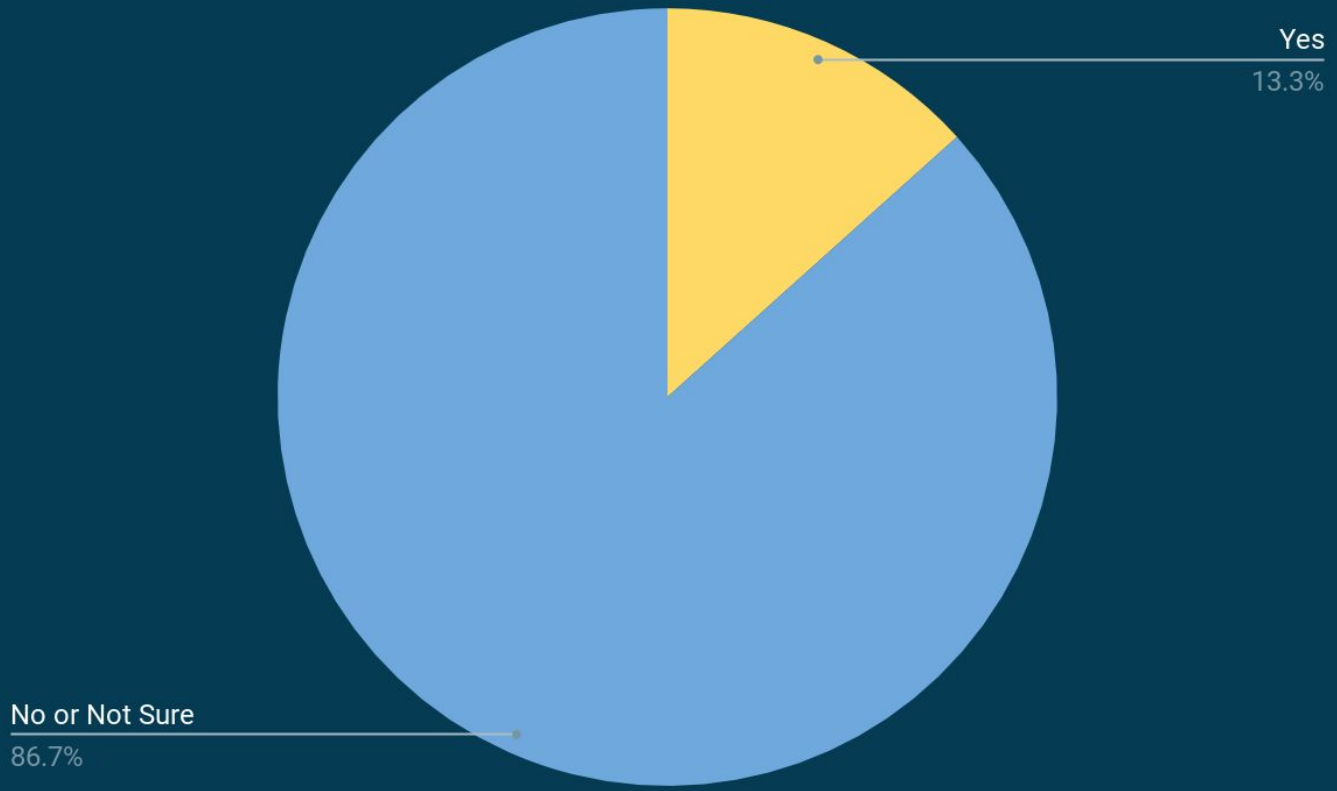
- Joint request for information from HDR (recycled water) and SFEI (NbS)
- Results will inform selection of facilities for site-specific investigation

Survey

Has your agency considered nature-based solutions for wastewater treatment/ disposal?

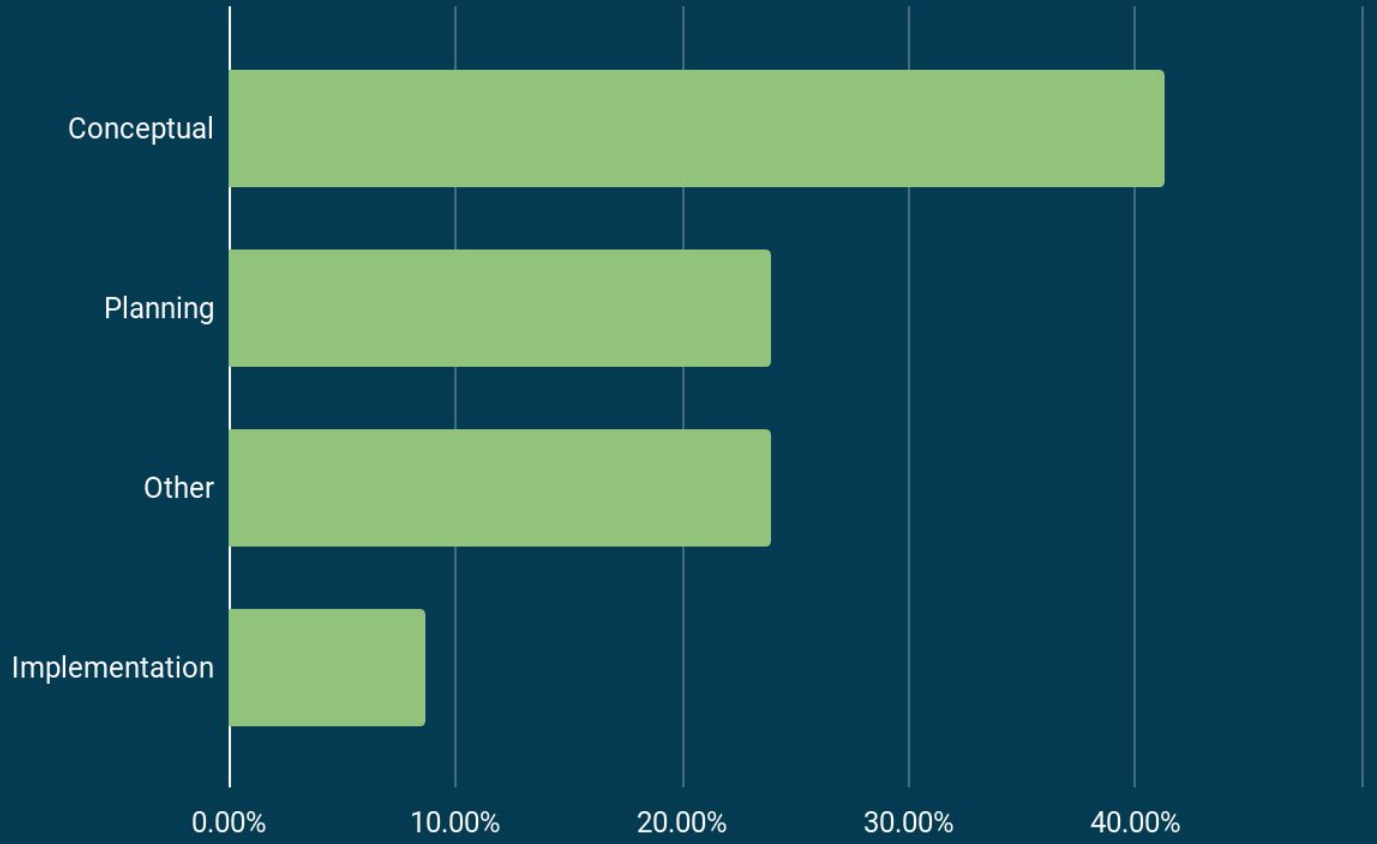
Survey

Do your capital improvement plans consider or plan for implementation of NbS for wastewater treatment or other purposes?



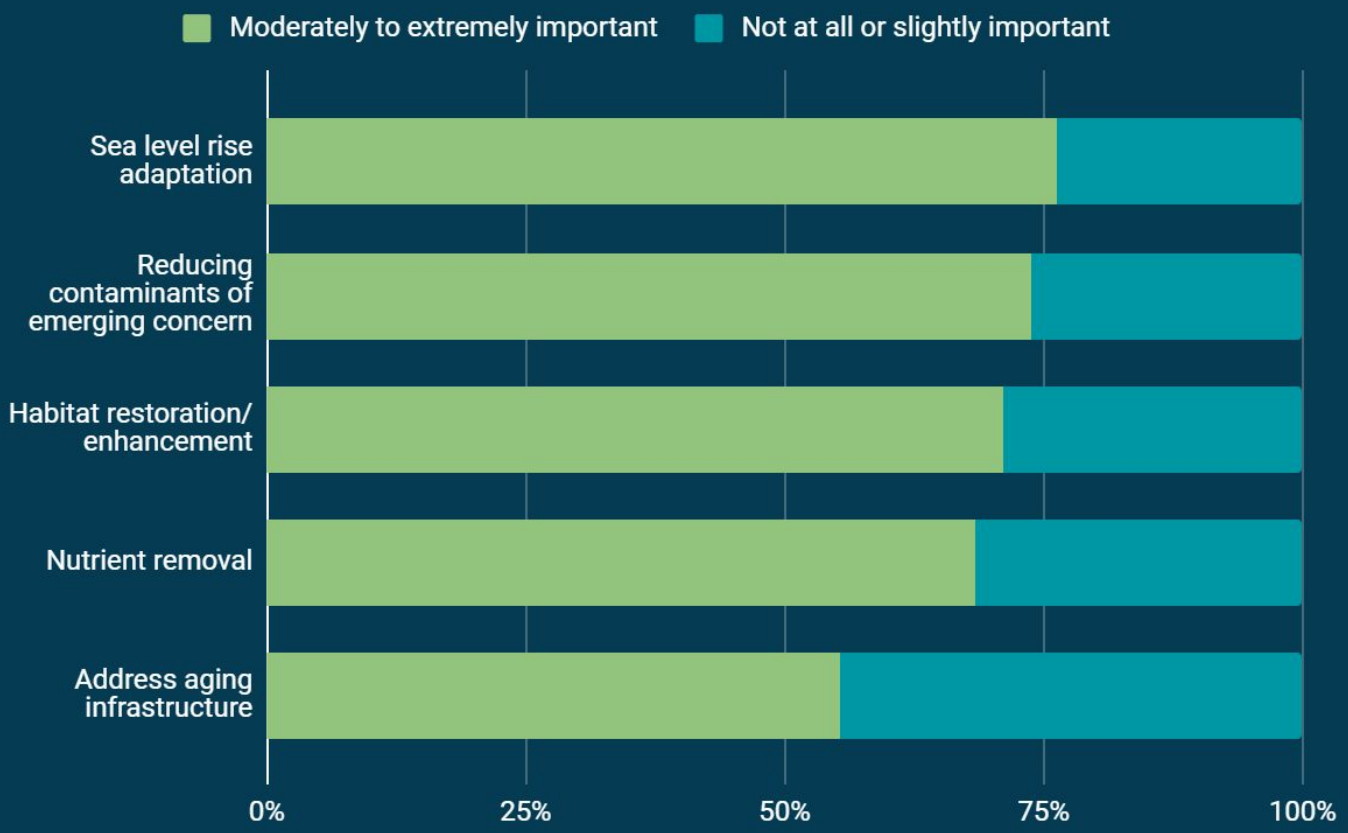
Survey

Describe the level of planning/ implementation performed to date.



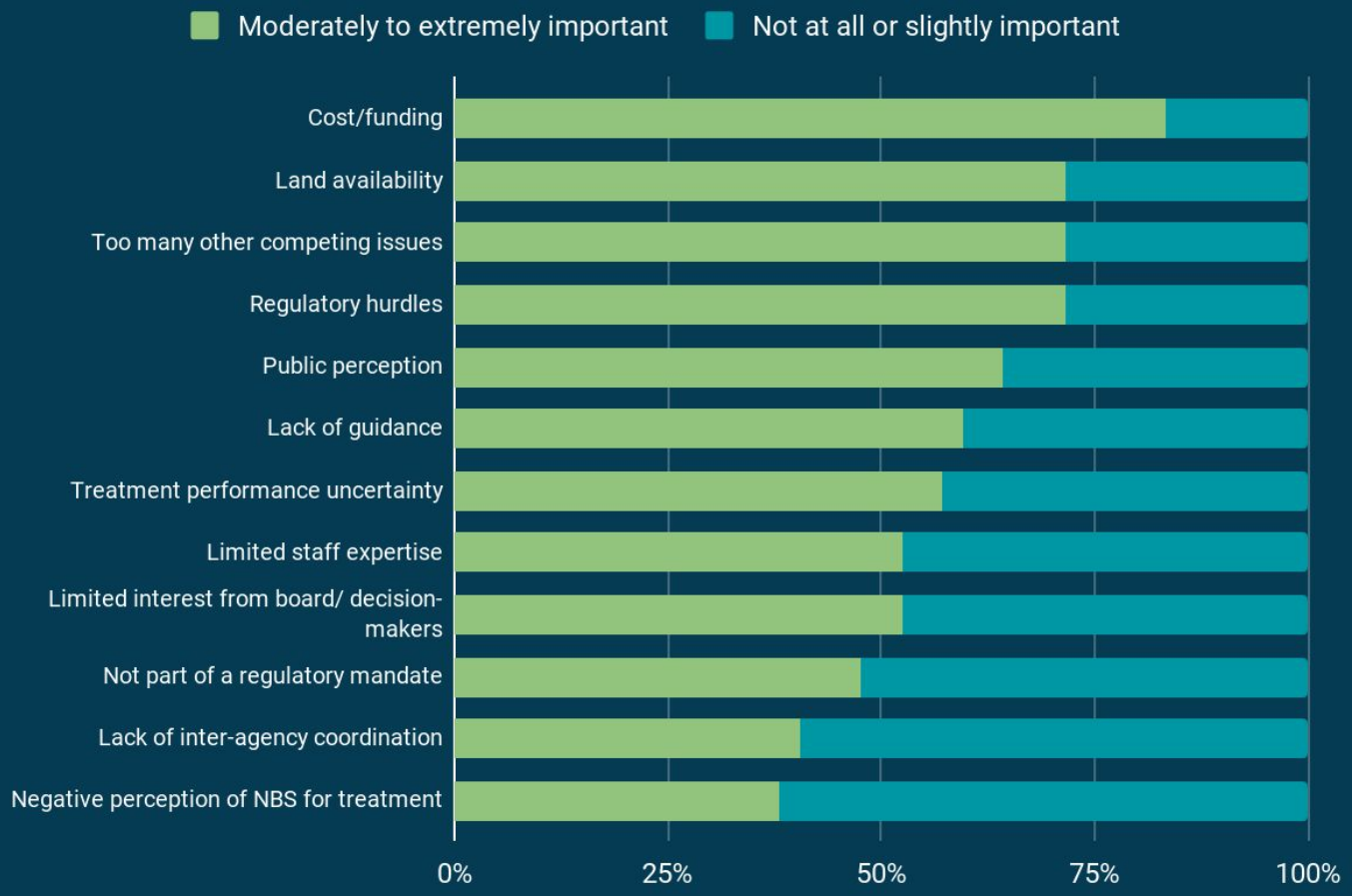
Survey

Rate your agency's interest in pursuing NbS according to the following objectives:



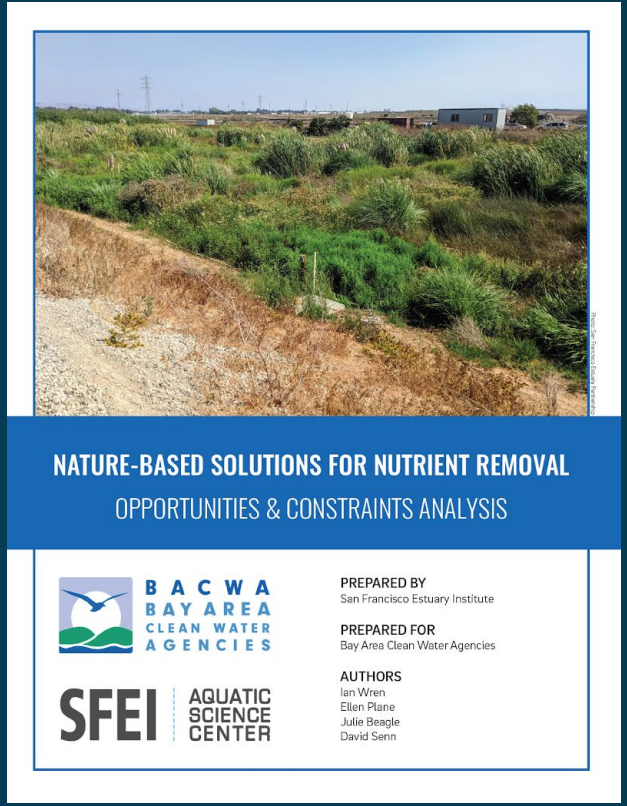
Survey

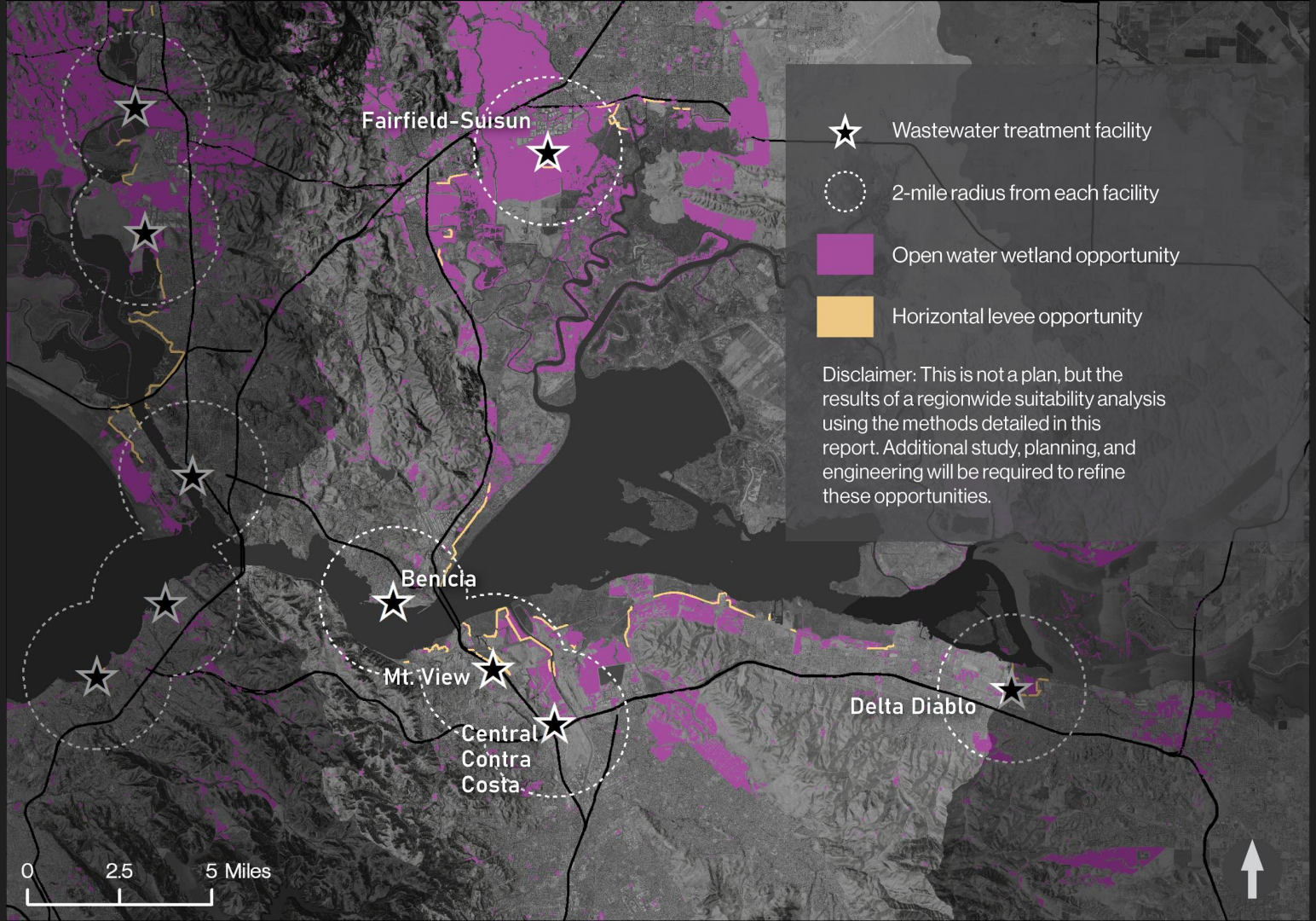
Rate the following factors, in terms of preventing or constraining your agency's adoption of NbS for wastewater treatment:

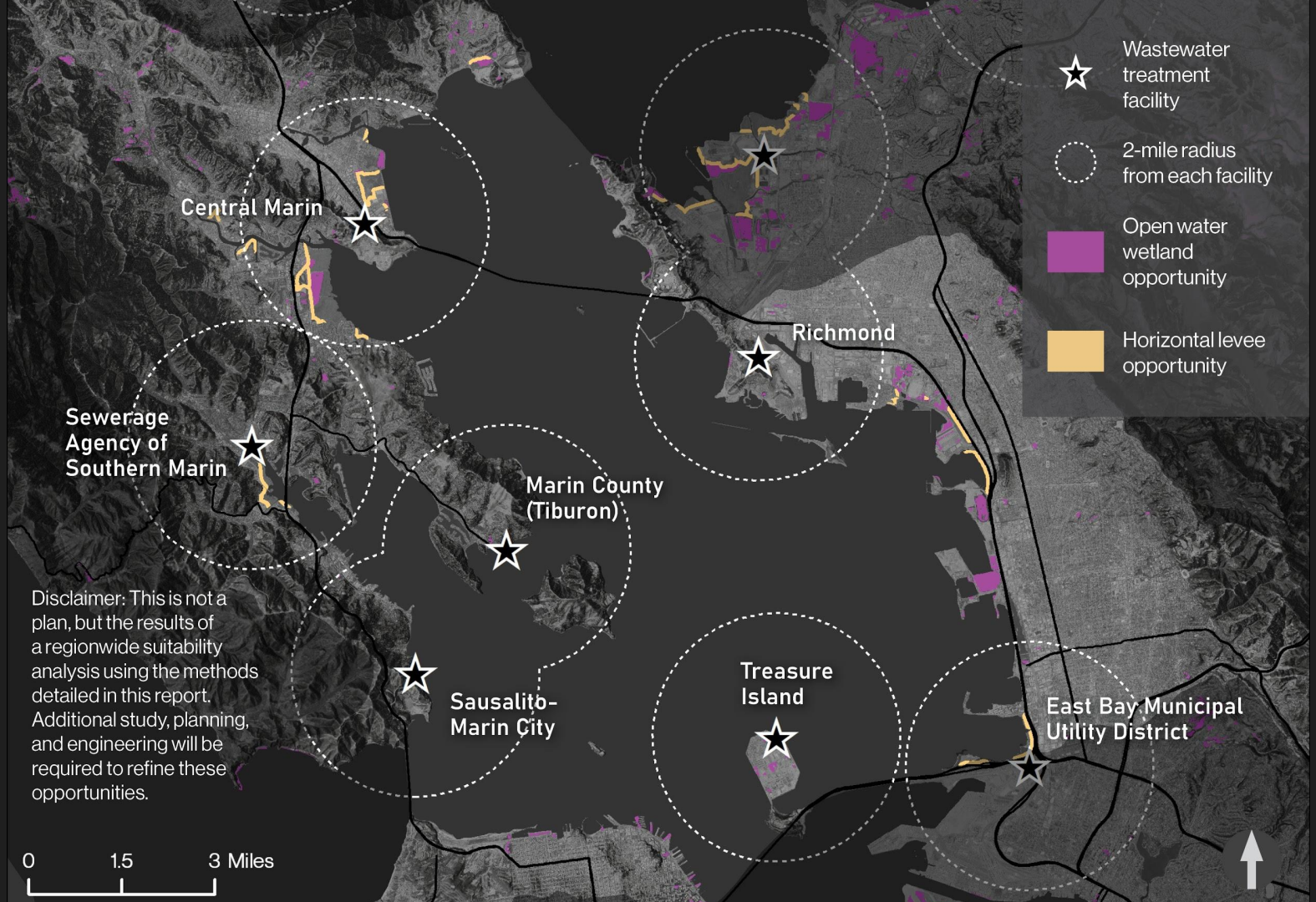


Desktop Study of Opportunities & Constraints

- Leverages the Adaptation Atlas to identify opportunities for open water treatment wetlands and horizontal levees
- Estimate potential nutrient load reductions associated with modeled areas
- Generate factsheets to communicate opportunities and constraints
- Inform site-specific analyses at WWRFs with high NbS potential




Fairfield-Suisun
Benicia
Mt. View
Central Contra Costa
Delta Diablo
Wastewater treatment facility
2-mile radius from each facility
Open water wetland opportunity
Horizontal levee opportunity
Disclaimer: This is not a plan, but the results of a regionwide suitability analysis using the methods detailed in this report. Additional study, planning, and engineering will be required to refine these opportunities.
0
2.5
5 Miles


Wastewater treatment facility
2-mile radius from each facility
Open water wetland opportunity
Horizontal levee opportunity
Central Marin
Richmond
Sewerage Agency of Southern Marin
Marin County (Tiburon)
Sausalito-Marin City
Treasure Island
East Bay Municipal Utility District
Disclaimer: This is not a plan, but the results of a regionwide suitability analysis using the methods detailed in this report. Additional study, planning, and engineering will be required to refine these opportunities.
0
1.5
3 Miles

CENTRAL CONTRA COSTA SANITARY DISTRICT

NATURE-BASED TREATMENT SOLUTIONS

The Central San Wastewater Treatment Plant discharges non-nitrified effluent to Suisun Bay. The facility serves ~115,000 service connections in Contra Costa Co. - with a dry weather permitted capacity of 53.8 mgd and average dry weather flows of ~32 mgd. Central San has indicated on-site options for NbS are limited given space requirements for wet weather storage. Habitat restoration and flood control projects in the area represent potential partnership opportunities.

Preliminary Findings

Multiple opportunities for open water wetlands were identified, including some adjacent to the facility. If open water wetlands were implemented at all three highlighted sites, nitrified TIN loads could be reduced by about 30%. If the nearest horizontal levee opportunity was implemented, TIN loads could be reduced by about 3%.

Opportunities & Constraints

A promising opportunity for the Central San plant is a potential partnership with the Lower Walnut Creek Restoration Project. Options for hybrid wet weather storage and NbS-based nutrient removal in the summer may be possible. The likely need for nitrification represents a significant hurdle.

Photo courtesy of Google Earth

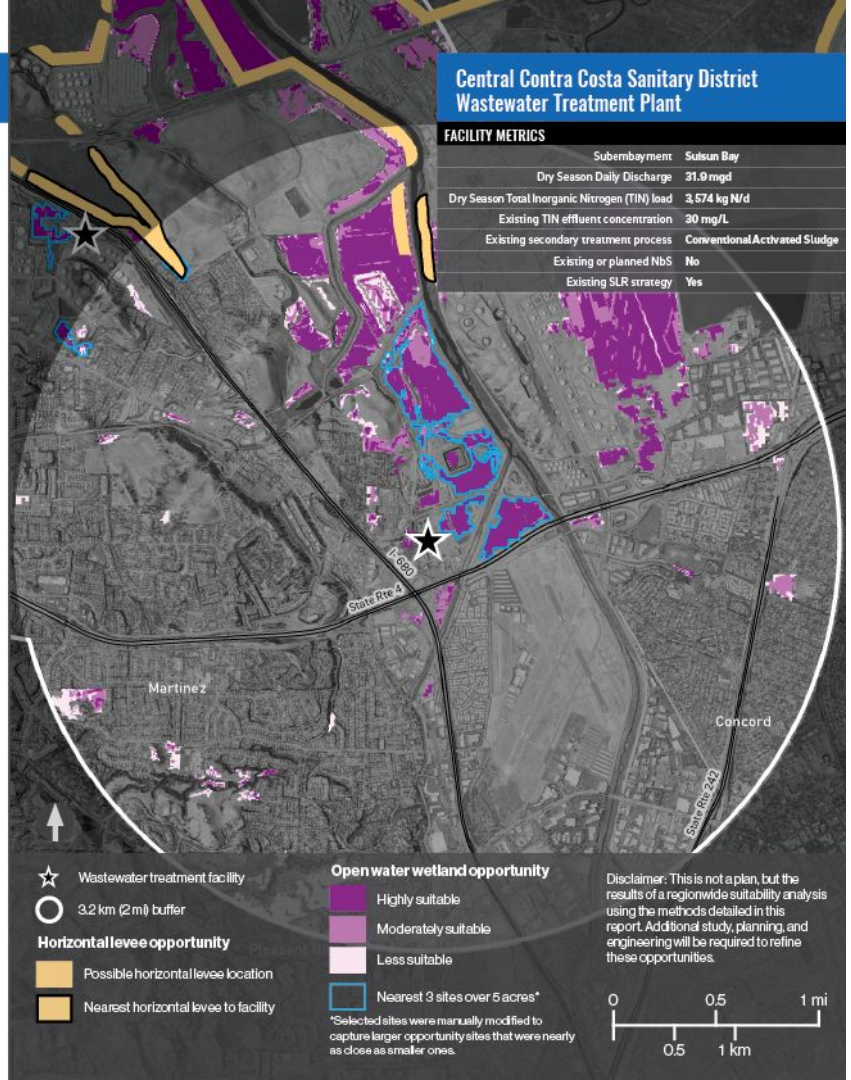
Refer to pages 14-15 for a key to interpreting the metrics in the following tables:

Overall suitability for nature-based treatment solutions	
Measure	**Suitability**
Open water wetlands	High
Horizontal levees	Moderate

Open water wetland opportunities	*open water wetlands on map*
Within 2 miles of facility	
Total Potentially Suitable Area	685 acres
Nearby sites over 5 acres (highlighted in blue on map)	
Potentially Suitable Area	4 - 37 acres
Total Potential Flow Capacity	0.3 - 10.9 mgd
Total TIN Reduction Potential	30 - 1,230 kg/day
Facility-Specific TIN Reduction	1% - 31%

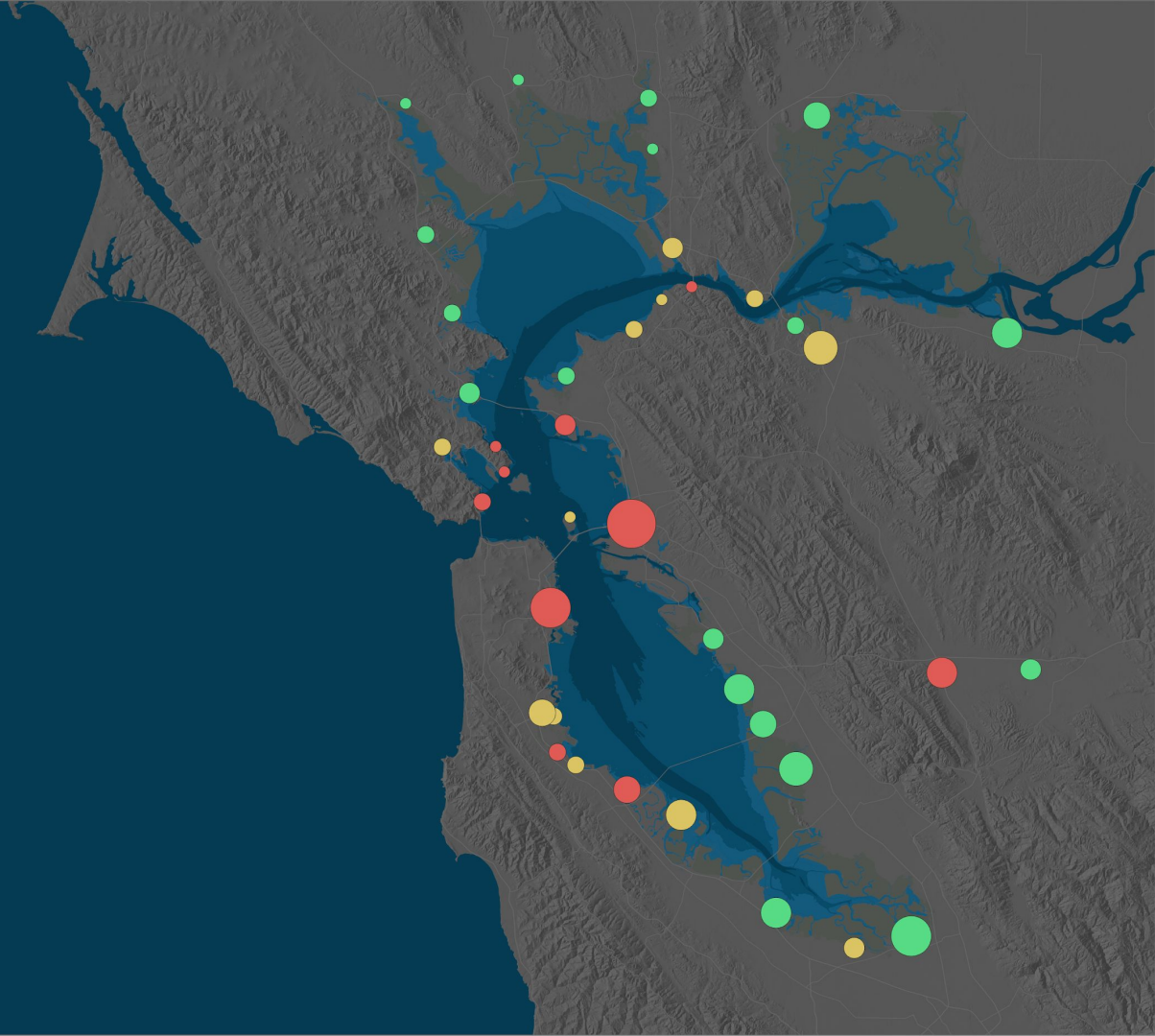
Horizontal levee opportunities	*horizontal levees on map*
Potentially Suitable Length	0.7 - 8.3 km
Total Potential Flow Capacity	1.3 - 14.2 mgd
Total TIN Reduction Potential	100 - 1,090 kg/day
Facility-Specific TIN Reduction	3% - 30%

Site opportunities and constraints	
Consideration	**Relative Magnitude**
Excess Treatment Capacity	Moderate
Land Use/Regulatory Conflicts	Moderate



Preliminary Results: Opportunity

- High Potential (18)
- Medium Potential (12)
- Low Potential (10)



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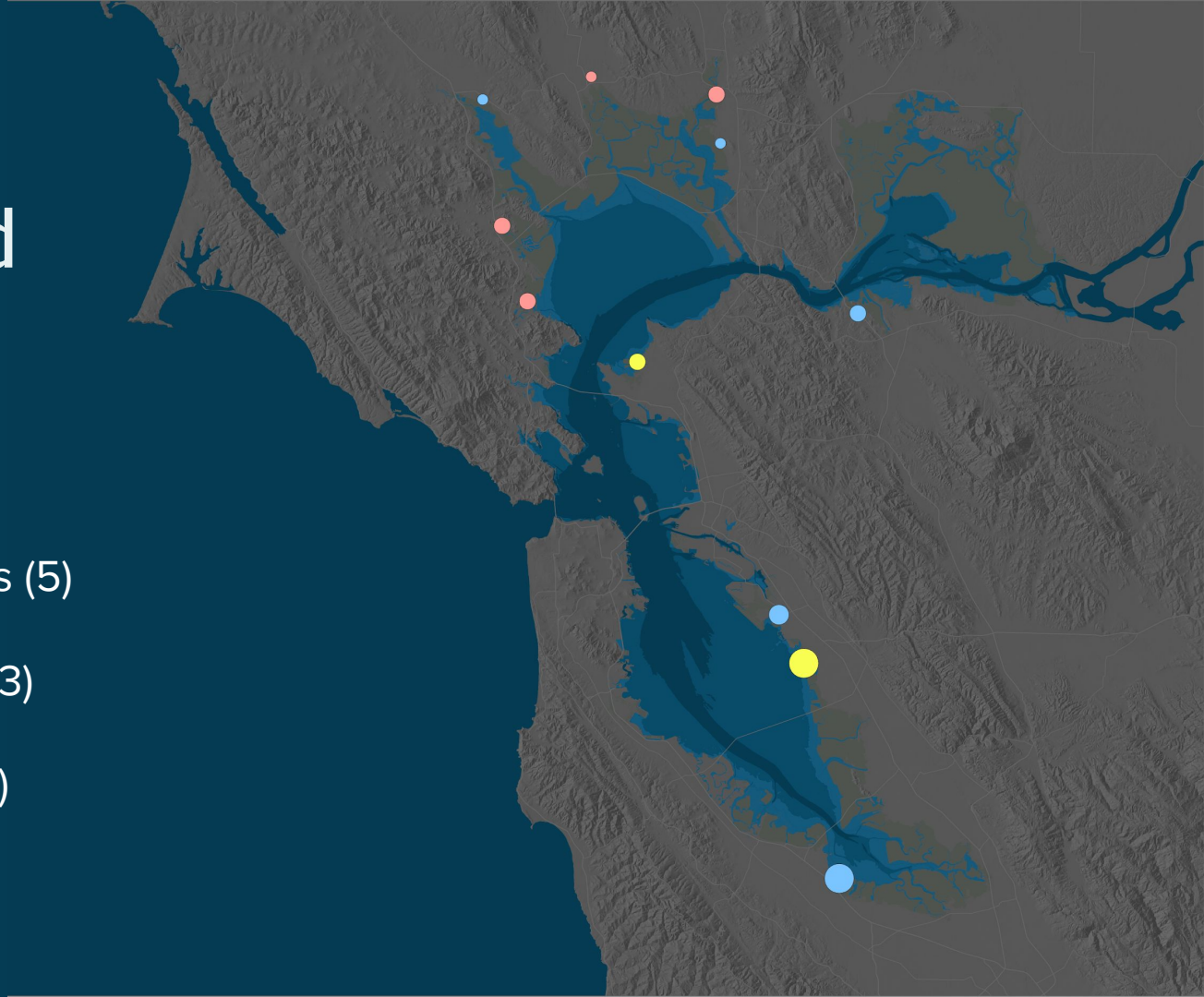
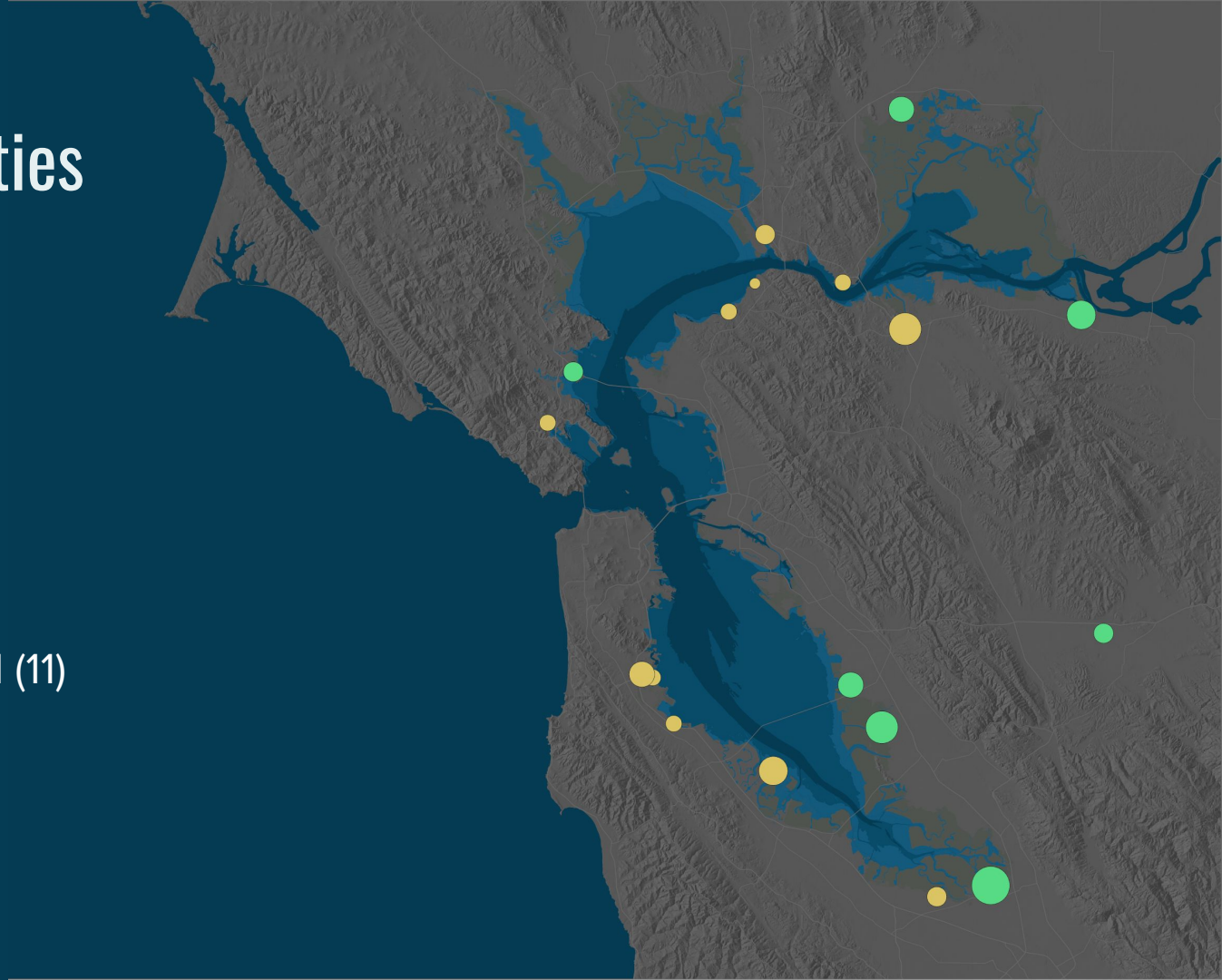


Remaining Facilities with Medium to High Potential



- High Potential (7)
- Medium Potential (11)

Nexus to Other Projects

Nature-based solutions for shoreline resilience & water quality improvement is an emerging regional priority.

How to integrate a diversity of objectives is the challenge:

- Habitat restoration
- Recreation & education
- Flood risk
- Recycled water concentrate management

Photo: USFWS

Coordinating with Aligned Projects

Regulatory

- Regional Board Basin Planning
- BCDC Bay Plan Amendments

Capacity & Governance

- Transforming Shorelines (SFEP)
- Bay Adapt (BCDC)
- ReNUWIt / Bay Area One Water
- Plan Bay Area (MTC)

Technical

- Valley Water - RO concentrate management
- Transforming Shorelines
- Operational Landscape Units

THANK YOU AND PLEASE GET IN TOUCH!

Ian Wren, Ellen Plane, Jeremy Lowe, David Senn

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