Nature-based Solutions Regional Roundup

Heidi Nutters, Senior Program Manager, SF Estuary Partnership
Scarlet-Marie Kilpatrick, Intern, SF Estuary Institute

Photo: Ben Botkin

San Francisco Estuary Partnership

- A place-based EPA program
- Collaborative and non-regulatory
- Leverage federal, state, and regional resources to implement the Estuary Blueprint

Where do we want to be in 2050?

What can we do over the next 5 years to get there?

SAN FRANCISCO Estuary Blueprint

San Francisco ESTUARY PARTNERSHIP

What do we mean by nature-based solutions?

"Nature-based Solutions leverage nature and the power of healthy ecosystems to protect people, optimize infrastructure and safeguard a stable and biodiverse future" - International Union for the Conservation of Nature and Natural Resources (IUCN)

Why Nature-based Solutions (NbS)?

- Increasing urgency to advance projects using innovative approaches that support multiple benefit to people and nature
- Regional Guidance
  - Plan Bay Area 2050, Estuary Blueprint, Bay Adapt Joint Platform
  - BCDC Regional Shoreline Adaptation Plan (RSAP)
- State and Federal Guidance
  - Executive Orders

Types of Nature-based Solutions

- Natural habitats such as tidal marshes, tidal flats, sandy beaches, eelgrass and oyster beds
- Hybrid approaches such as "living seawalls"
- "Ecotone" and "horizontal" levees
- Treatment wetlands
- Dual process nature-based systems

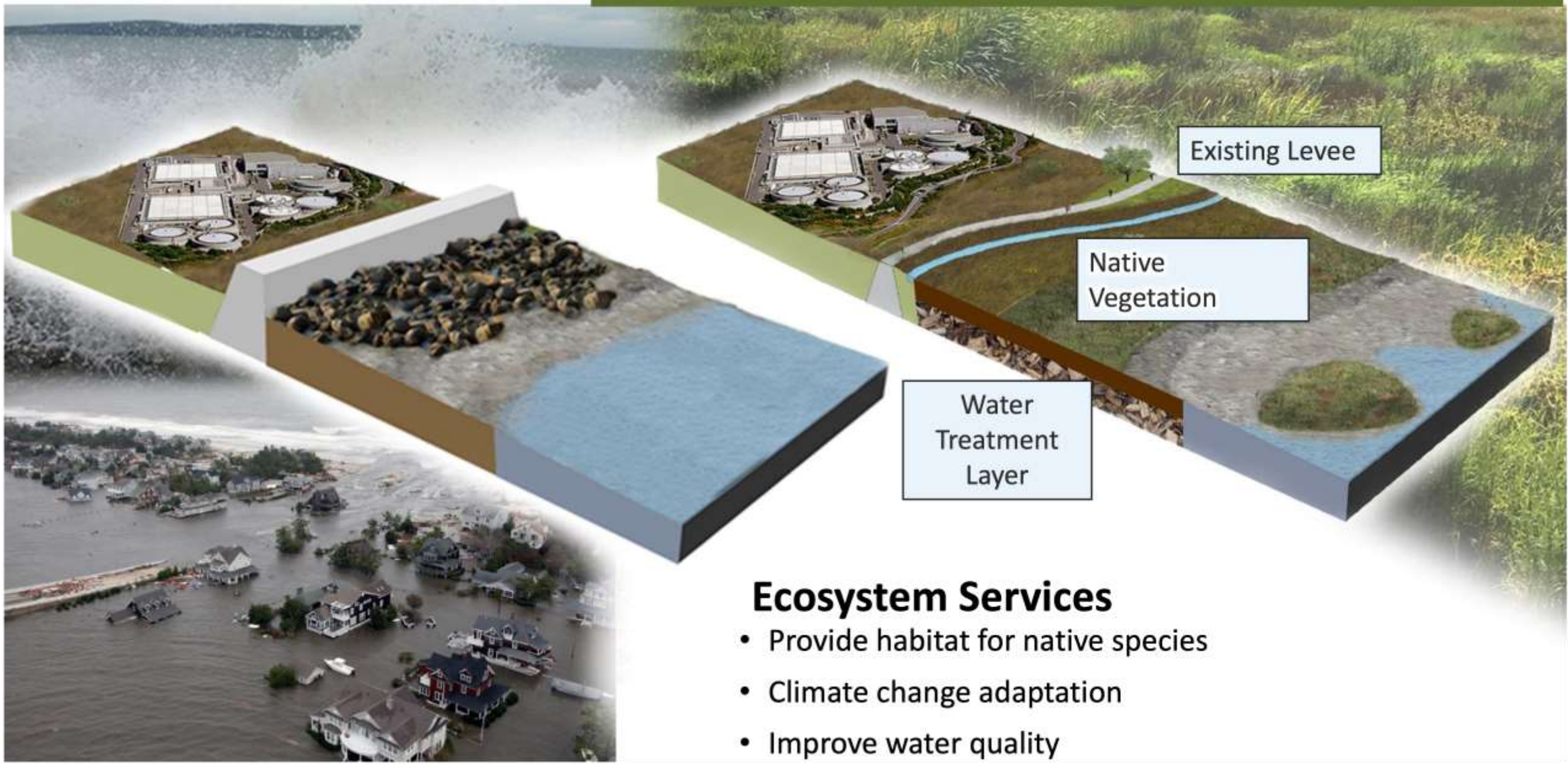
Horizontal Levee Definition

“An engineered sloped subsurface treatment wetland built between coastal levees and tidal marshes - essentially an ecotone levee that incorporates nature-based treatment of wastewater effluent.” – Harris-Lovett, et al. 2021.


Imagery: Nate Kauffman

CONVENTIONAL LEVEES & SEA WALLS

HORIZONTAL LEVEE SOLUTION



Ecosystem Services

- Provide habitat for native species
- Climate change adaptation
- Improve water quality

Image credit: Angela Stiegler

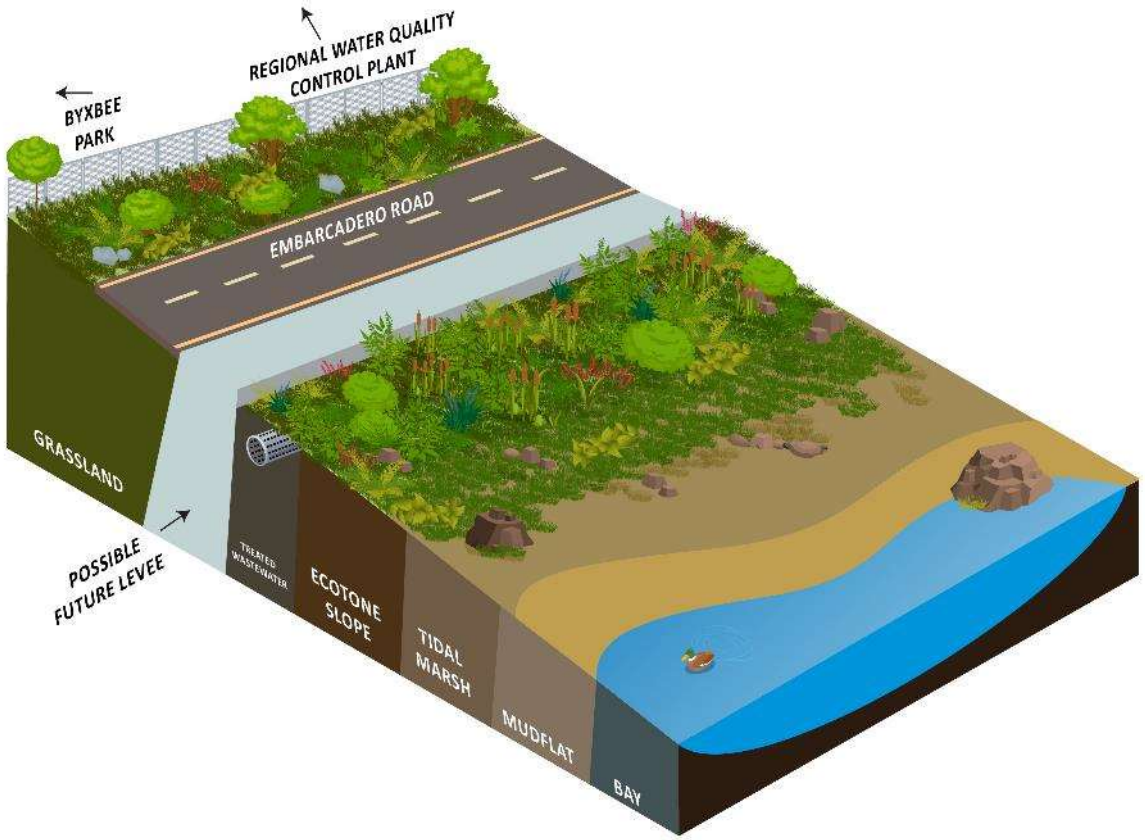

Imagery: Nate Kauffman

We partner with communities around the region

Oro Loma Horizontal Levee

- Pilot project built in 2015 to study water quality improvement opportunities
- Partnership between UC Berkeley, Valley Water, Oro Loma Sanitary District, SF Estuary Institute, Save The Bay, East Bay Dischargers Authority, SFEP
- Findings show significant removal of nutrients and contaminants of emerging concern – PFAS, metals, pharmaceuticals and more

Palo Alto Horizontal Levee – Project Goals



- Improve habitat along the perimeter of Harbor Marsh.
- Adapt to sea level rise and coordinate with future larger levee improvement project (i.e., SAFER Bay/Shoreline Study).
- Maintain public access to the existing trail system while providing opportunities for compatible low-impact recreation, increased social infrastructure, and educational opportunities on sea level rise.
- Ensure perspectives of marginalized communities are incorporated into social infrastructure and educational components.
- Provide polishing treatment to discharged treated wastewater.

Project Highlights

Expected Construction 2025?

- **First horizontal levee** with treated wastewater conveyance directly to the SF Bay
- **Implements Estuary Blueprint** Task 3-1, 4-1, 4-2 – focused on design and implementation of nature-based shoreline adaptation projects
- **Innovative** design, permitting and construction strategies
- **Paves the way** for future horizontal levee projects regionally
- **Funding** from US EPA Region 9 WQIF and Climate Ready Estuaries, State Coastal Conservancy, City of Palo Alto

Fairfield-Suisun Sewer District Community Treatment Wetland Project

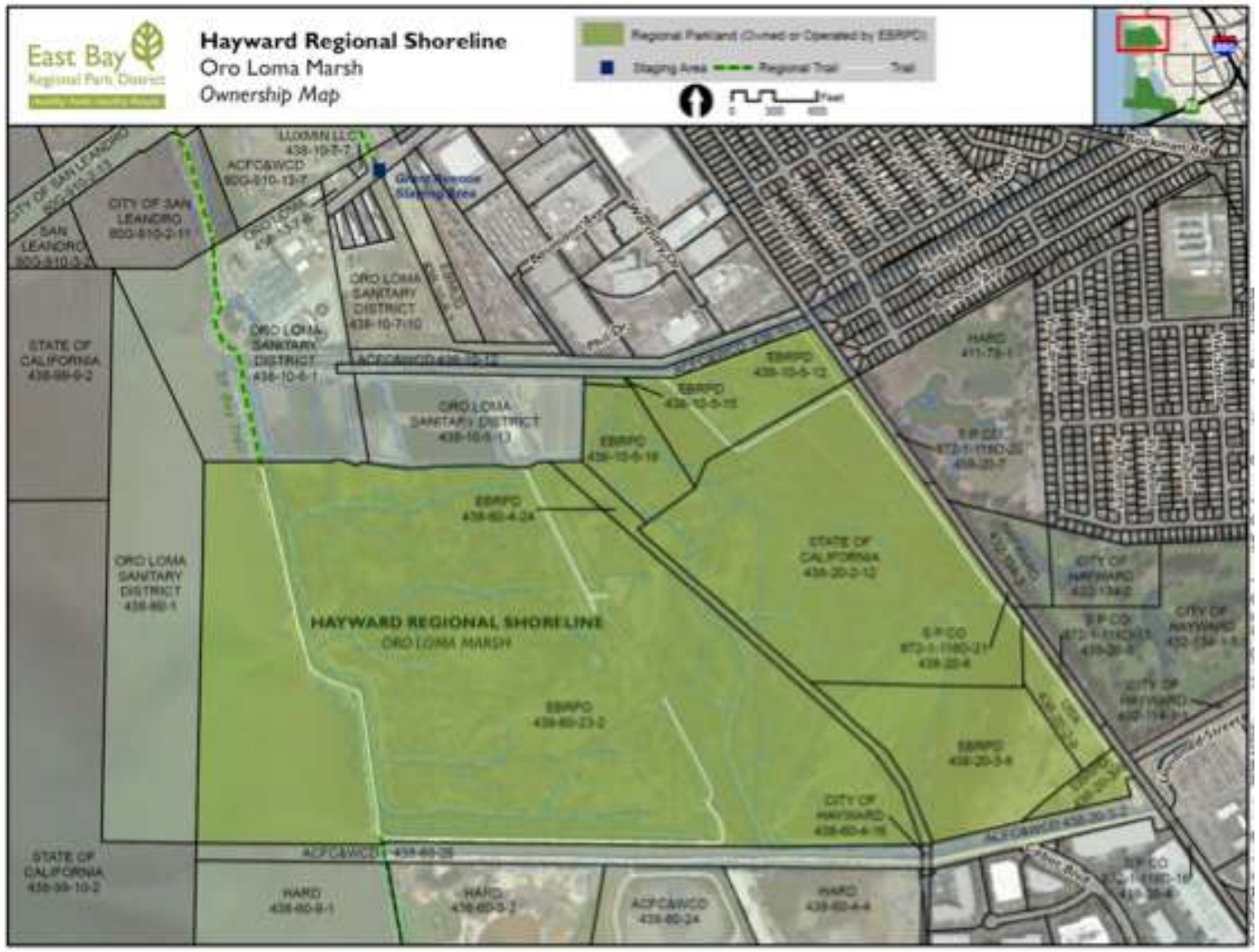
Initial Vision …

- **Reduce nutrients** reaching the San Francisco Bay
- Sea-level rise **adaptation and resilience** for FSSD and surrounding properties
- **Equitable access** to open space and walking trails
- Conceptual design development (2023-24):
  - Nitrogen Removal and Carbon Capture in Treatment Wetland
  - Carbon Storage in Engineered Peatland

First Mile Horizontal Levee

- Use “green infrastructure” in the form of a horizontal/ecotone levee to provide sea-level rise resilience and critical refugia habitat along the north and east perimeter of Oro Loma Marsh
- Providing water quality improvements for treated wastewater.
- Reduce flood risk for developed areas east of the site including the community park, the former Skywest golf course, and adjacent neighborhoods which are currently mapped within FEMA flood hazard areas.

It's Complicated



- Land ownership
- Historical uses
- Permitting
- Mitigation requirements
- Public engagement
- Stormwater management
- Responsibility for O&M

Regional Capacity Building

- Transforming Shorelines Collaborative
- Regulatory Pathways for Nature-based Solutions
- Direct partnership with on the ground partners to develop projects, OLU-scale processes and identifying funding
- Wastewater Equity working group – applying principles of equity and community engagement
- Dedicated grant writing support for CBOs and Tribes to engage meaningfully
- Bay Area One Water Network

On the Ground Observations

- Bringing together skillsets for earthwork/restoration and work within wastewater treatment plants is challenging
- Lack of incentives to champion these kinds of projects
- Major investment in technical assistance is still needed to achieve regional goals for NbS
- Implementation challenges around governance, permitting and funding remain
- Subregional processes allow great opportunity for community engagement
- Leveraging partnerships leads to greatest success

Exciting Hard Pivot!

Dual Process Nature-based Systems

Additional Constructed Wetland Designs to Reduce Nutrient Loads

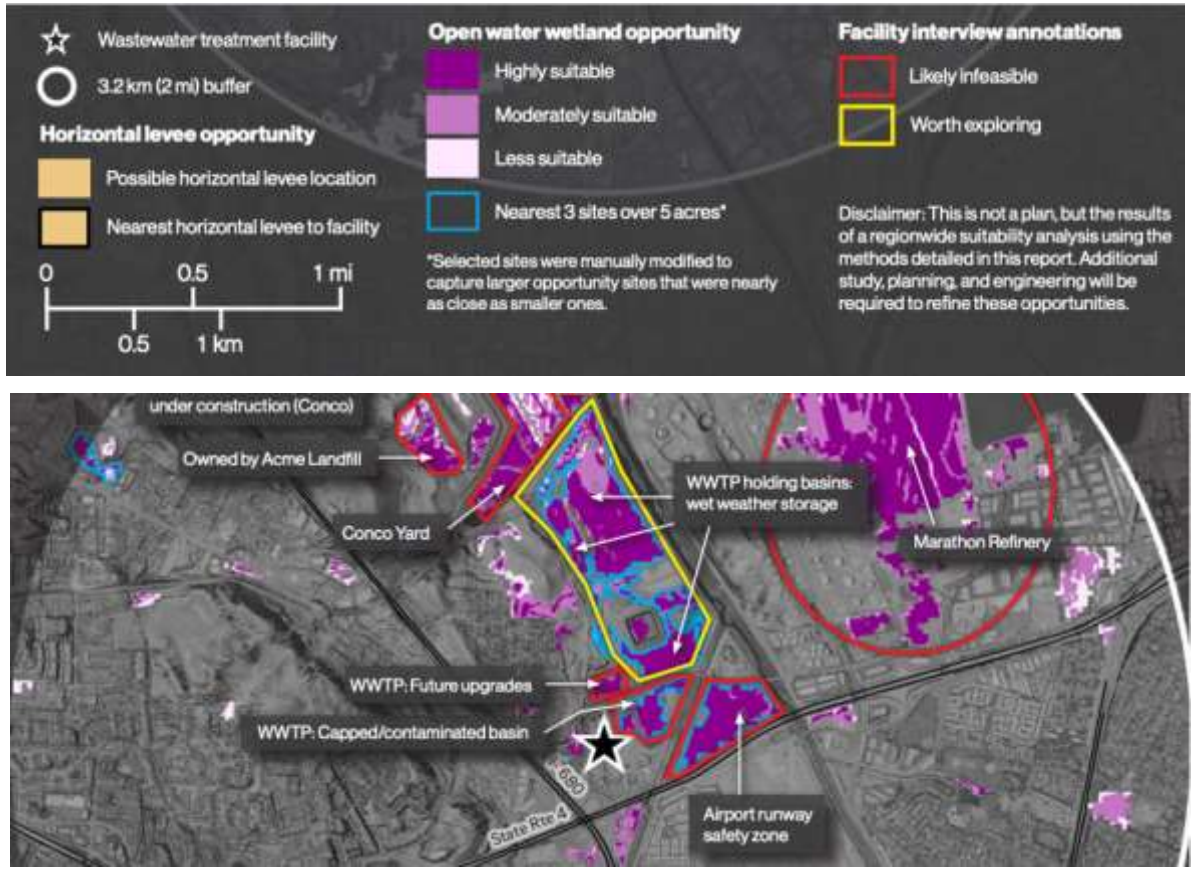
Vertical Flow Wetland, Photo Source: Tsihrintzis et al.

Unit-Process Open-Water Wetland, Photo by Scarlet Kilpatrick, UC Berkeley

Constructed Wetlands as Modular Unit-Processes

Unit-Process Open-Water Wetland Cells, Photo Source: Silverman et al.

Land Availability Limits Implementation Opportunities



Central Contra Costa Sanitary District Wastewater Treatment Plant

Central Contra Costa Flow Equalization Basin

Source: SFEI

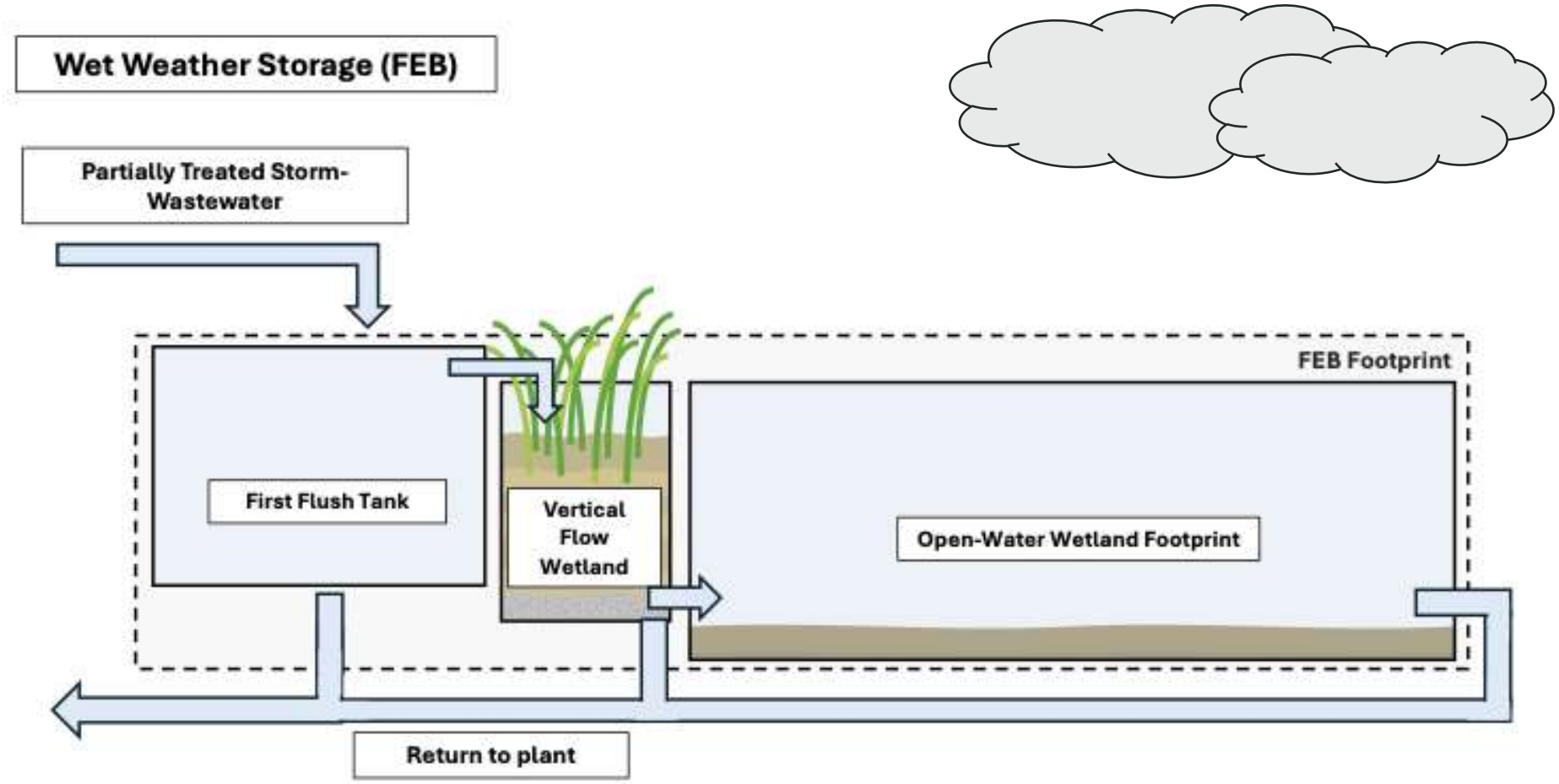
Dual-purpose Equalization Basins

- Wet Season Priority
  - Storage
- Dry Season Priority
  - Nutrient Removal
- **Seasonal treatment wetland in an equalization basin footprint**
- Considerations
  - Resilience to wastewater contaminants
  - Storm "First Flush"
  - Transitioning and contaminant remobilization

Equalization Basins Must Retain Wet Weather Capacity

Wet weather FEB at Oro Loma Sanitary District. Photos by Ellen Plane, SFEI

A Potential Conceptual Diagram for Basin Repurposing



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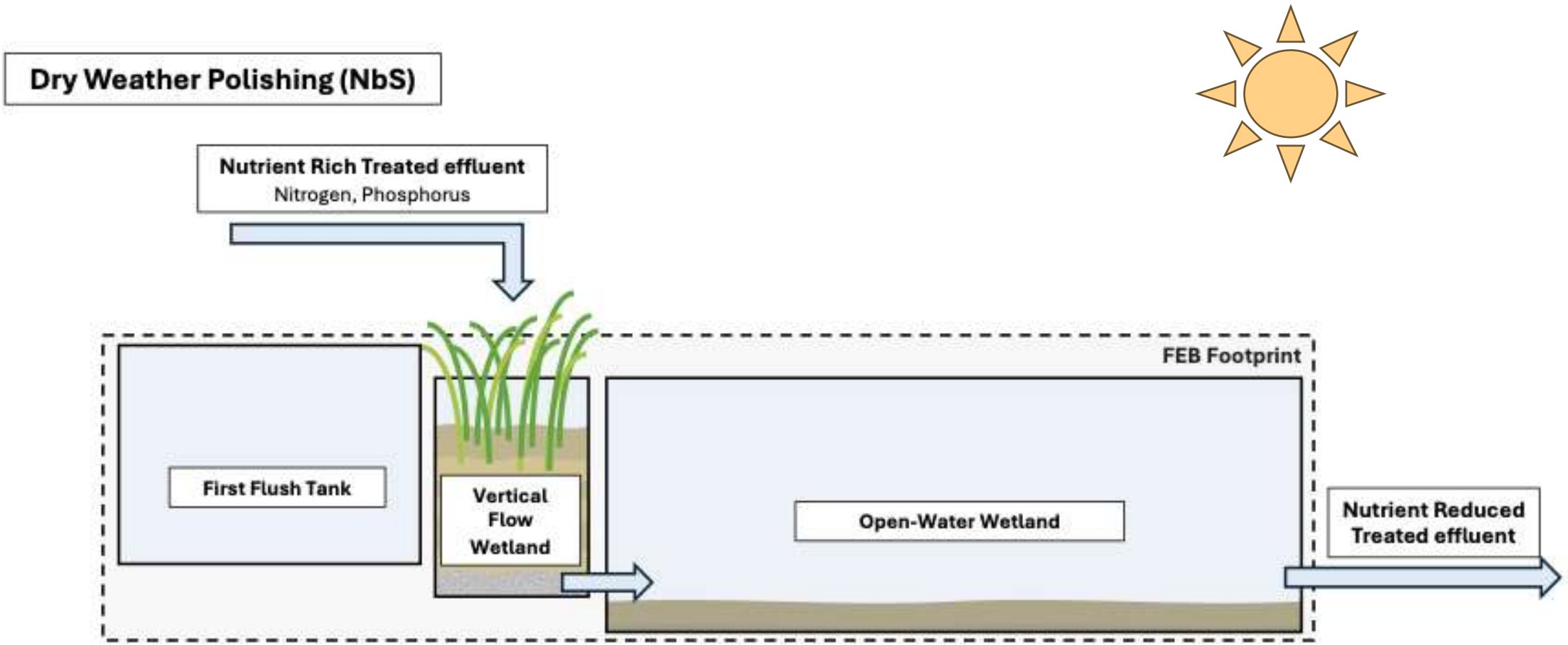

Dual-purpose Equalization Basin Opportunities

- Modular design for existing basin footprints
  - Wetlands in series to maximize space
- Construction of new basins for increased climate resilience
- Opportunities for a case-study / pilot

Dual-Purpose Equalization Basin Memo

Thank you

Horizontal Levee Session at 3:25pm on May 29

"Horizontal Levees: Partnering with Wastewater Treatment Plants for the Next Wave of Nature-based Innovation"

Heidi Nutters, Senior Program Manager

heidi.nutters@sfestuary.org

Scarlet-Marie Kilpatrick,