2025 CALIFORNIA LAND RECYCLING CONFERENCE
TRANSFORMING LAND, EMPOWERING COMMUNITIES

Changing Tides

Coastal Climate Adaptability

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BROWNFIELDS AND LAND REVITALIZATION
OFFICE OF BROWNFIELDS
Department of Toxic Substances Control · Cleanup In Vulnerable Communities Initiative
CENTER FOR CREATIVE LAND RECYCLING
RECLAIM. CONNECT. TRANSFORM.

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Introduction to Changing Tides: Coastal Climate Adaptability

Christina Rain, P.E.
Langan Engineering and Environmental Services

Presented to

FROM THE GROUND UP
CALIFORNIA LAND RECYCLING CONFERENCE
SEPTEMBER 17-19 2024
CARSON, CA

Speakers

Christina Rain, PE
Senior Project Manager, Langan

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Changing Tides: Coastal Climate Adaptability

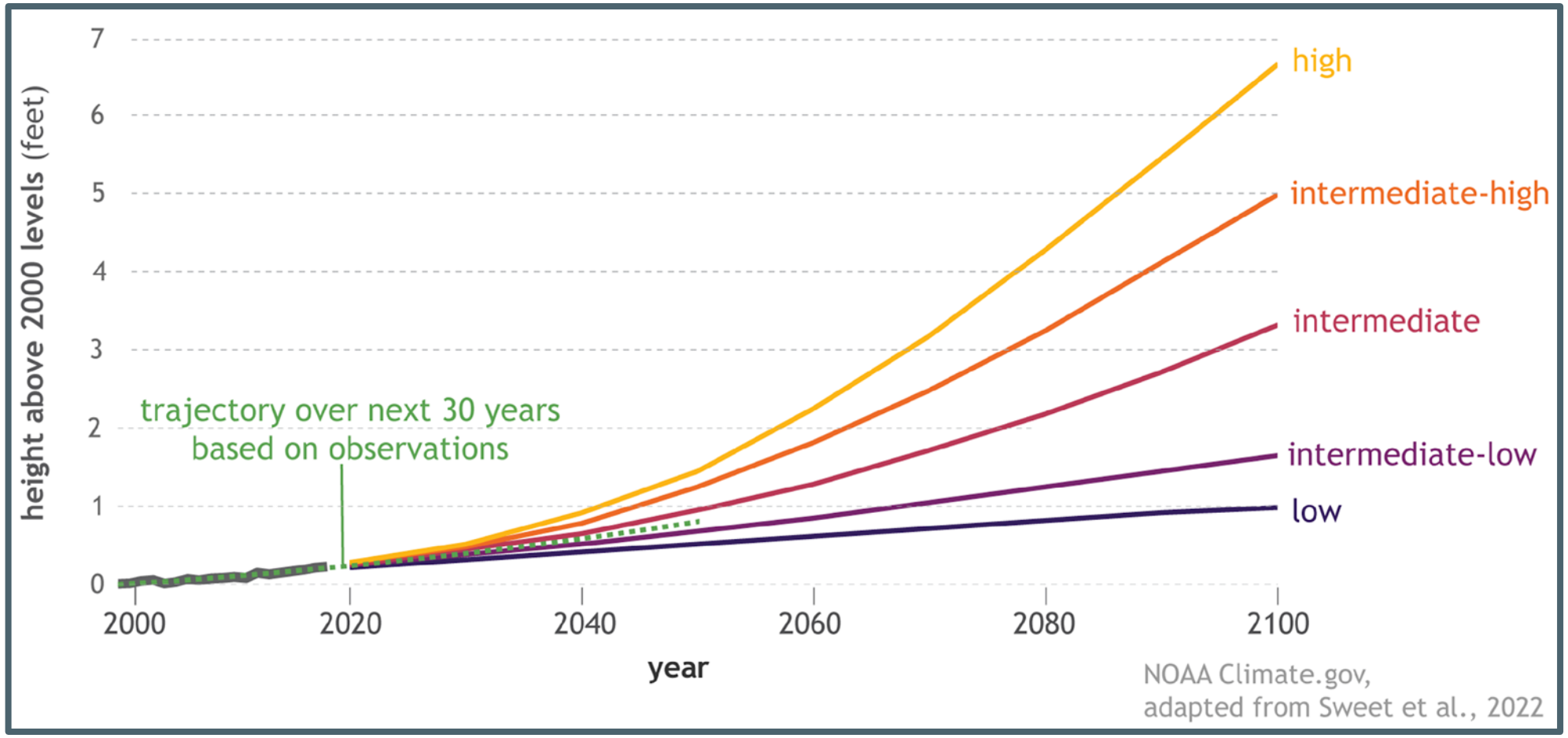
As sea levels rise and climate policies evolve, coastal brownfields—including former landfills—face urgent challenges that demand innovative, resilient solutions.

This session explores how vulnerable shoreline sites in island and coastal communities can adapt to climate impacts while supporting sustainable redevelopment.

Introduction

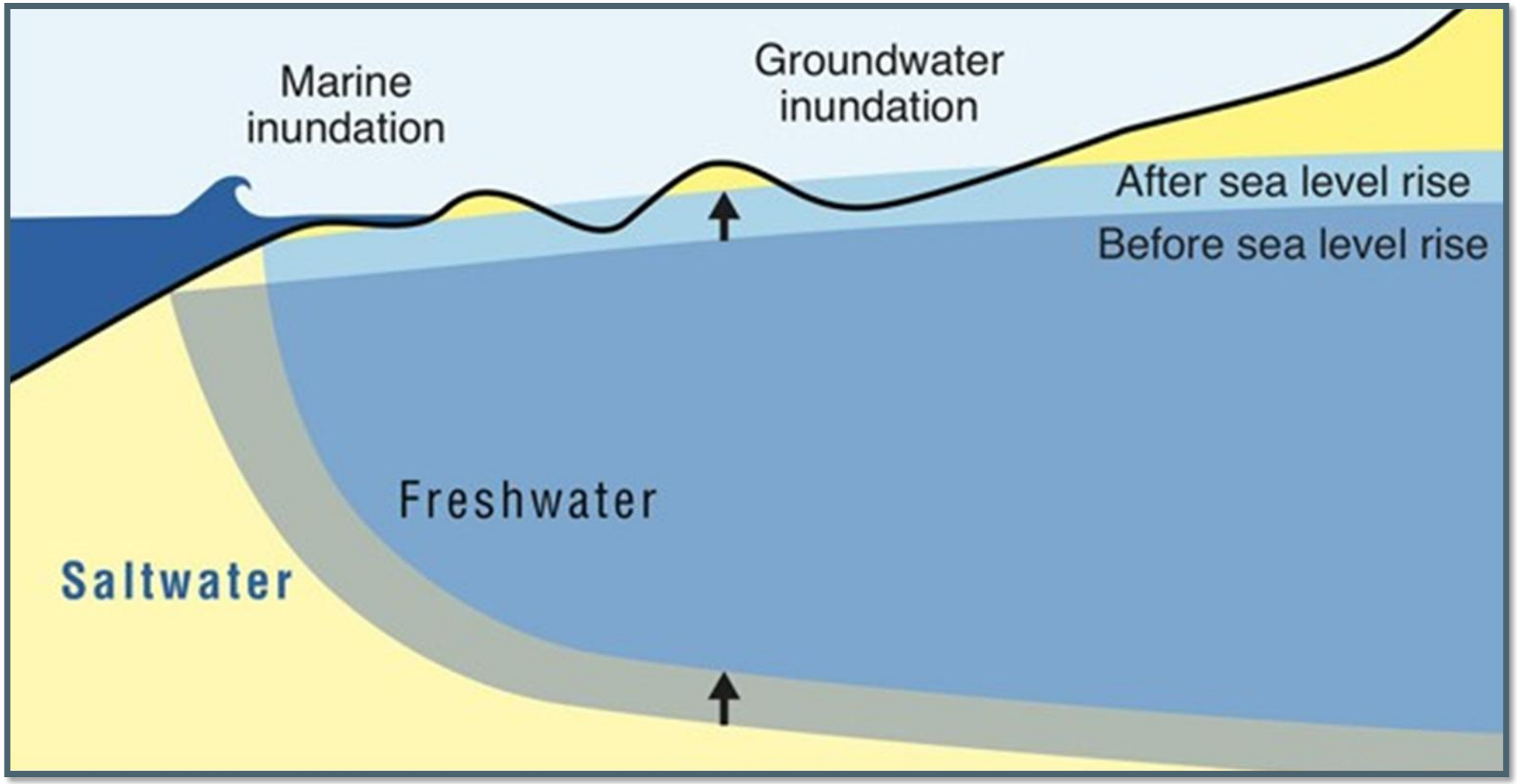
- What is sea level rise? And why is it a concern?
- How can sea level rise and groundwater level rise impact brownfields?
- What are the regulatory drivers for assessing sea level rise at brownfields?
- Case studies and solutions for assessment and adaptation

Possible Pathways for Future Sea Level Rise



Source: U.S. National Oceanic and Atmospheric Administration (NOAA), 2022

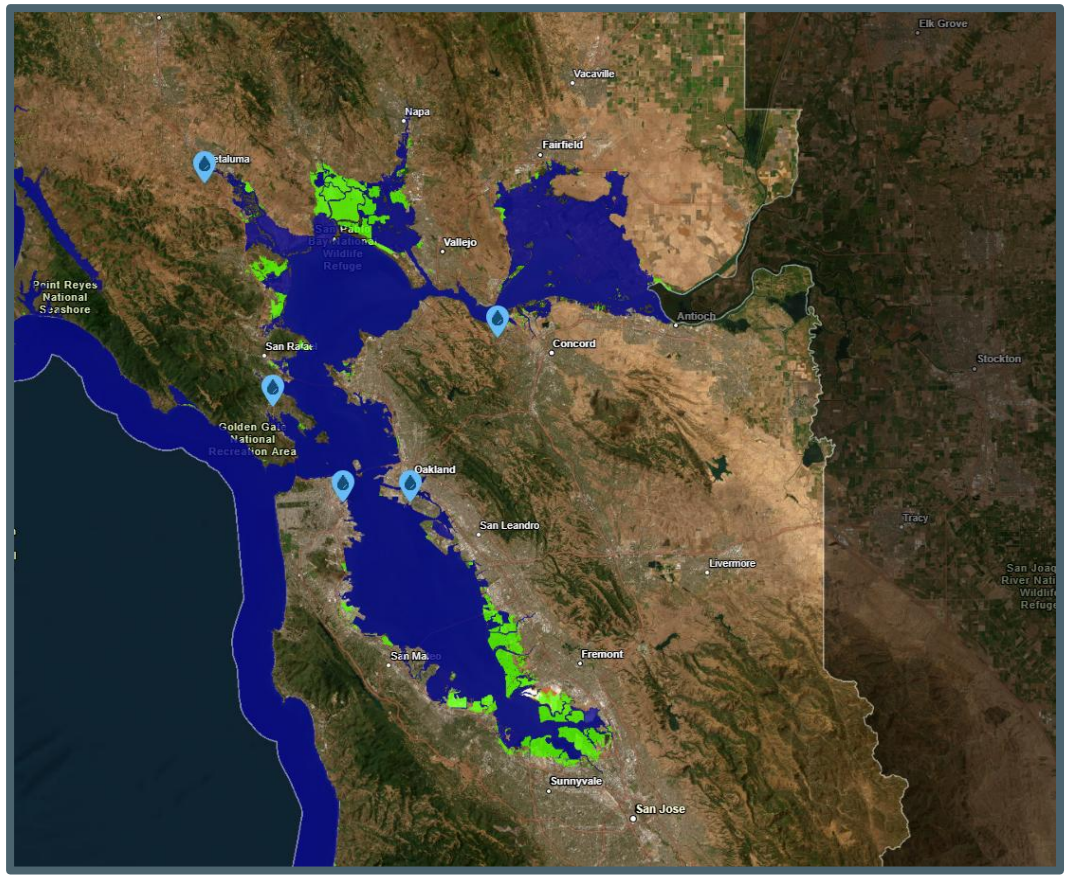
Groundwater Level Rise due to Sea Level Rise



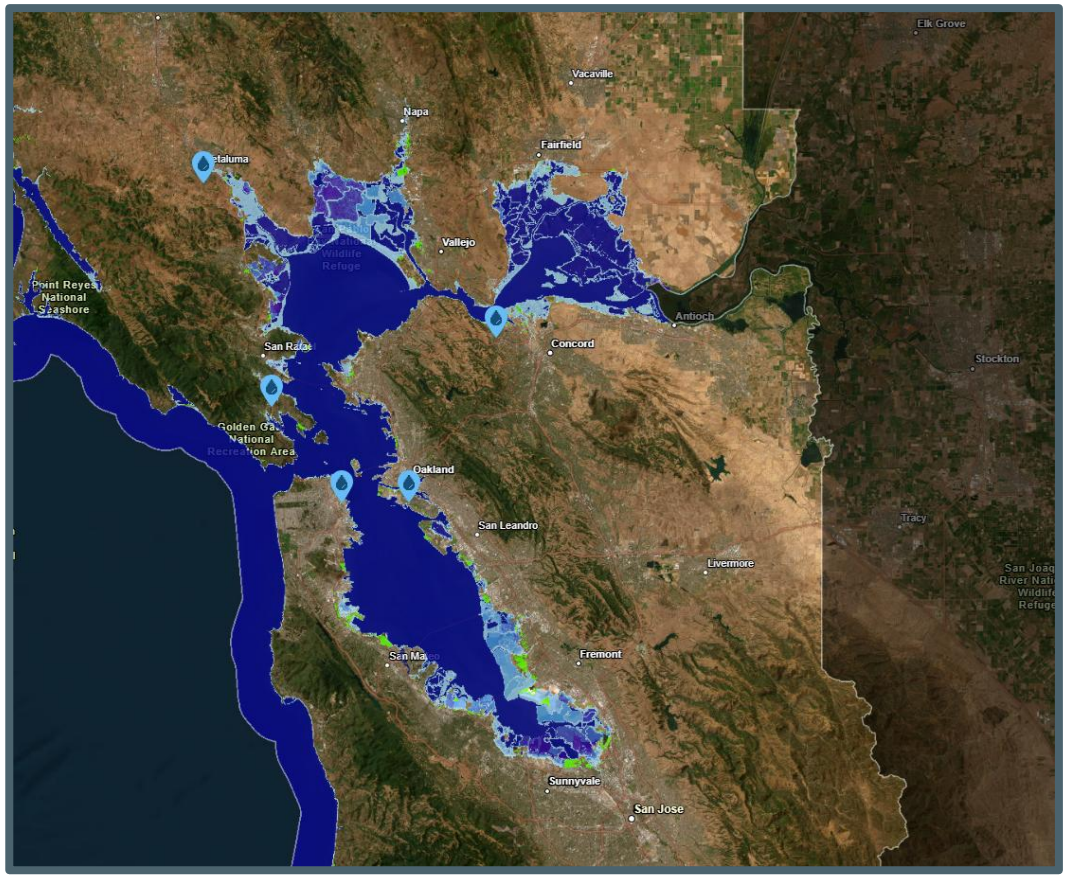
Source: UH Mānoa Coastal Geology Group and Nancy Hulbirt

NOAA Sea Level Rise Viewer and Calculator

U.S. National Oceanic and Atmospheric Administration, 2025

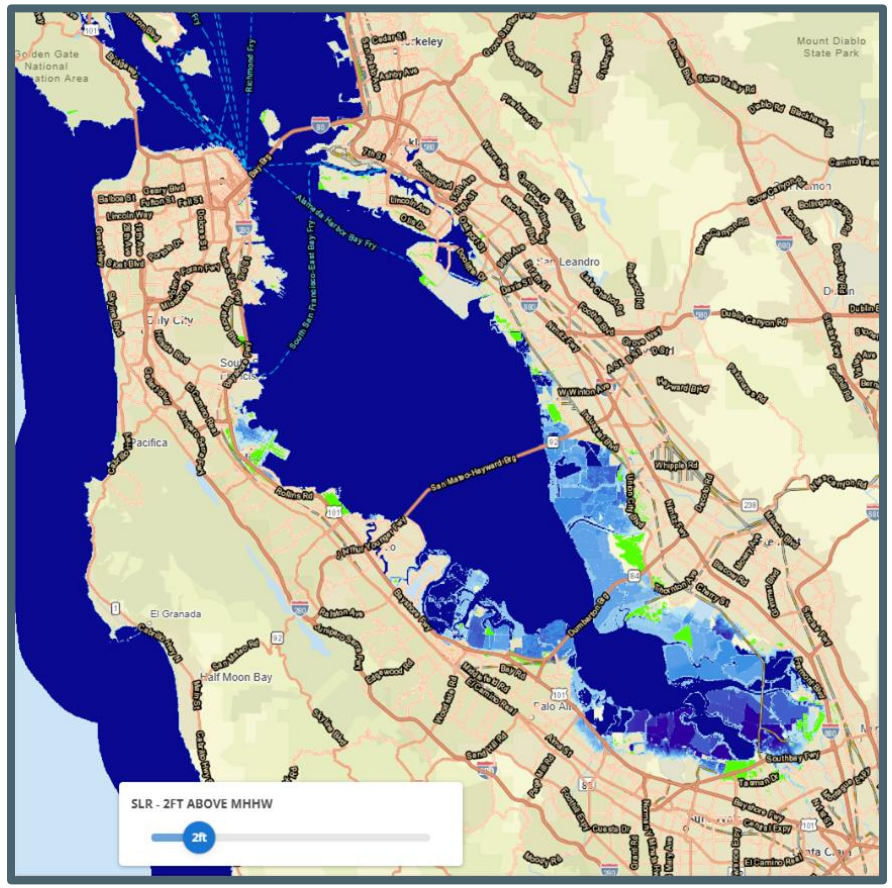


Present Day

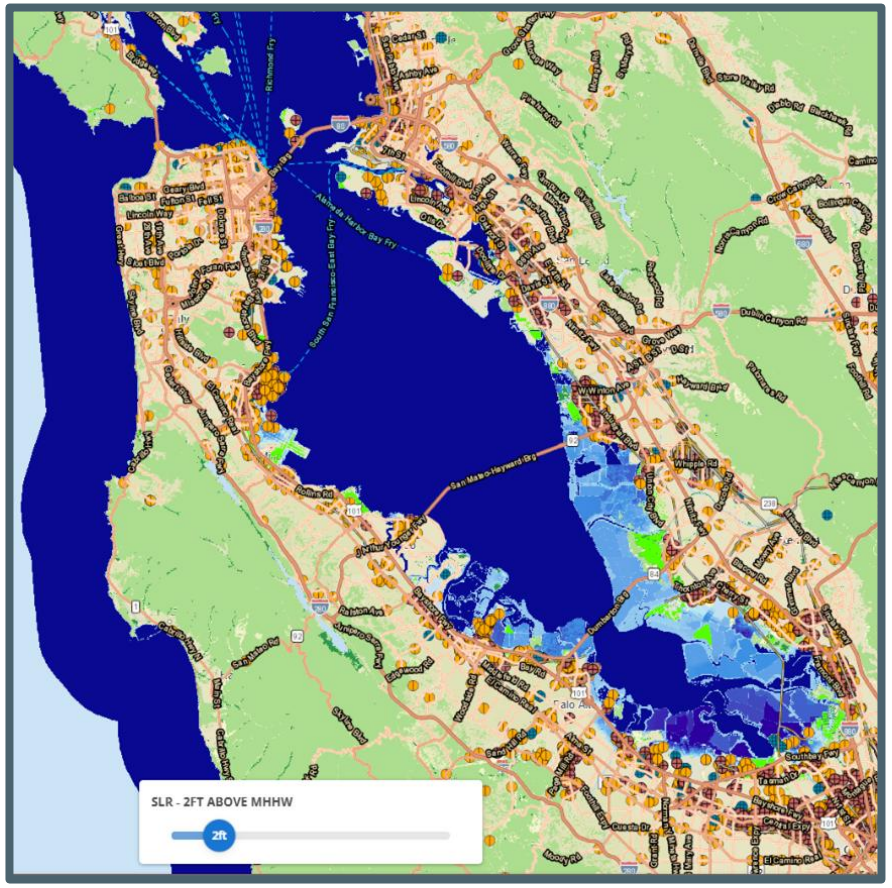


2 Foot SLR Scenario

NOAA Flood Exposure Mapper



2 Foot SLR Scenario



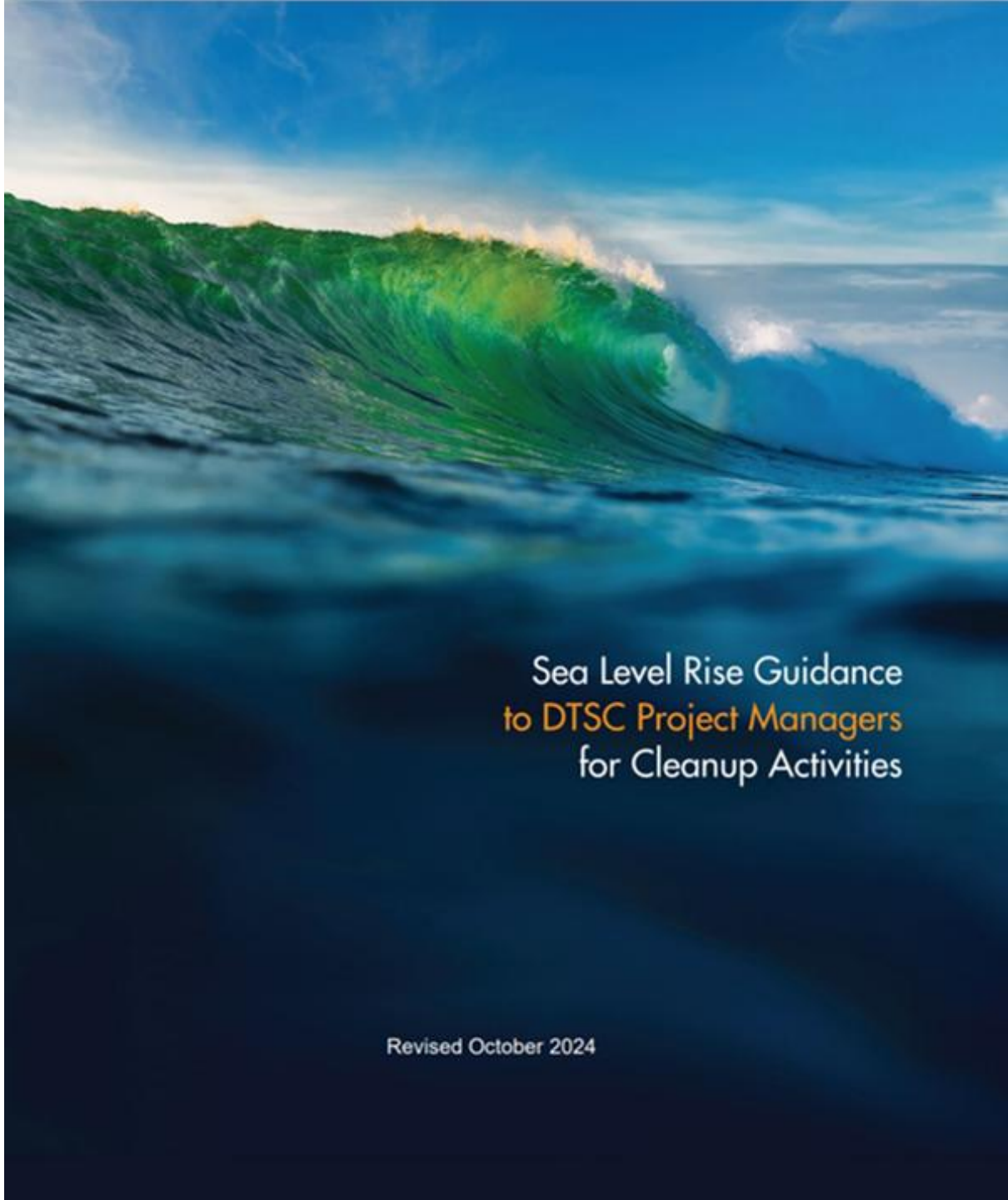
Potential Pollution Source/Brownfield Property

Source: U.S. National Oceanic and Atmospheric Administration, 2025

Regulatory Climate

DTSC Guidance

- SLR may change hydraulic, geologic, hydrogeologic, and chemical conditions of contaminated sites
    - Possible increased threat of release of contaminants in surface water, groundwater, air, soil, and sediment
    - Need to mitigate the impact sea level rise can have on contaminated properties
- DTSC guidance provides a framework for assessing SLR and preparing SLR vulnerability assessments (SLRVA) and adaptation plans at DTSC cleanup program sites
- Senate Bill 1, the Sea Level Rise Mitigation and Adaptation Act of 2021, directed state “agencies to identify, assess, and, to the extent feasible and consistent with their statutory authorities, avoid, minimize and mitigate the impacts of sea level rise.“ DTSC guidance is part of implementation of these mandates.



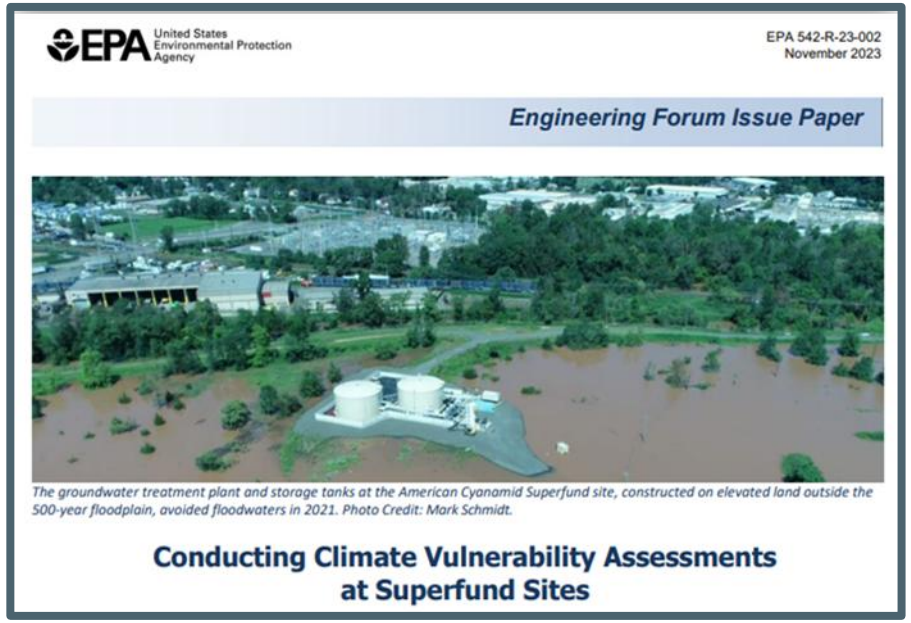
SFRWQCB Order

California Regional Water Quality Control Board, San Francisco Bay Region, Order No. R2-2024-0002, Amending Waste Discharge Requirements (WDRs) for Oceanfront and Bayfront Landfills & Industrial Facilities

- The RWQCB identified more than 30 Bay Area landfills and industrial facilities as vulnerable to SLR, extreme storm events, king tides, and groundwater rise
- SLR may lead to possible increased leachate production, mobilization of contaminants from the waste mass into leachate and groundwater, and landfill gas generation and/or migration
- Flooding risk may be exacerbated by land subsidence due to settlement and consolidation
- Order requires facilities to address potential effects of SLR through the preparation of Long-Term Flood Protection Plan, including groundwater level rise considerations

Superfund Guidance

- U.S. Environmental Protection Agency's (EPA's) discretionary authority under CERCLA and the National Contingency Plan (NCP)
- The EPA may require consideration of climate resilience under Federal Superfund cleanup plans and five-year reviews
- The EPA also recommends consideration of climate resilience for Non-Federal National Priorities List (NPL) Sites (June 30, 2021)
- EPA Recommendations:
    - Conduct Climate Vulnerability Assessment (Nov. 2023 EPA Guidance)
    - Evaluate Resilience Measures (Dec 2023 FEMA Nature Based Solutions Guide; EPA Tools for Resilience Planning ARC-X)
    - Build Adaptive Capacity



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CHANGING TIDES : COASTAL CLIMATE ADAPTABILITY

Oyster Point Landfill Redevelopment

Presented by: Hayley Farr, PE

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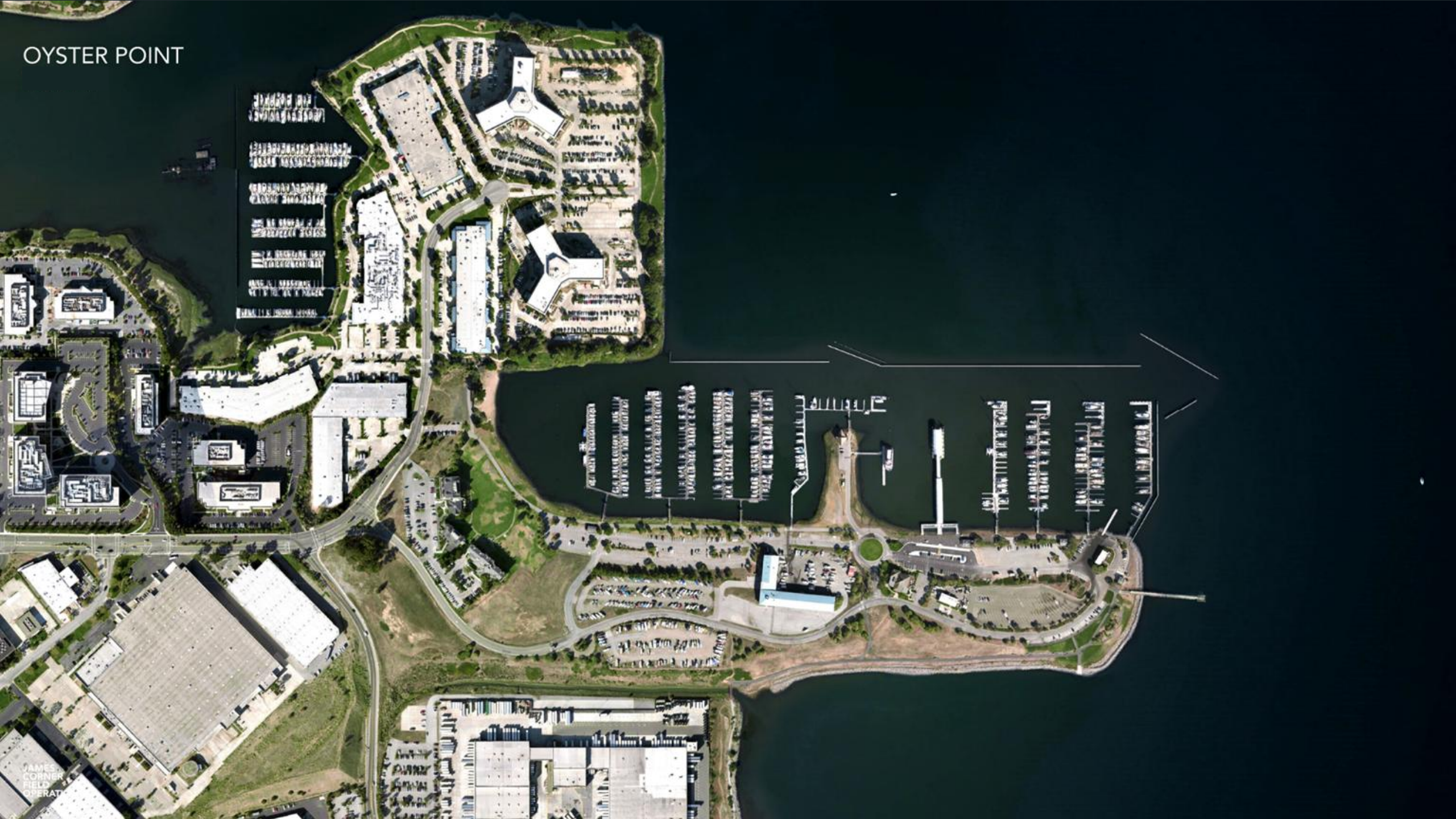
September 17, 2025

OYSTER POINT +
SAN FRANCISCO BAYFRONT

JAMES CORNER FIELD OPERATIONS


OYSTER POINT

OYSTER POINT
PHASES

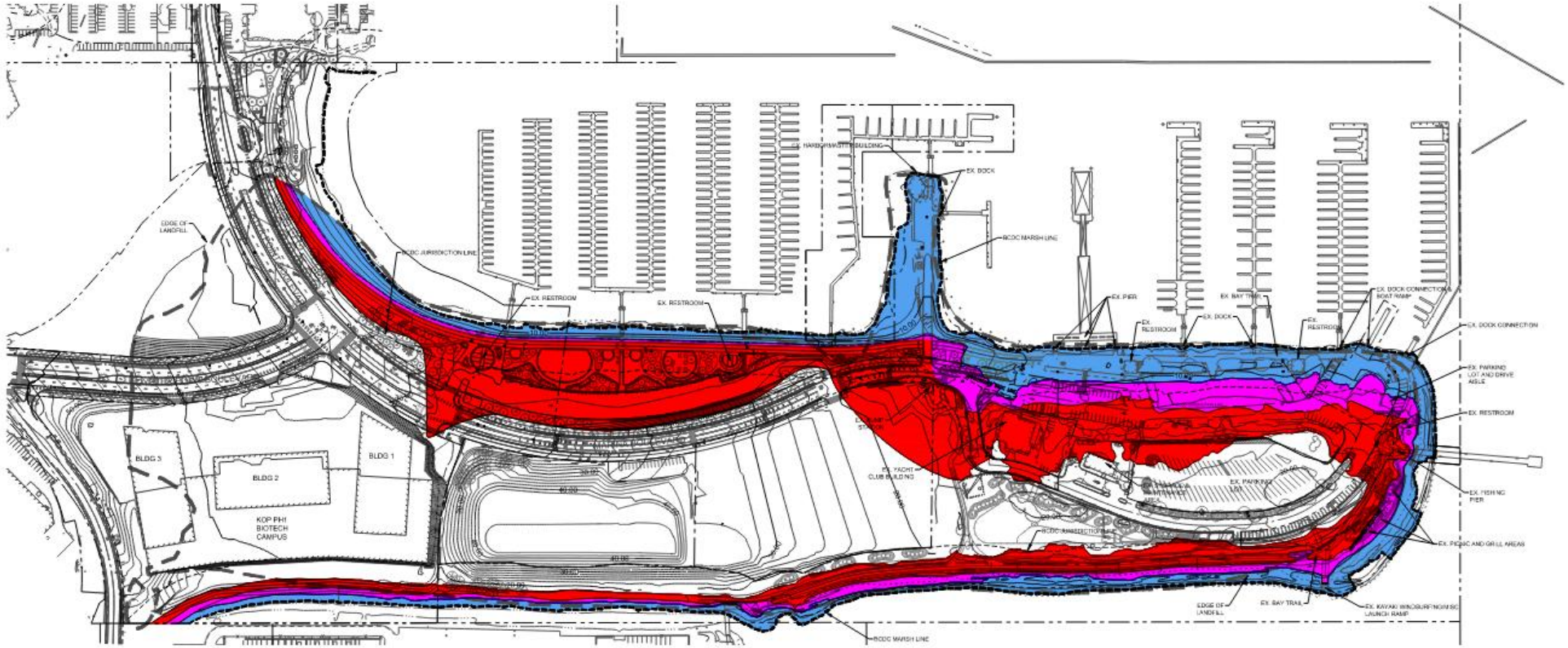
JAMES
CORNER
FIELD
OPERATIONS

LEGEND

- EXISTING 100-YR BASEFLOOD ELEVATION EXTENTS ASSUMED ELEVATION OF 11' PER CURRENT FEMA FLOODMAP
- YEAR 2080 100-YR BASEFLOOD ELEVATION EXTENTS 12.9' ELEVATION CONTOUR
- YEAR 2100 100-YR BASEFLOOD ELEVATION EXTENTS 17.9' ELEVATION CONTOUR
- LIMIT OF REFUSE
- BCDC MARSH LINE
- PROPERTY LINE
- BCDC JURISDICTION LINE

NOTES

1. FLOOD PREDICTION BASED ON THE MEDIUM-HIGH RISK AVERSION PROJECTED SEA-LEVEL RISE FOR SAN FRANCISCO AS STATED IN THE 2018 CALIFORNIA SEA-LEVEL RISE GUIDANCE MANUAL
   - 2050 : 1.9' OF SEA-LEVEL RISE
   - 2100 : 6.9' OF SEA-LEVEL RISE
2. SITE SETTLEMENT PROJECTIONS PROVIDED BY LANDIAN WERE INCORPORATED INTO THE YEAR 2080 AND YEAR 2100 FLOOD PROJECTIONS.
3. ELEVATIONS ARE BASED ON NAVD88 DATUM



N

0 50 100 200 300

Scale: 1" = 100'


352
stripe


WOMEN


WOMEN


Cytokinetics
354
MEN

Key Takeaways

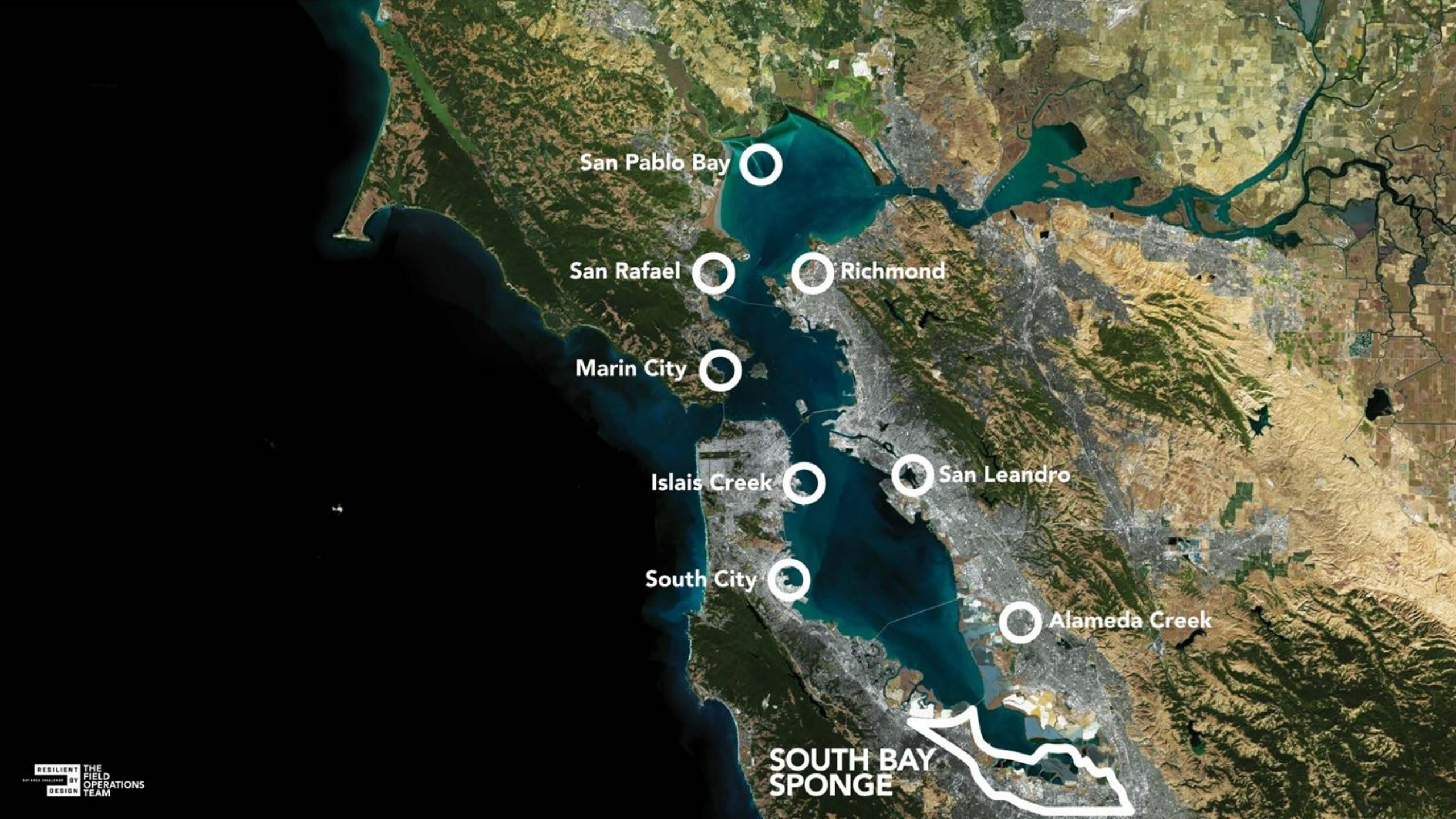
- SLR impacts at bayfront landfills include additional potential vulnerabilities beyond flooding (leachate, landfill gas, contaminant mobilization, etc.)
- Many regulatory agencies are requiring SLR assessments for bayfront sites, including landfills
- Different SLR design scenarios may be appropriate for buildings/infrastructure/natural spaces
- Developing SLR adaptation strategies is an exercise in balancing risk, costs, feasibility, and community values
- Opportunity to prioritize nature-based solutions

SOUTH BAY SPONGE

RESILIENT BY DESIGN
BAY AREA CHALLENGE

THE FIELD OPERATIONS TEAM


JAMES
CORNER
FIELD
OPERATIONS
CITIES & NATURE



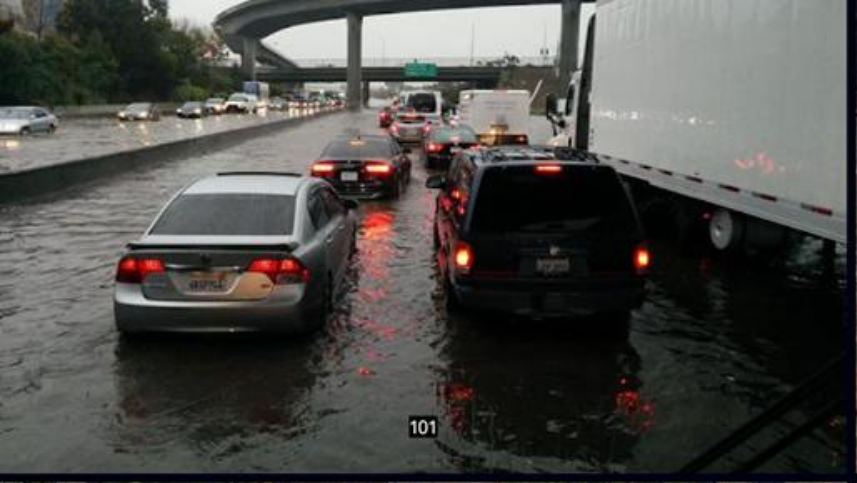
RESILIENT BY DESIGN BAY AREA CHALLENGE

THE FIELD OPERATIONS TEAM

What is resiliency?

Resiliency is the capacity to bounce back. Resiliency does not mean 100% protection and insulation from challenges. It is the capacity to recover from and adapt to ongoing and varied challenges over time. A “resilient community” is one that can quickly recover, creatively adapt and absorb stresses without too much loss of investment.


Newark
Fremont
Menlo Park
East Palo Alto
South Bay Towns
20 miles
Palo Alto
San Jose
Mountain View
Sunnyvale
Santa Clara
RESILIENT BY DESIGN
THE FIELD OPERATIONS TEAM


101


San Francisquito Creek Storm Flows


San Francisquito Creek


Sunnyvale - Central Expressway


East Palo Alto


San Jose


Palo Alto

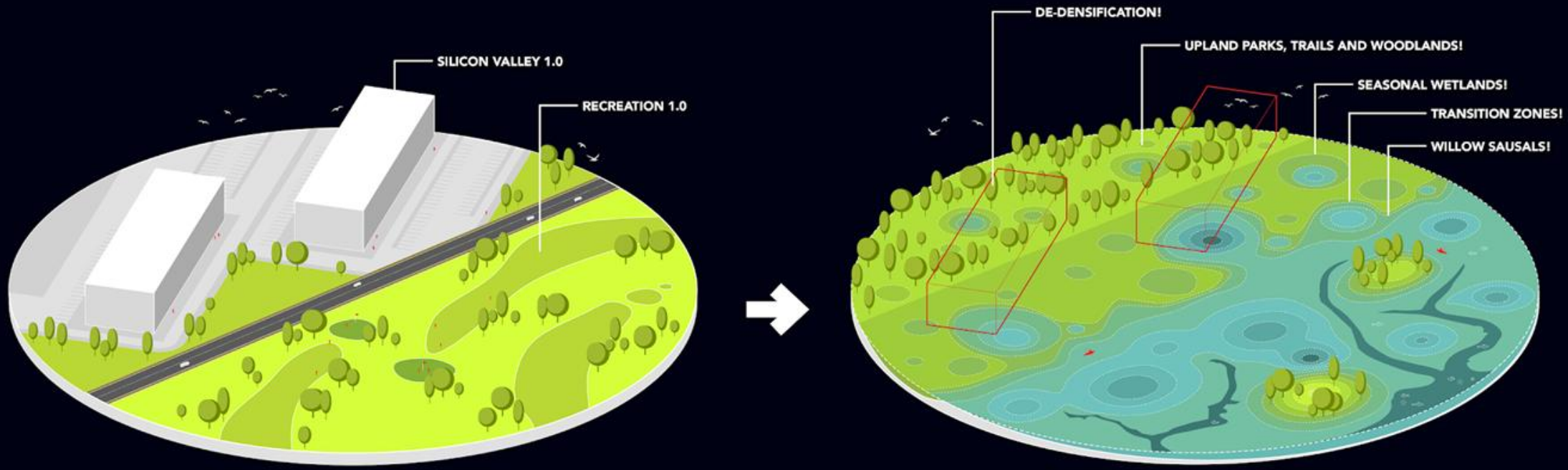

Sunnyvale


East Palo Alto


nature = sponge


nature = sponge
Oyster Beds
Oyster Ho.
Cooley Landing
Ravenswood
Calaveras Pt.
Mowry Slough
San Francisquito Creek
Long Pt.
Charleston Slough
Mountainview Slough
Guth Landing
Mountainview Landing
Jagels Landing
Guadalupe River
Alviso
Barron Creek
Mayfield
LO ALTO

The South Bay Sponge
New landscapes of absorption




The South Bay Sponge
New landscapes of absorption
SALT PONDS RESTORATION PROJECT
FRESHWATER SPONGE
SALTWATER SPONGE


South Bay Sponge

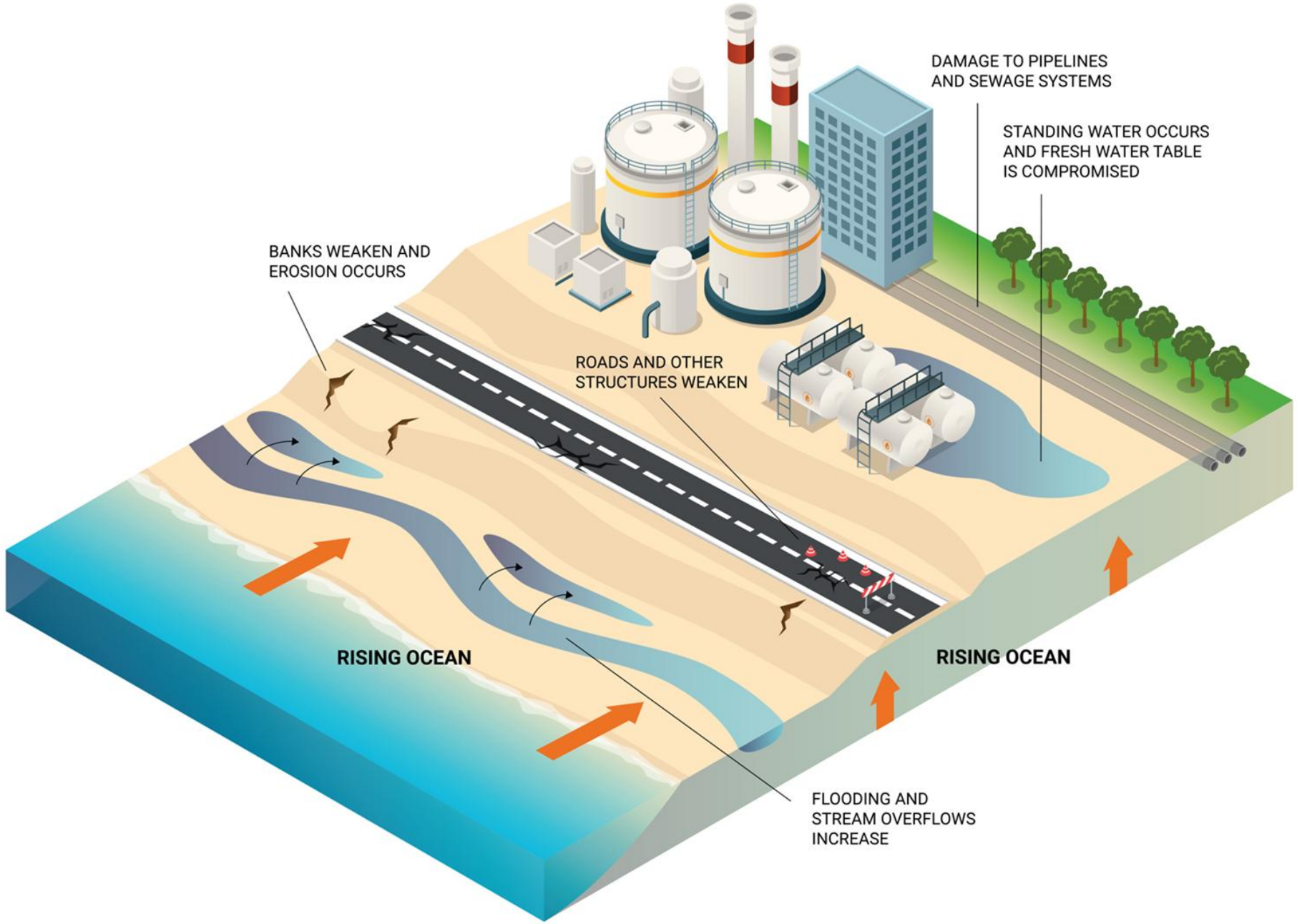
Stantec

Integrating Nature-based Solutions into Coastal Remedial Designs

Impacts of Sea Level Rise

Rising groundwater due to sea-level rise can result in numerous hazards:

- Nuisance flooding
- Water quality deterioration due to increased uncontrolled discharges
- Damage to infrastructure (e.g. buildings, roads, utilities)
- Stormwater management
- Increased water management associated with remediation systems
- Saltwater intrusion affecting groundwater supply
- Daylighting of light non-aqueous phase liquids (LNAPL)



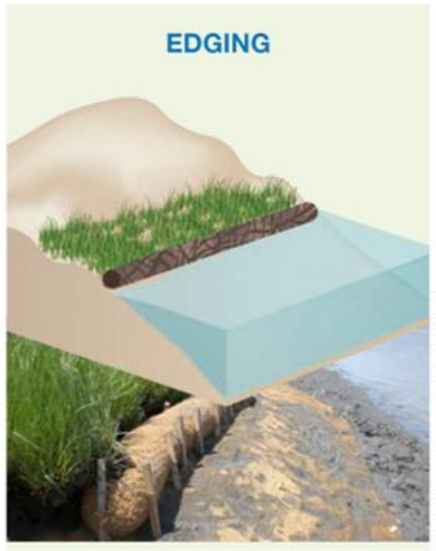
What are Nature-based Solutions (NbS)?

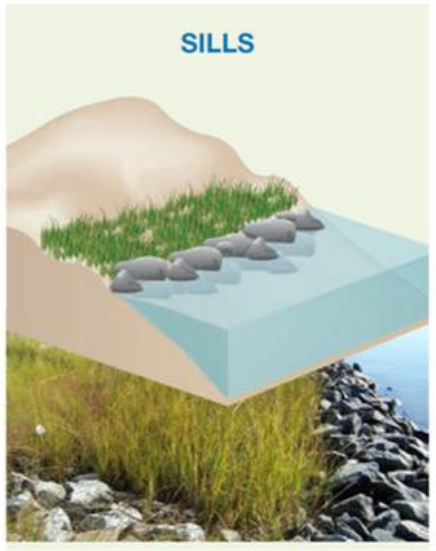
Nature-based Solutions, sometimes referred to as engineering with nature, is a design approach that leverages the positive benefits of natural systems in conjunction with traditional engineering.

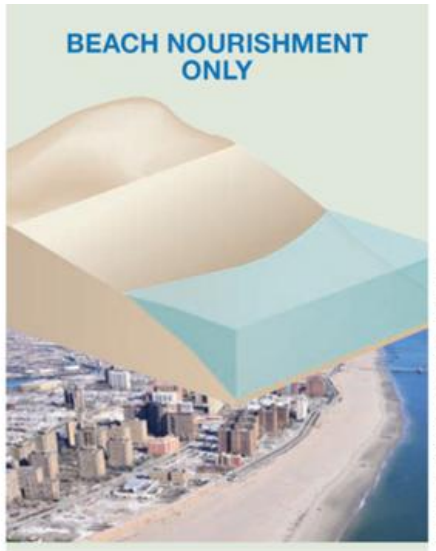
- Works in harmony with natural systems
- Benefits habitat, biodiversity, and air and water quality
- Sequesters carbon
- Provides new community assets, benefitting human well-being
- Further corporate ESG goals

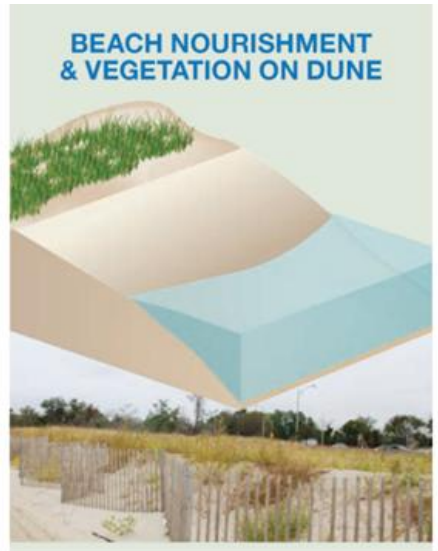
GREEN - SOFTER TECHNIQUES

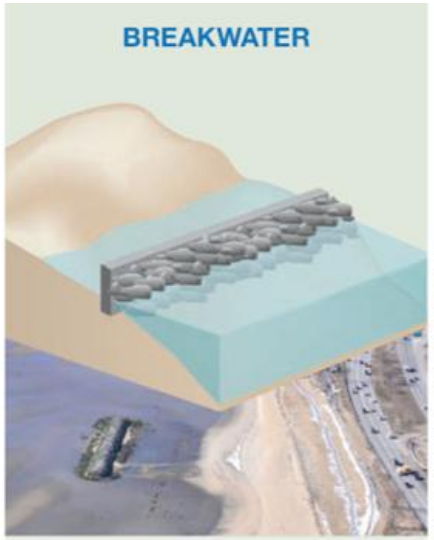
Small Waves | Small Fetch | Gentle Slope | Sheltered Coast

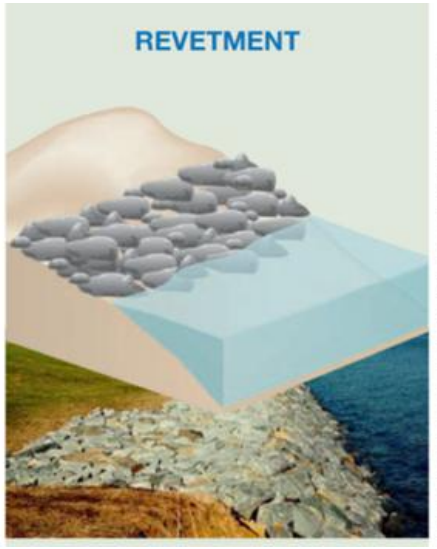


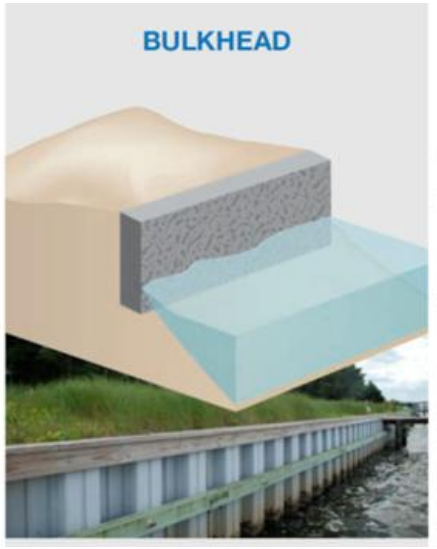


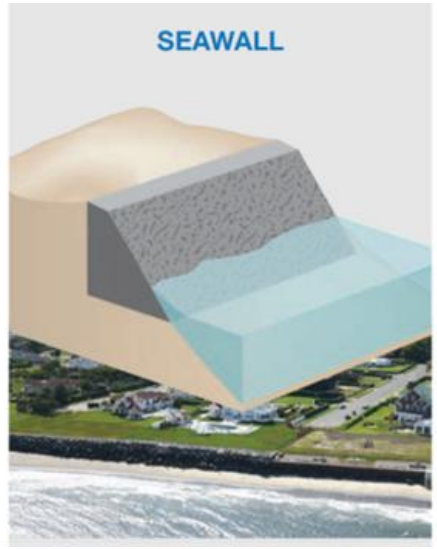












GRAY - HARDER TECHNIQUES

Large Waves | Large Fetch | Steep Slope | Open Coast

Systems Approach to Geomorphic Engineering (SAGE), NOAA & USACE 2017

NbS Treatment Technologies

Passive Treatment / Simple Maintenance → Low OPEX

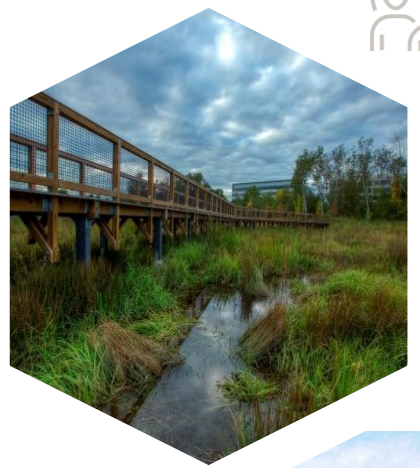
Resilient (Climate/Hydraulic/Chemical)

Consistent Reliable Treatment Performance for a variety of contaminants (e.g., nutrients, metals, BTEX, PAHs, Cl-VOCs, PCBs)

Aesthetically Pleasing → Public Space & Recreational Opportunities

Habitat Creation → Enhance Biodiversity → Natural Capital Benefits

Carbon Sequestration over Long Life



CSO Treatment
TSS, nutrients, metals
Massachusetts

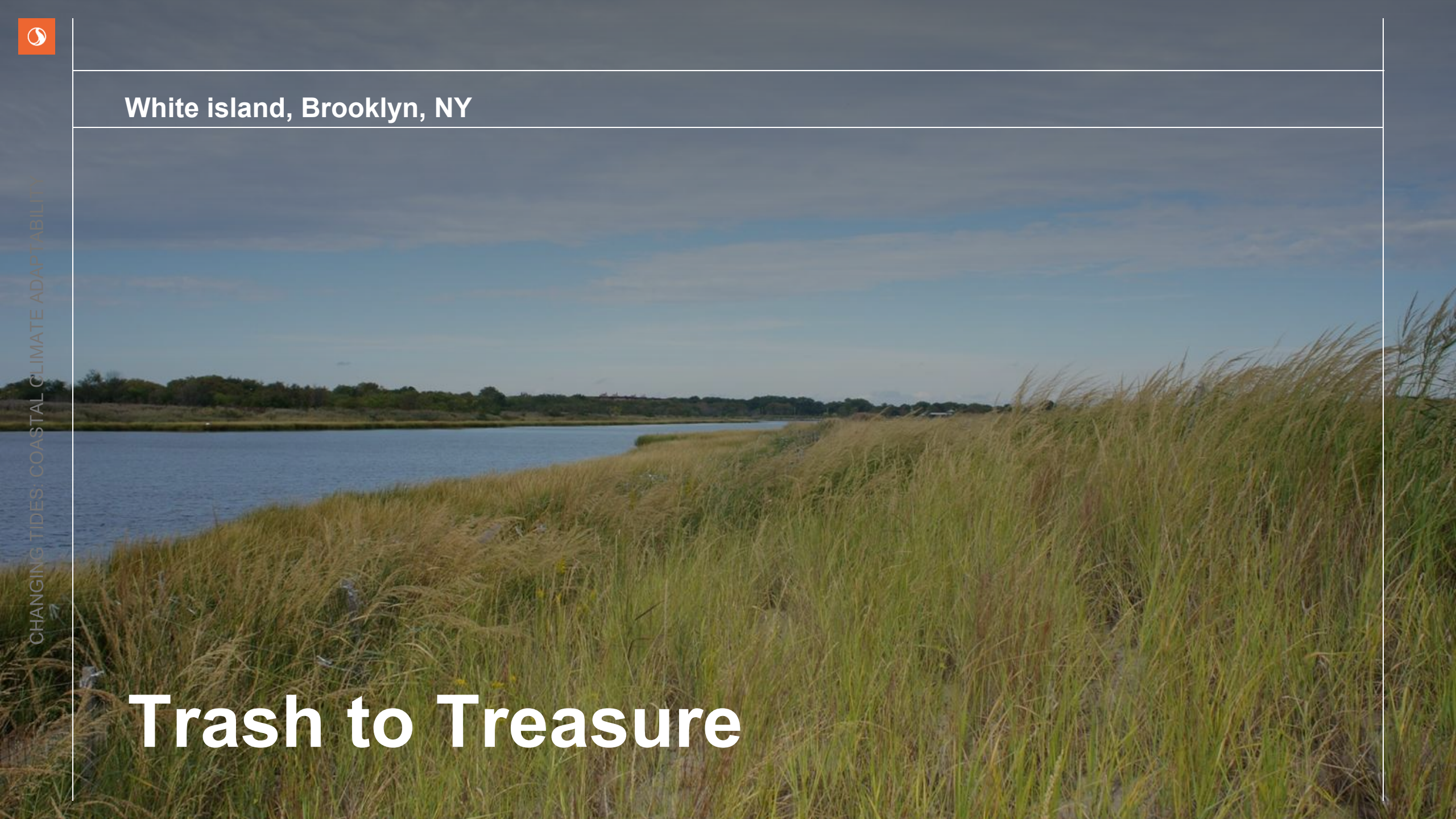
Sanitary Treatment
BOD and nutrients
UK

Groundwater Treatment
Metals & Cl-VOCs
Hungary

Groundwater Treatment/ Metals
Maryland

Former Oil Refinery
Metals, BTEX, PAHs
Canada

White island, Brooklyn, NY



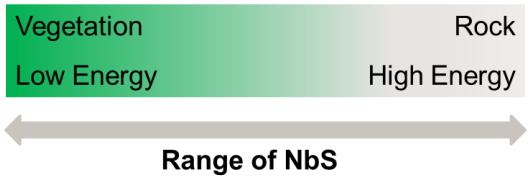
Trash to Treasure

Design Objectives

- Shoreline Stabilization
- Contain Landfill Waste
- Invasive Species Control
- Create Habitat

Shoreline Techniqu

Slope	Stabilization Technique
>4:1	Vegetation
3:1	Cellular Confinement System (CCS)
2:1	Articulated Concrete Block (ACB)
1.5:1	Armor Stone



Hurrican e Sandy

Tottenville Shoreline Protection Project, Staten Island, NY

Rebuild by Design

Background

Historic Erosion along entire shoreline

Significant risk for wave action

Degraded tidal wetland

Structures within Coastal AE and VE zones

Destruction from Hurricane Sandy


RAISED EDGE
ECO-REVETMENT
EARTHEN BERM
HYBRID-DUNE REVETMENT
WETLAND ECO-REVETMENT
RARITAN BAY
LIVING BREAKWATERS
PROJECT BY OTHERS

Earthen Berm

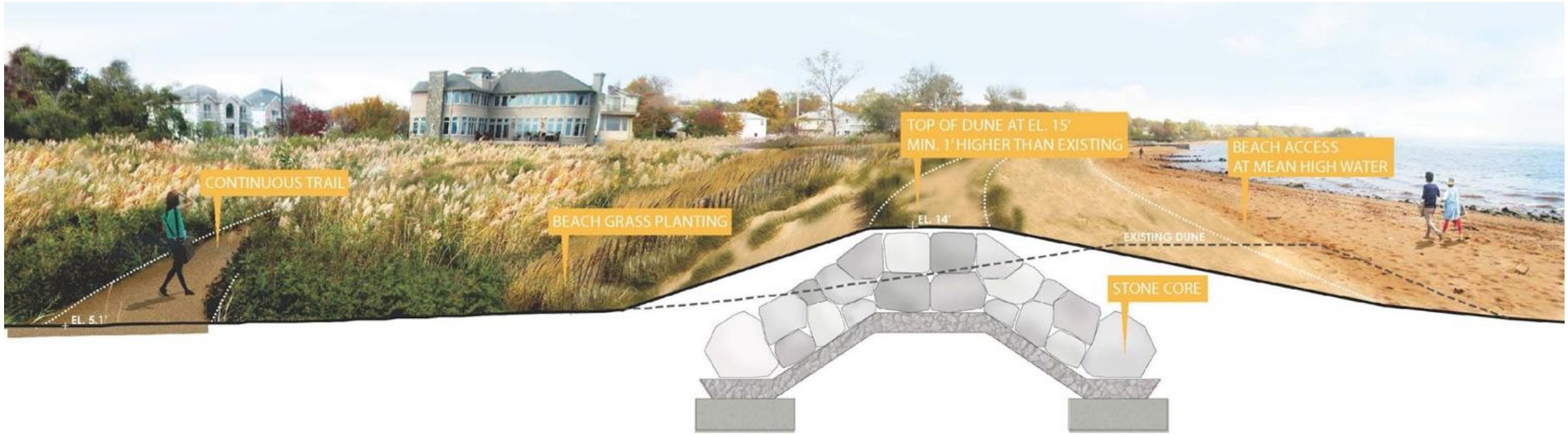
- Earthen Berm at +12.5’
- Wetland Restoration
- Continuous Trails and Park Access
- Ecological Planting and Restoration

Eco-Revetment

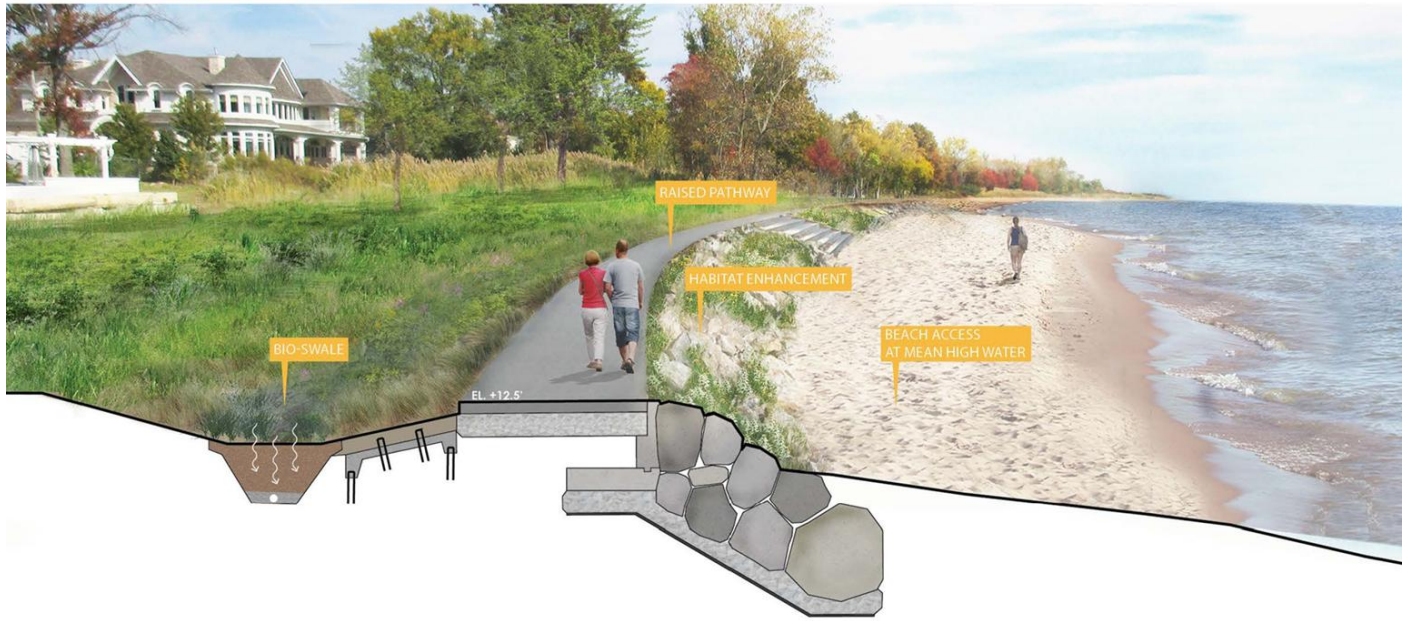
- Top of Eco-Revetment at +12.5’
- Green Infrastructure
- ADA Access Points and Gathering Spaces
- Community buy-in state supported house raising

Hybrid-Dune Revetment

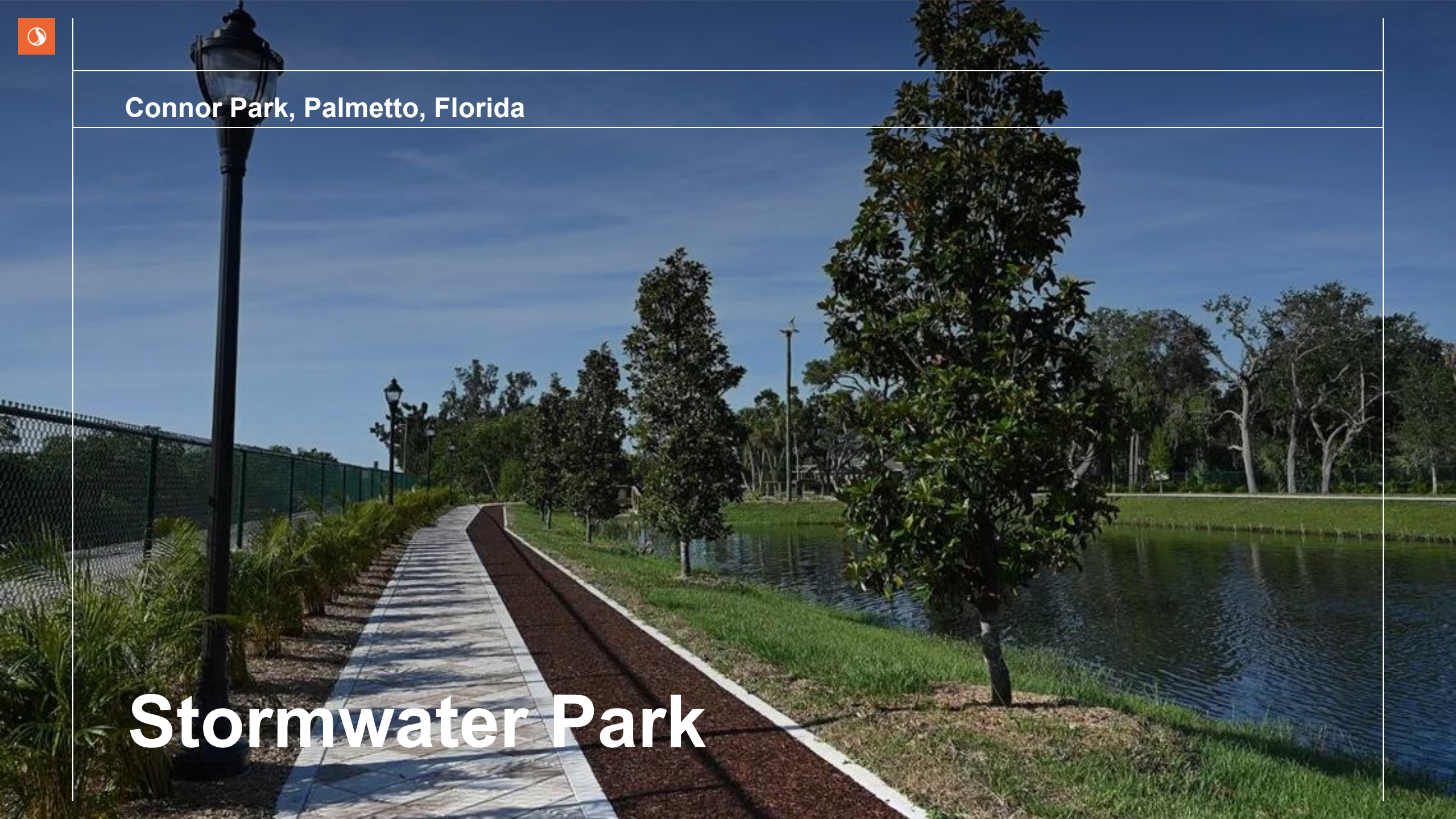
- Top of Dune at +15’
- Beach Grass Plantings
- Beach access at MHW



Raised Edge



- Top of Raised Edge at +12.5’
- Green Infrastructure
- Bio-swale



Connor Park, Palmetto, Florida

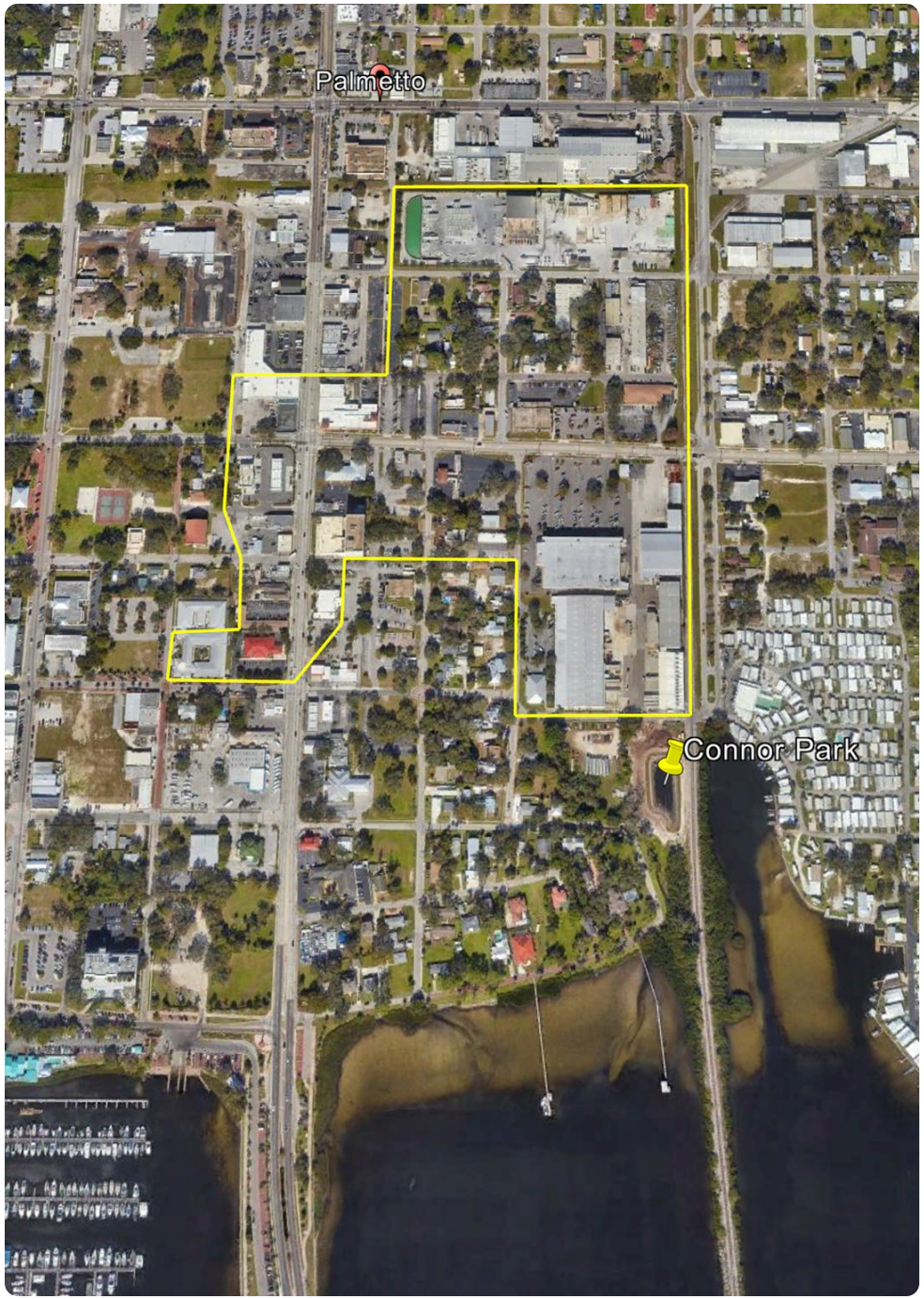
Stormwater Park

Background

1920s to 1970s:	Active Rail Spur and Depot
Early 1980s: divested	CSX decommissioned spur/depot and property
1985:	Site purchased from Atlantic Land and Improvement Company by Billie Edenfield
1998:	City of Palmetto acquired property
1999: took	Palmetto Community Redevelopment Agency over property and started investigations

Various phases of assessment conducted from 1997 through 2018 revealed soil impacted with benzo(a)pyrene, benzo(b)fluoranthene, carbon disulfide, pyrene, chrysene, arsenic and nitrogen.

Multiple grants awarded to support various phases of the brownfield assessment, cleanup and park redevelopment



Stormwater Management

Palmetto Bay = Future preserve

- 380 Reef Balls
- Shelter for fish, aquatic life
- Oyster habitat
- Seagrasses

Capture, divert, attenuate and treat stormwater runoff from 51-acre catchment entering Manatee River

- 172 lbs nitrogen removed per year
- 56 lbs phosphorus removed per year

Summary

NbS have demonstrated success in urban and high energy environments.

NbS not only address environmental challenges but also provide social and economic benefits, including improved public health and enhanced community resilience.

Amanda.Ludlow@Stantec.com

Thank you

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Transforming Land, Empowering Communities

September 16-18, 2025 | Carson, CA

OFFICE OF BROWNFIELDS

CENTER FOR CREATIVE LAND RECYCLING

THANK YOU!

TOGETHER WE EMPOWER COMMUNITIES THROUGH THE TRANSFORMATION OF BROWNFIELDS

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We appreciate your feedback, follow this QR code to submit an evaluation form on Whova.