From Atlas to Action:

Updated Guidance and Local Visioning for Nature - Based Adaptation in San Francisco Bay

October 28, 2025

Katie McKnight , Senior Design Manager & Environmental Scientist, SFEI

SFEI San Francisco Estuary Institute

Overview

- Updates to the *S.F. Bay Shoreline Adaptation Atlas*
- Guidance on connecting creeks to baylands in S.F. Bay
- From regional opportunity to place-based visioning: Adobe Creek in Petaluma, CA

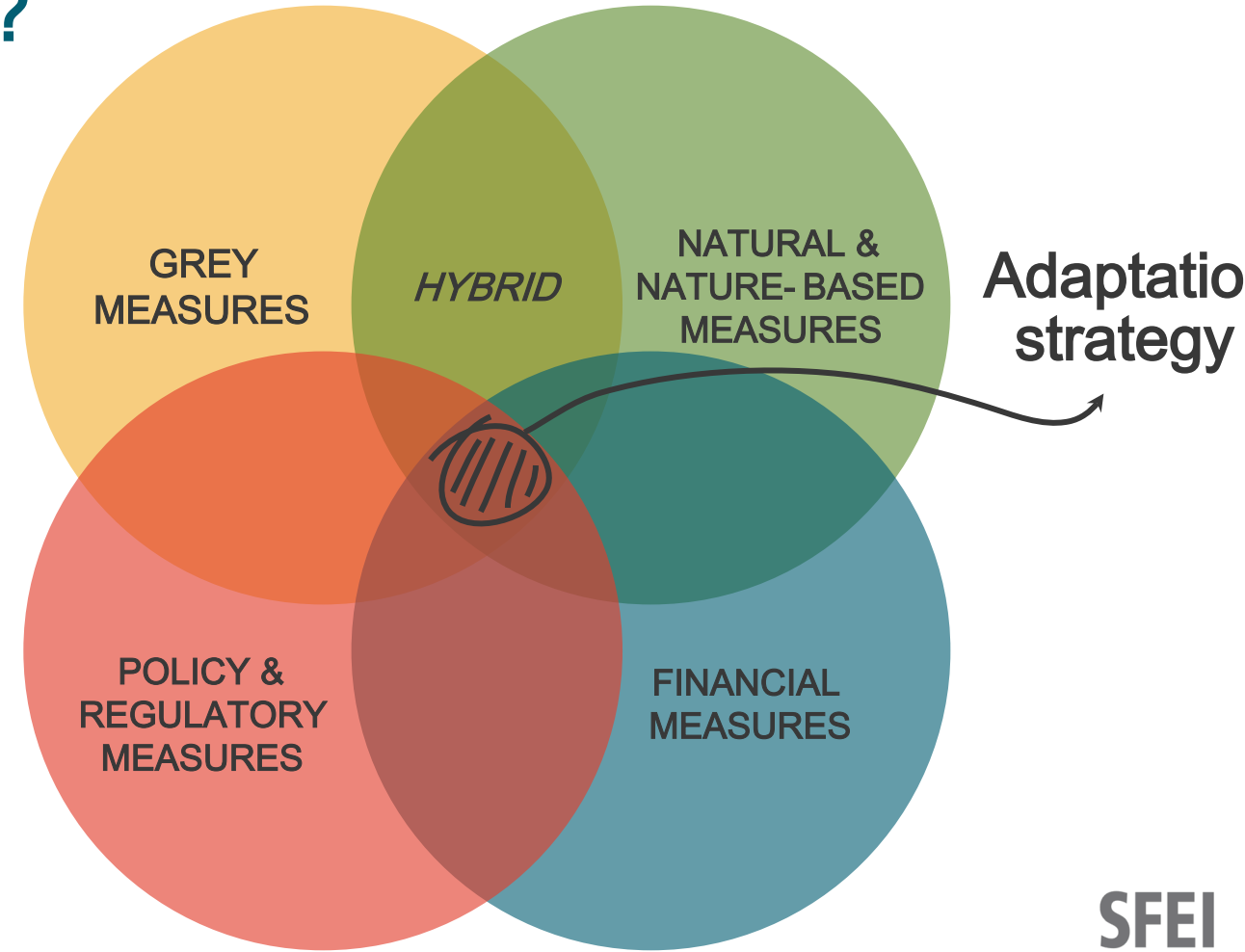
Adapting to sea level rise will require big changes

Photo by Shira Bezalel, SFEI

How we adapt the shoreline will determine the fate and health of the Bay

What can we do?

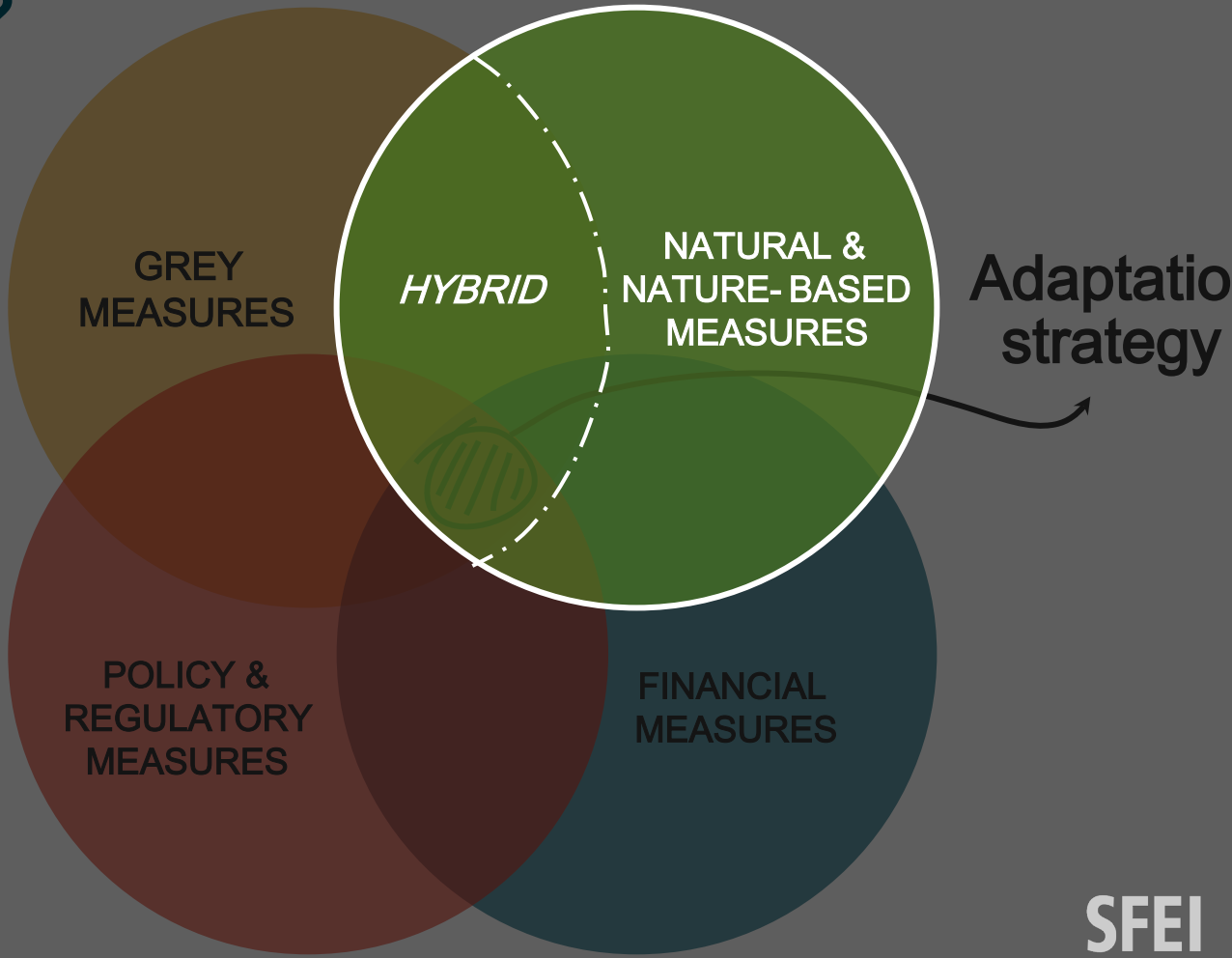
4 categories of adaptation approaches



SFEI

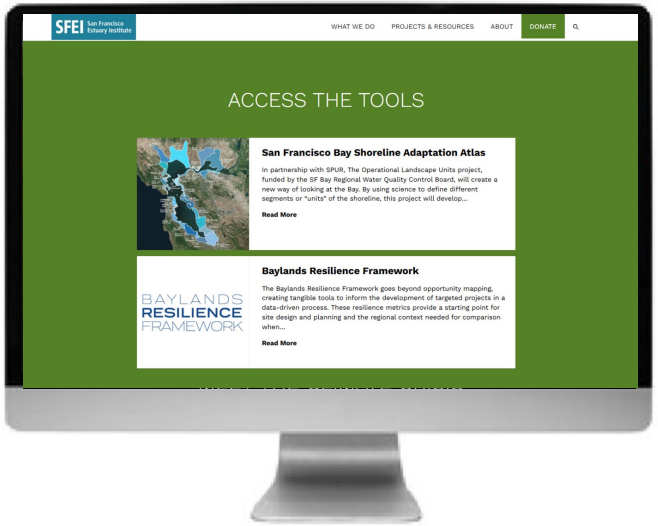
What can we do?

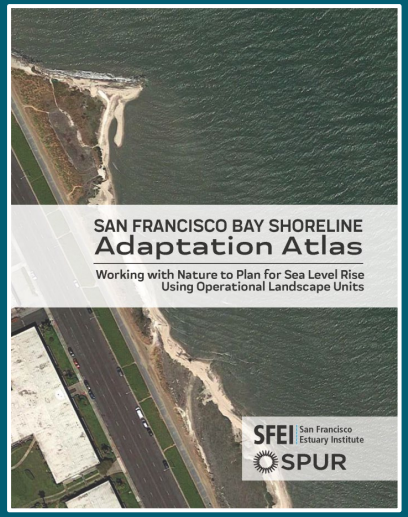
4 categories of adaptation approaches



SFEI

A nature - based toolkit





+

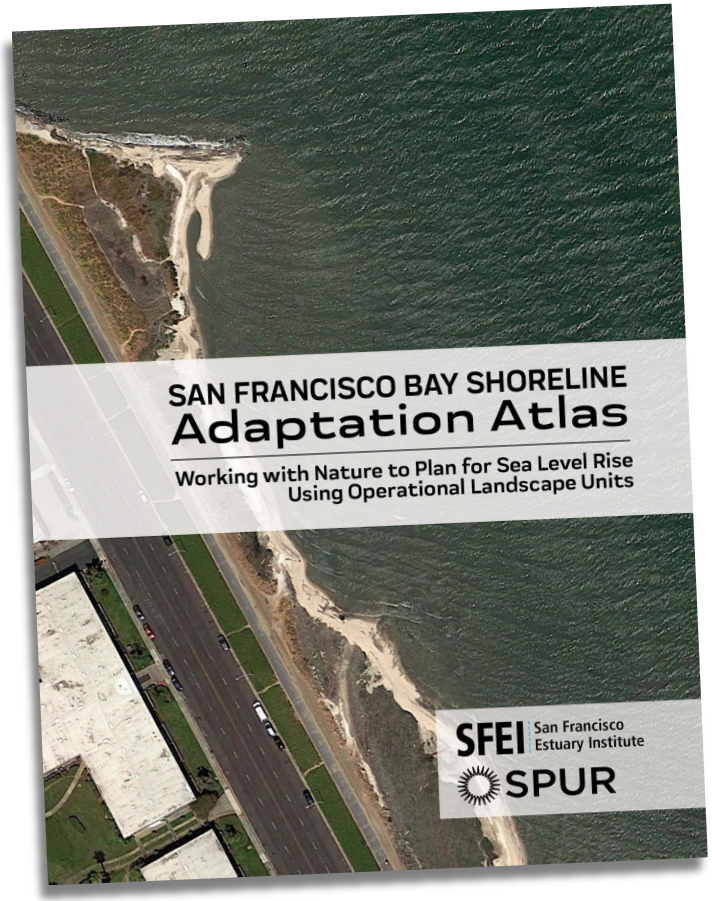
BAYLANDS RESILIENCE FRAMEWORK

adaptationatlas.sfei.org

sfei.org/projects/baylands-resilience-framework

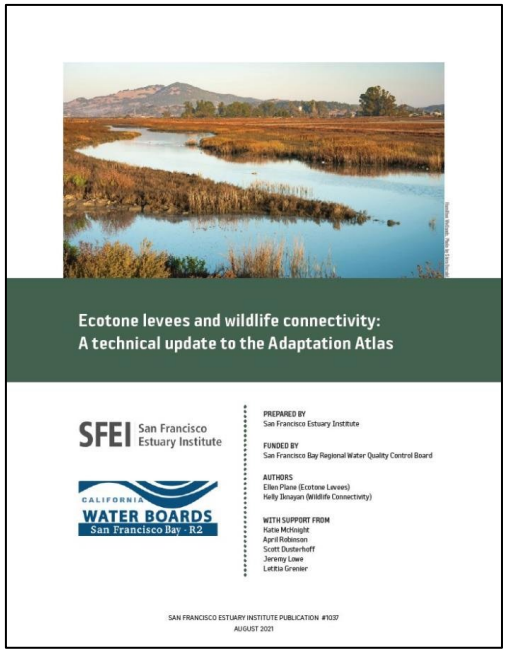
SFEI

The Adaptation Atlas maps opportunities for **nature - based solutions** (NbS) to help us **adapt to sea level rise** while gaining **benefits for people and wildlife**

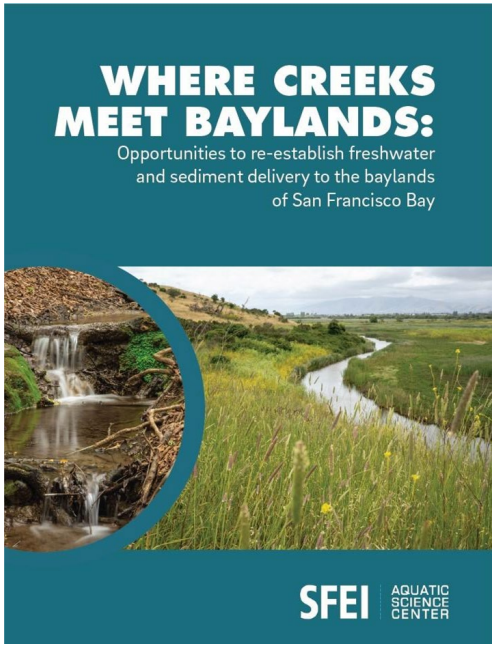


SFEI

Updated Guidance:



Regional mapping of **horizontal levees & wildlife connectivity**



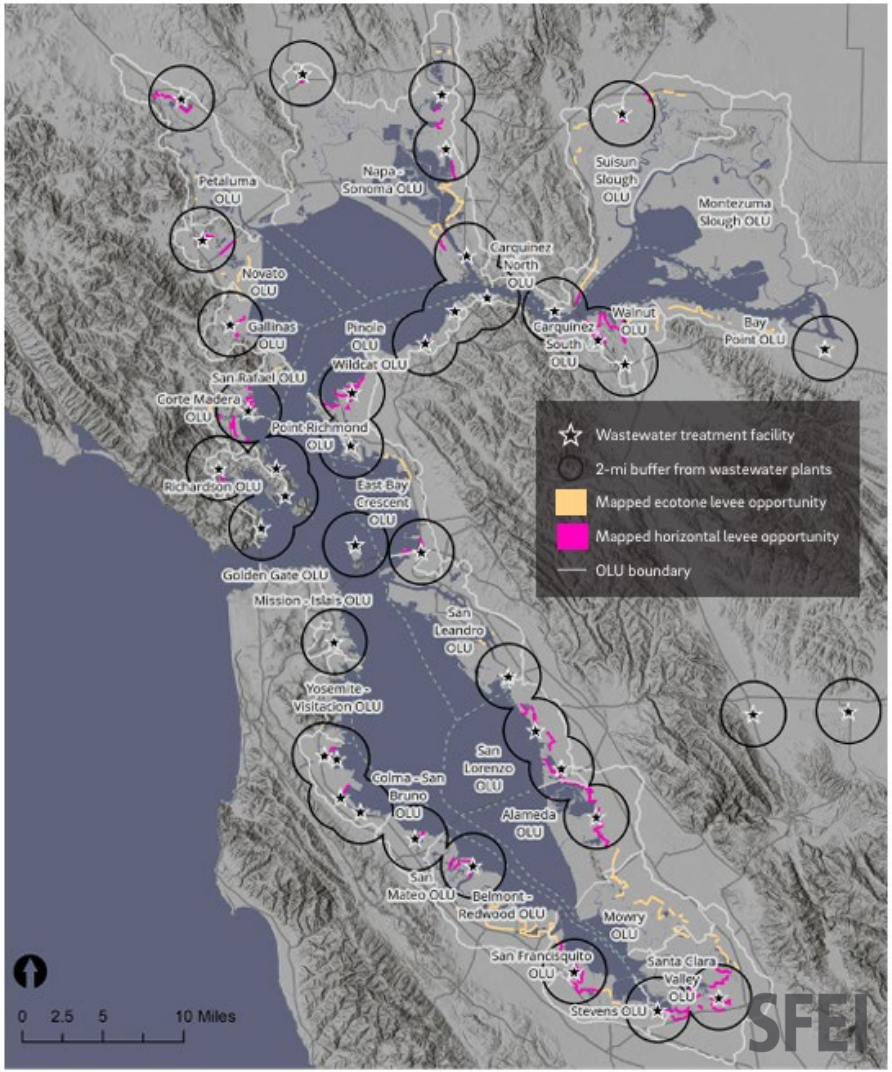
Regional opportunities to **connect creeks to baylands**

SFEI

Horizontal Levees

- Expanded ecotone levee mapping to include opportunities near wastewater treatment plants (i.e. horizontal levees)
- Refined input layers (e.g. development)
- Conducted more thorough review of opportunities

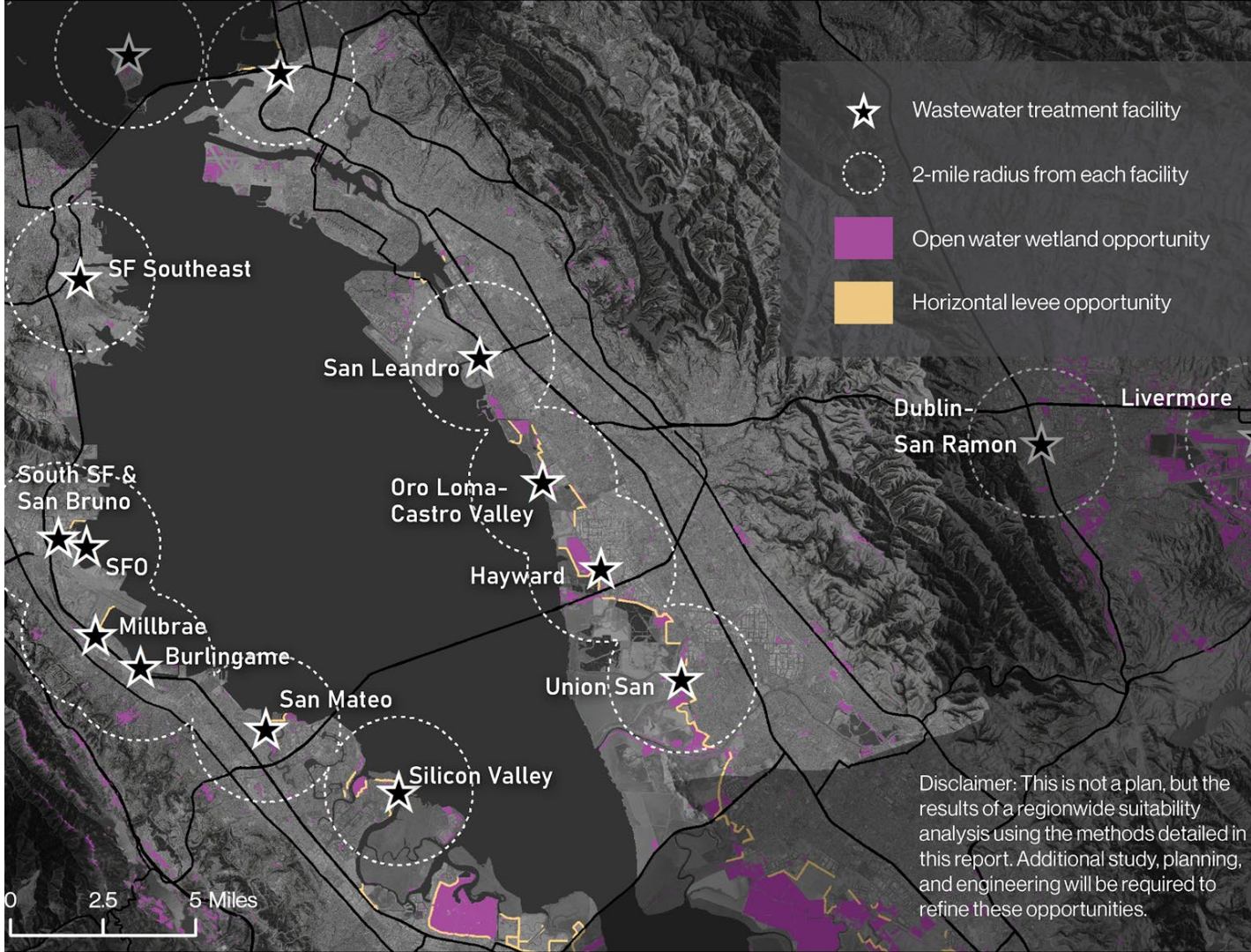
Ecotone Levees: shallow slopes that connect flood risk management levees to tidal marsh



Horizontal Levees: ecotone levees that incorporate subsurface seepage of treated wastewater

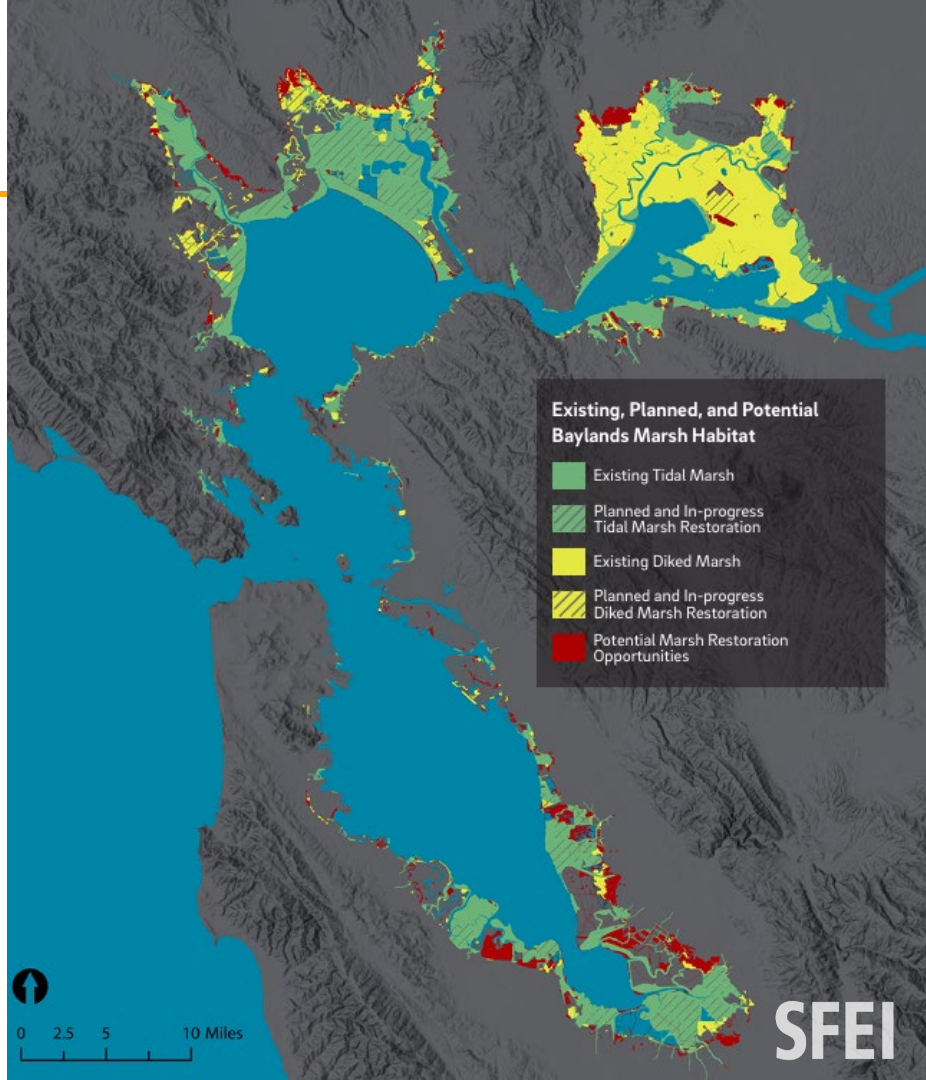
Benefits:

- Removes nutrients
- Create a gradient of habitats from fresh to brackish



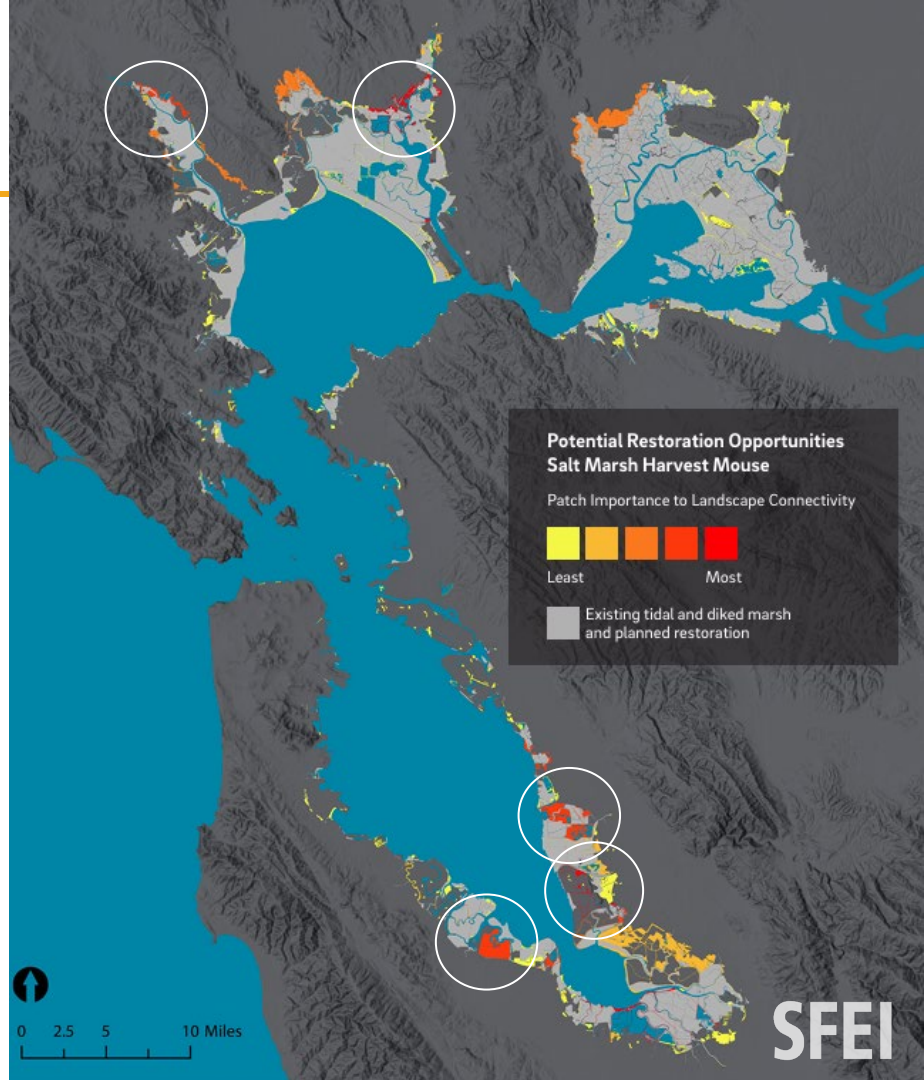
Wildlife Support

- Of all the potential marsh, marsh migration space, and ecotone levees mapped in the Adaptation Atlas, **which patches have the greatest potential to increase wildlife connectivity?**
- Considered 2 endangered and endemic species:
  - the Salt Marsh Harvest Mouse
  - Ridgway's Rail



Wildlife Support

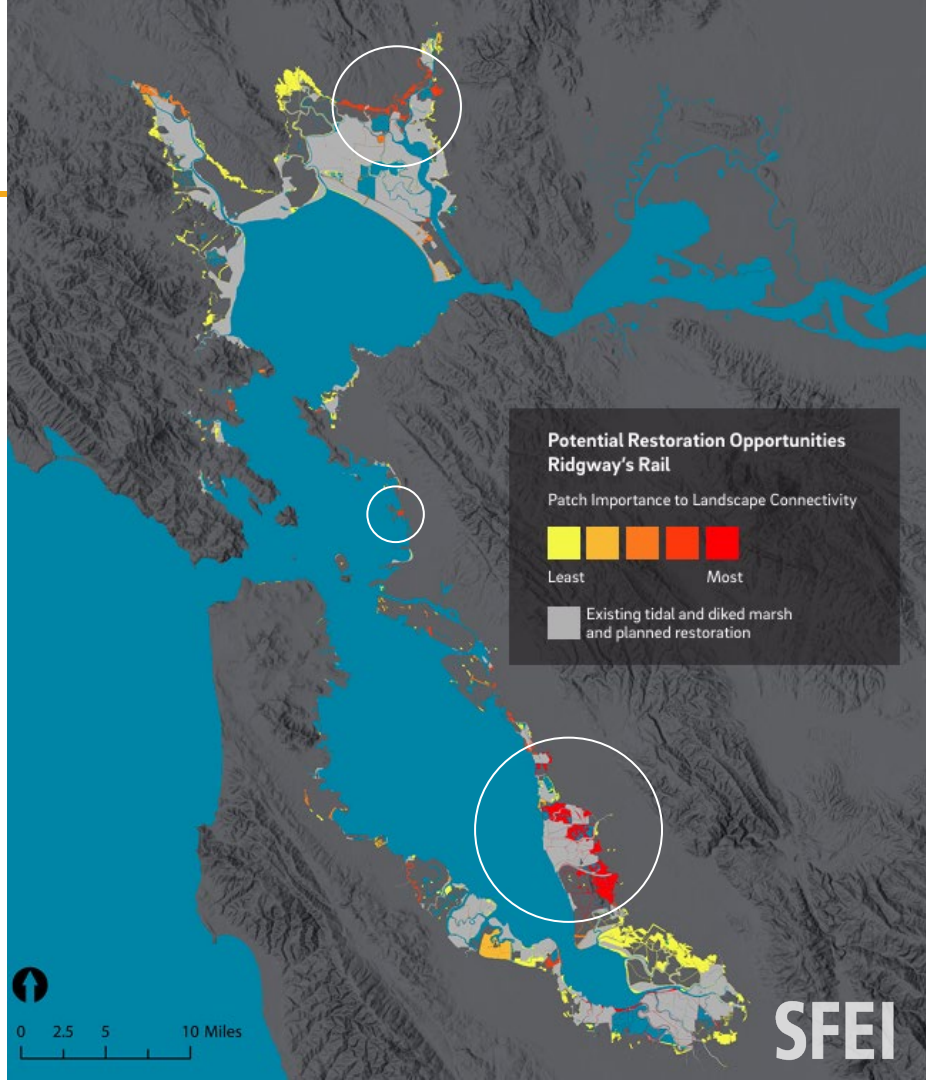
- Highest landscape connectivity potential for patches that help **link adjacent large habitats**
- Key sites are those that help shorten the distance between habitat patches

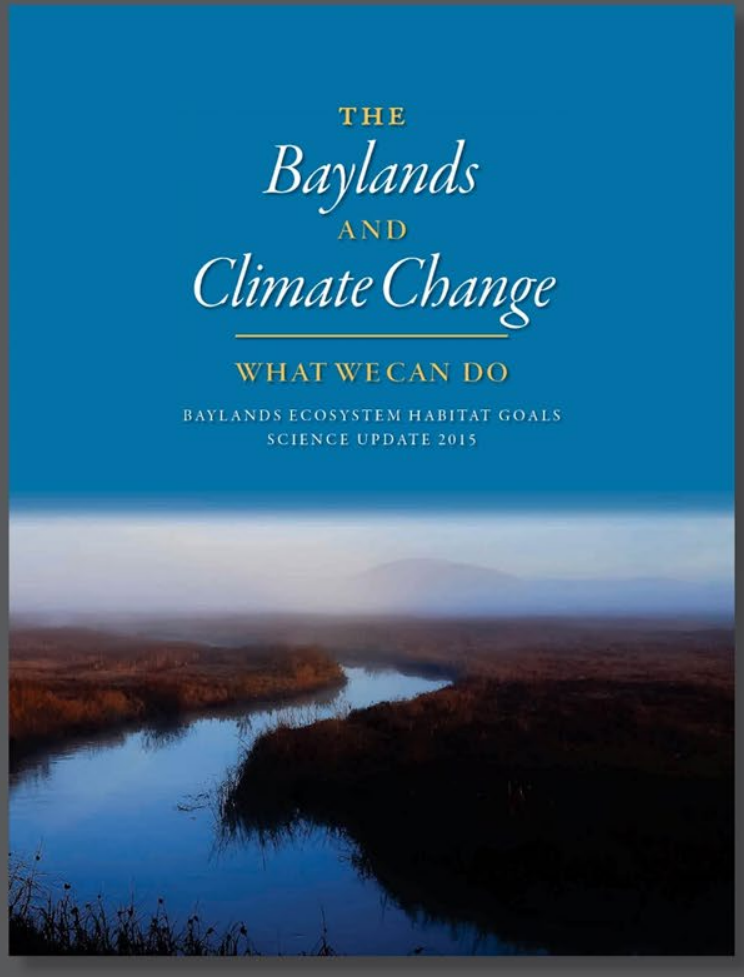


Wildlife Support

Some of the best places to restore habitat for RIRA work to:

- Connect the gaps
- Build bigger habitat zones
- Help both movement and climate adaptation



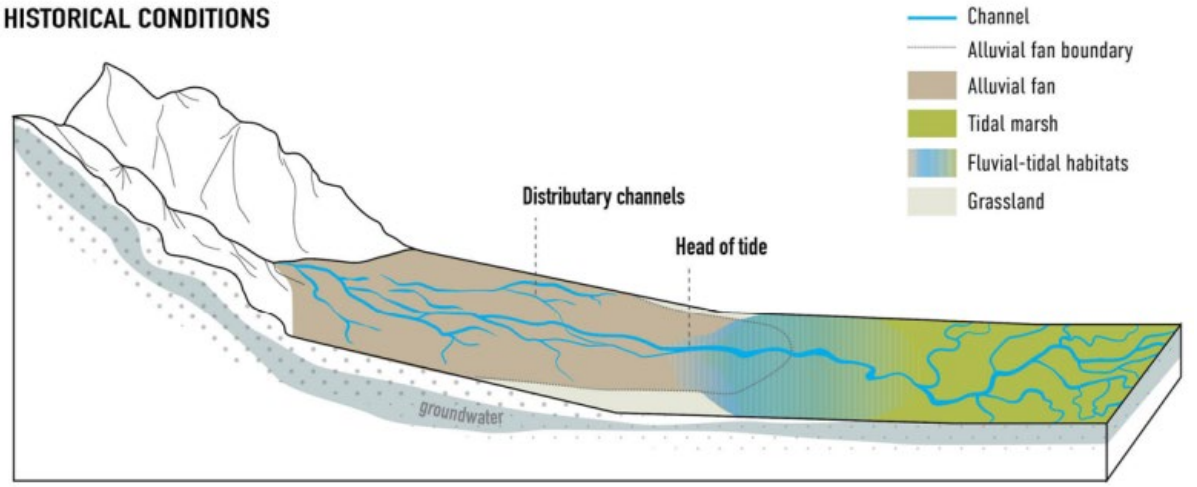


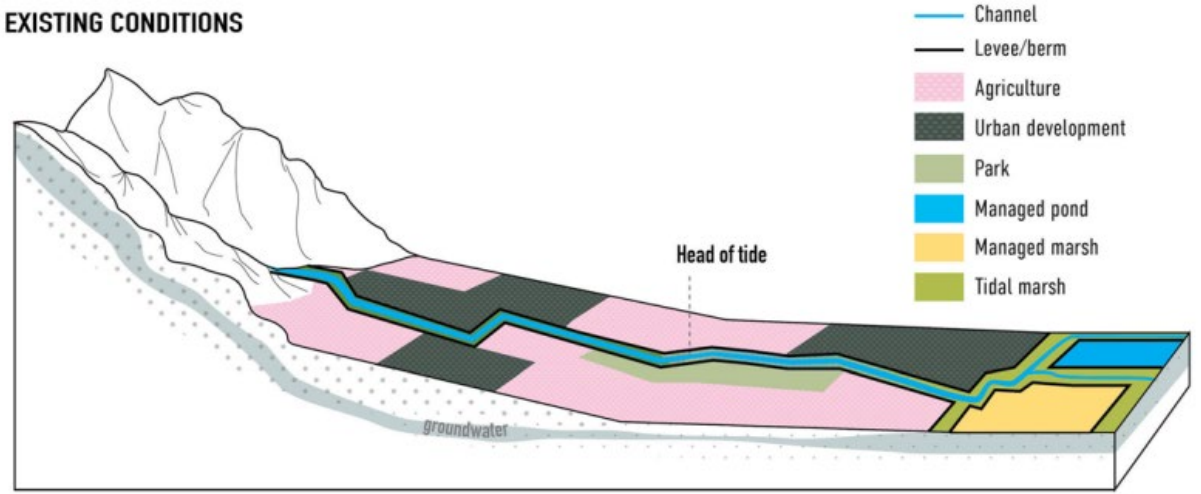
Restore estuary-watershed connections that nourish the baylands with sediment and freshwater

State of California
Coastal Conservancy

BAY AREA ECOSYSTEMS CLIMATE CHANGE CONSORTIUM

Connecting Creeks to Baylands:
A Sediment Strategy



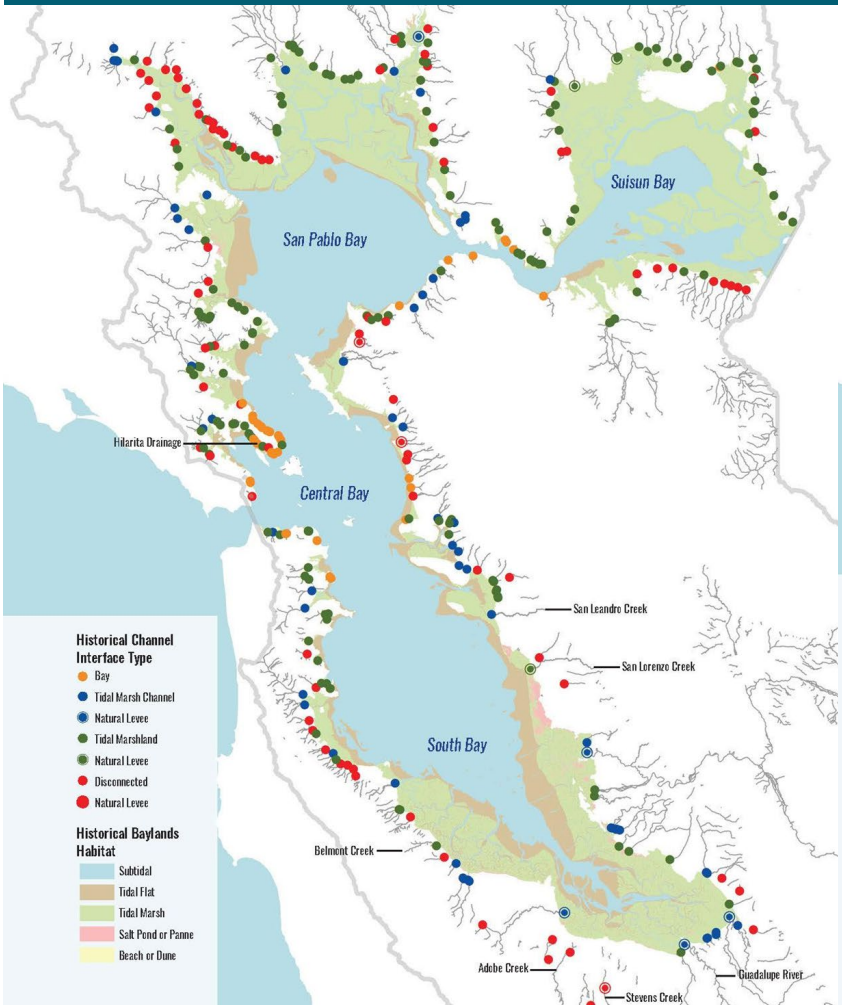


SFEI

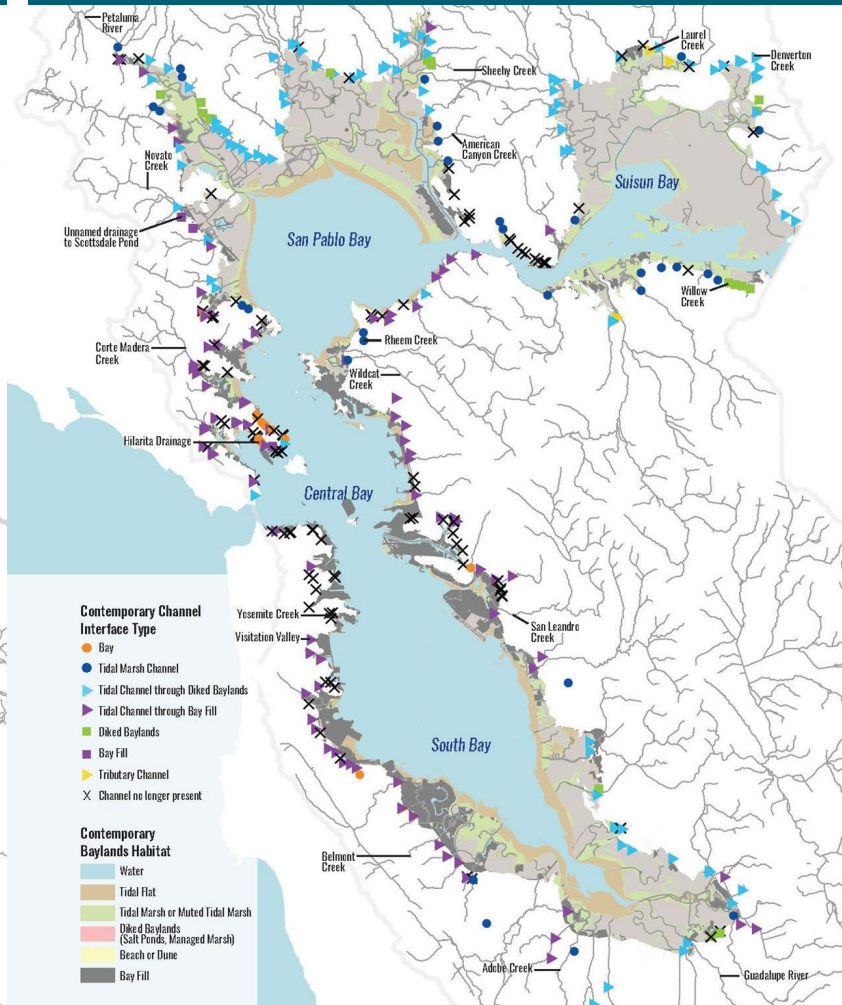
storymaps.sfei.org/flood - control/

SFEI

Historical Channel Types



Modern Channel Types



University of Delaware

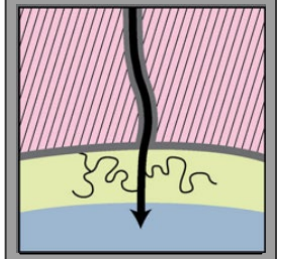
Tidal marshes & mudflats rely on mud to survive

Shira Bezalel

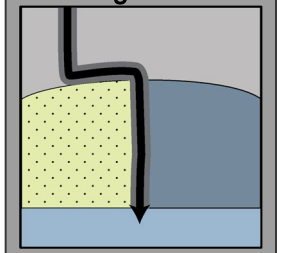
Opportunity types

EXISTING CONDITION

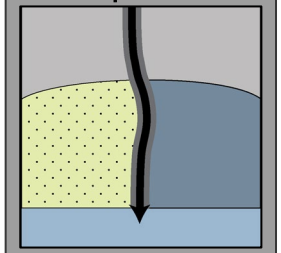
Confined channel



90-degree bend



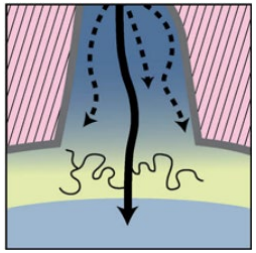
Flows past marsh



Legend

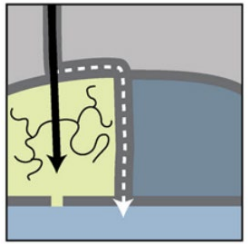
- Bay
- Managed pond
- Diked marsh
- Tidal marsh
- Fluvial-tidal ecotone
- Undeveloped open space
- Levee/berm
- Creek
- Distributary channels

Type 1: Distributary channels



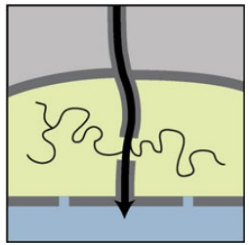
- Ample space
- Convert a confined channel to an unconfined channel
- Above head of tide

Type 2: Realigned channels



- Moderate space
- Align or establish direct creek flow
- Below head of tide

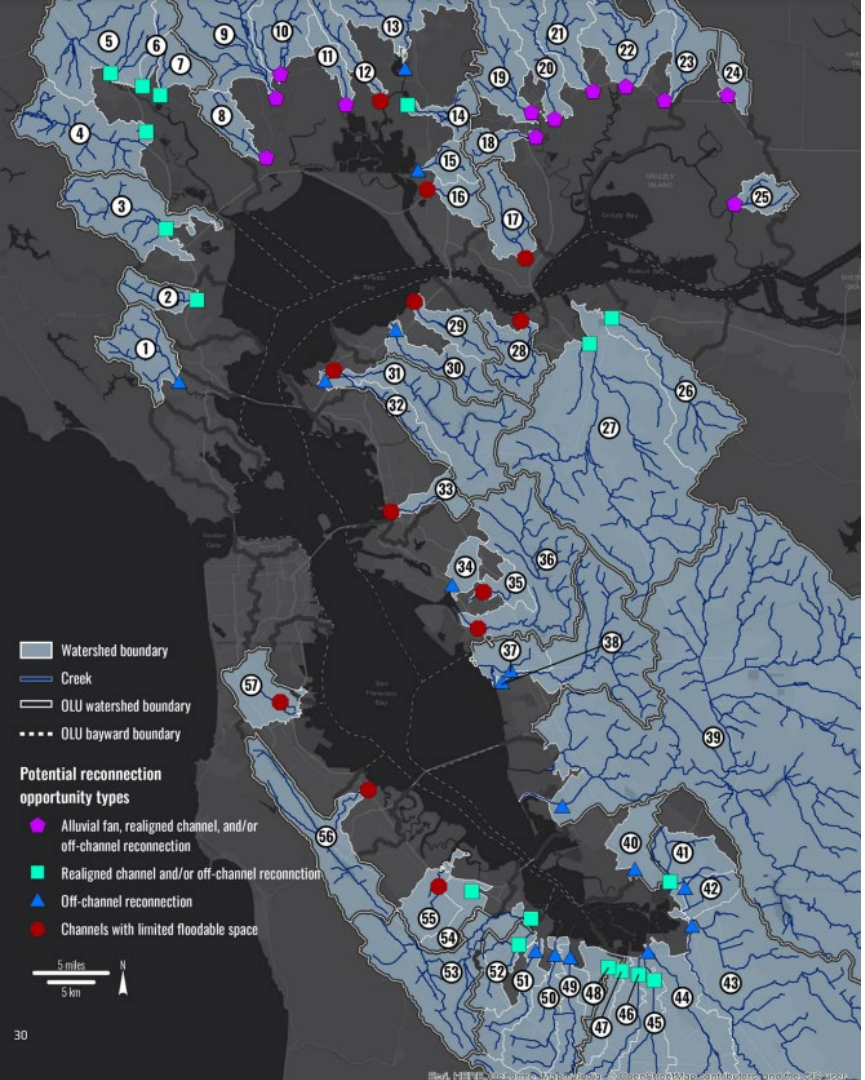
Type 3: Off-channel connections



- Limited space
- Connect an area adjacent to a channel to full tidal action
- Below head of tide

SFEI

Channels mapped by opportunity type



Opportunity types

- Alluvial fan, realigned channel, and/or off-channel reconnection
- Realigned channel and/or off-channel reconnection
- Off-channel reconnection
- Channels with limited floodable space

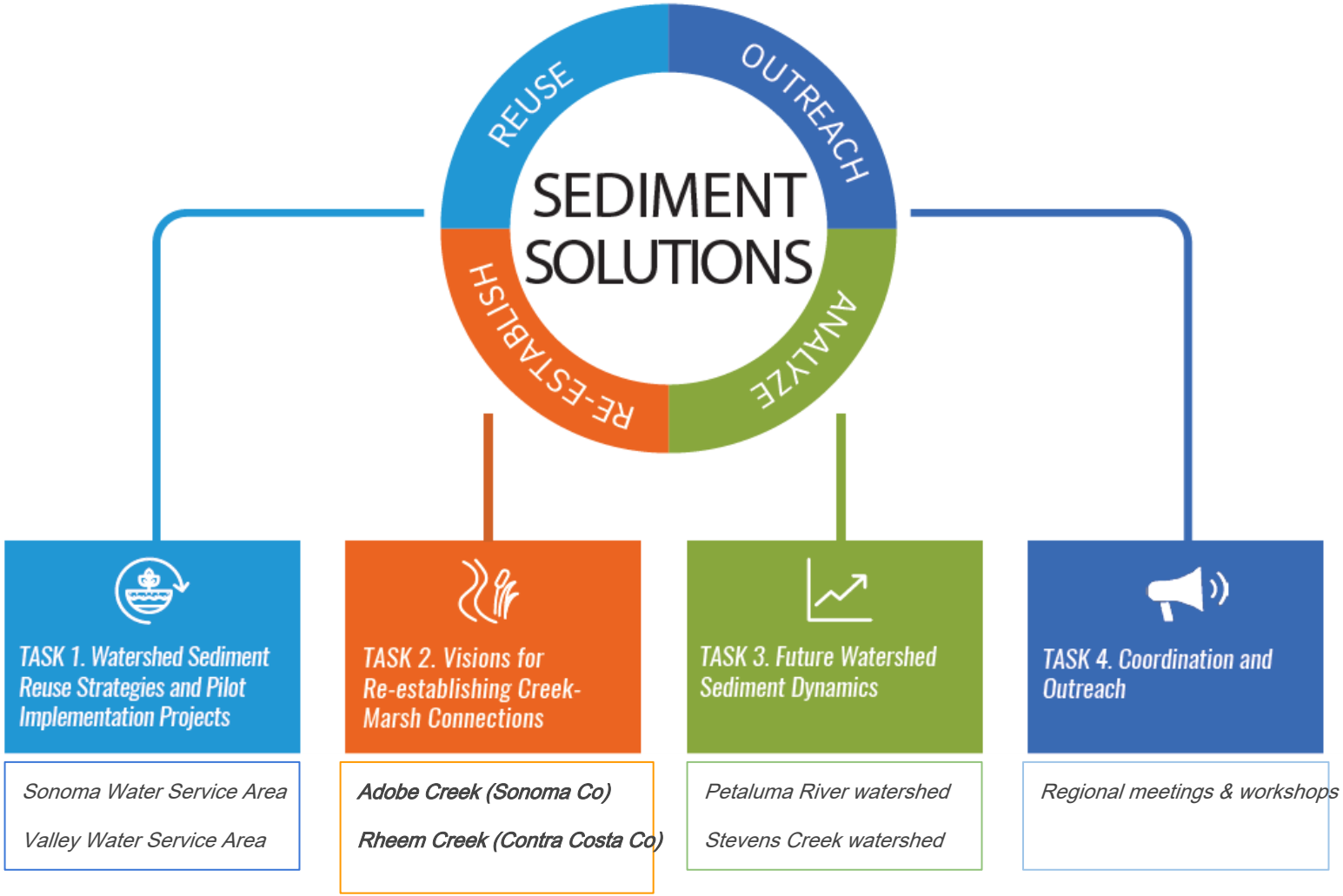
SFEI

Opportunity Matrix

OLU Name	ID #	Creek Name	Opportunity type	Lateral resilience			Vertical resilience		Steelhead support
				Tidal marsh suitability (existing and potential)	Marsh migration space suitability	Polder management suitability	Sediment supply (average annual yield, metric tonnes)	Vertical accretion (potential ability to accrete vertically)	Steelhead habitat (Status of ***O. mykiss irideus***)
Corte Madera	1	Corte Madera Creek	Off-channel	Some ◑	Limited ○	Limited ○	2,800 ●	Other ○	Observed ●
Gallinas	2	Miller Creek	Realigned channel, Off-channel	High ●	High ●	High ●	5,800 ●	Other ○	Observed ●
Novato	3	Novato Creek	Realigned channel, Off-channel	Some ◑	Some ◑	High ●	4,100 ●	Other ○	Observed ●
Petaluma	4	San Antonio Creek	Realigned channel, Off-channel	High ●	High ●	Some ◑	28,800 ●	Highest ●	Not observed ○
	5	Petaluma River	Realigned channel, Off-channel	High ●	High ●	High ●	46,300 ●	Highest ●	Observed ●
	6	Adobe Creek	Realigned channel, Off-channel	Some ◑	High ●	Some ◑	3,600 ●	Highest ●	Observed ●
	7	Unnamed Sonoma County Creek	Realigned channel, Off-channel	Some ◑	Some ◑	Limited ○	6,400 ●	Highest ●	Not observed ○

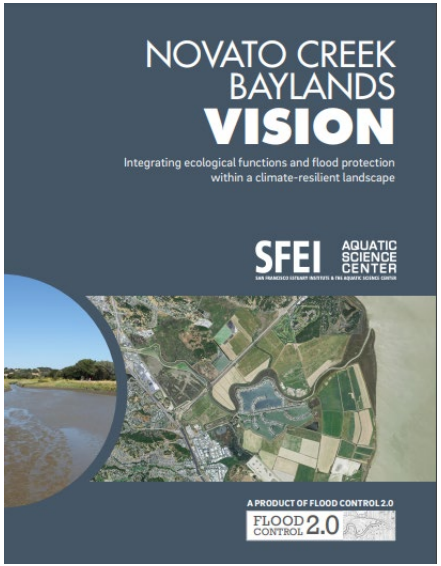
SFEI

Moving from Regional Opportunity to Place - Based Vision

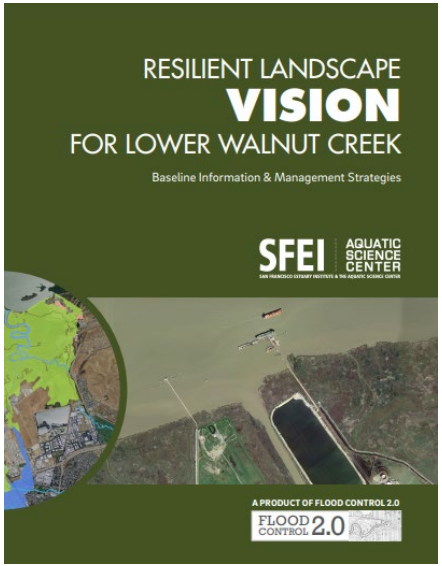

REUSE
OUTREACH
SEDIMENT SOLUTIONS
RE-ESTABLISH
ANALYZE
TASK 1. Watershed Sediment Reuse Strategies and Pilot Implementation Projects
TASK 2. Visions for Re-establishing Creek-Marsh Connections
TASK 3. Future Watershed Sediment Dynamics
TASK 4. Coordination and Outreach
Sonoma Water Service Area
Valley Water Service Area
Adobe Creek (Sonoma Co)
Rheem Creek (Contra Costa Co)
Petaluma River watershed
Stevens Creek watershed
Regional meetings & workshops

SFEI's Resilient Landscape Vision Portfolio

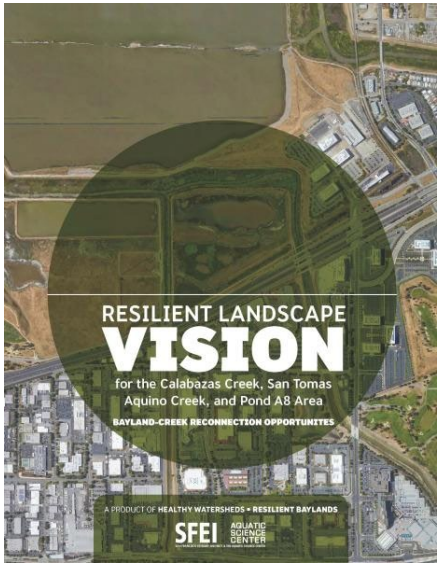
Lower Novato Creek (2015)



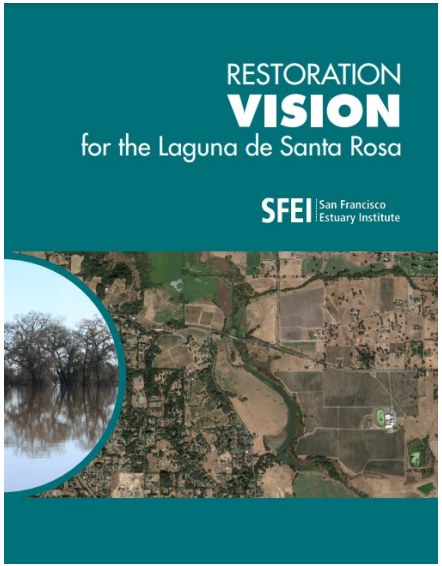
Lower Walnut Creek (2016)



Calabazas & San Tomas Aquino creeks (2018)



Laguna de Santa Rosa (2020)



Resilient landscape vision

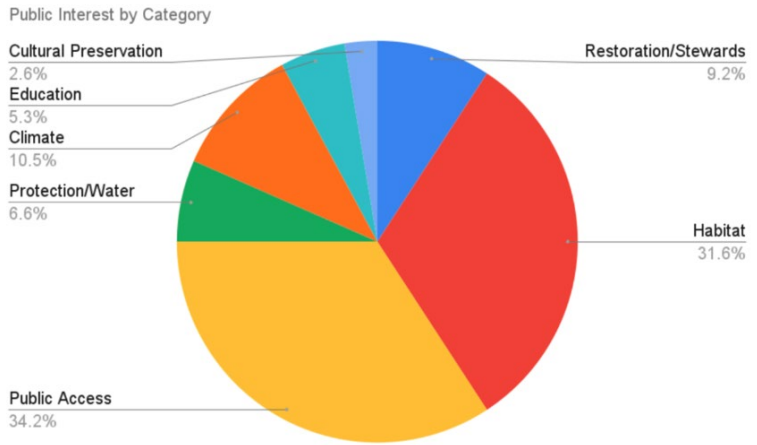
A multibenefit design solution that reintegrates natural processes between creeks and baylands while prioritizing ecosystem services that benefit people, plants, and wildlife

The Question:

How can we increase Alman Marsh's long-term resilience while supporting Lower Adobe Creek's creek habitat and flood management objectives?

- **Deliver sediment**
- **Support current flood management objectives**
- **Benefit wildlife**
- **Benefit people**
- **Other benefits?**

Community meeting - Feb. 2024



Workshop - August 2024


Study Area
Lakeville Highway
Adobe Creek
Rocky Memorial Dog Park
Future development
Tidal Marsh
Alman Marsh
Tidal Marsh
Petaluma River
Shollenberger Park
Dredged Sediment Staging Area
Seasonal Wetland
Gray's Marsh
Tidal Marsh
Mudflat
Ellis Creek Wastewater Recycling Facility
Seasonal Pool
Pond C
Pond B
Pond A
Pond D
Ellis Creek

SFEI

Management Goals

1. **Improve ecosystem functions and services** of the baylands for people and wildlife
2. **Increase the resilience of the baylands** to a rising sea level
3. **Support and enhance recreational, educational, and cultural** benefits and uses

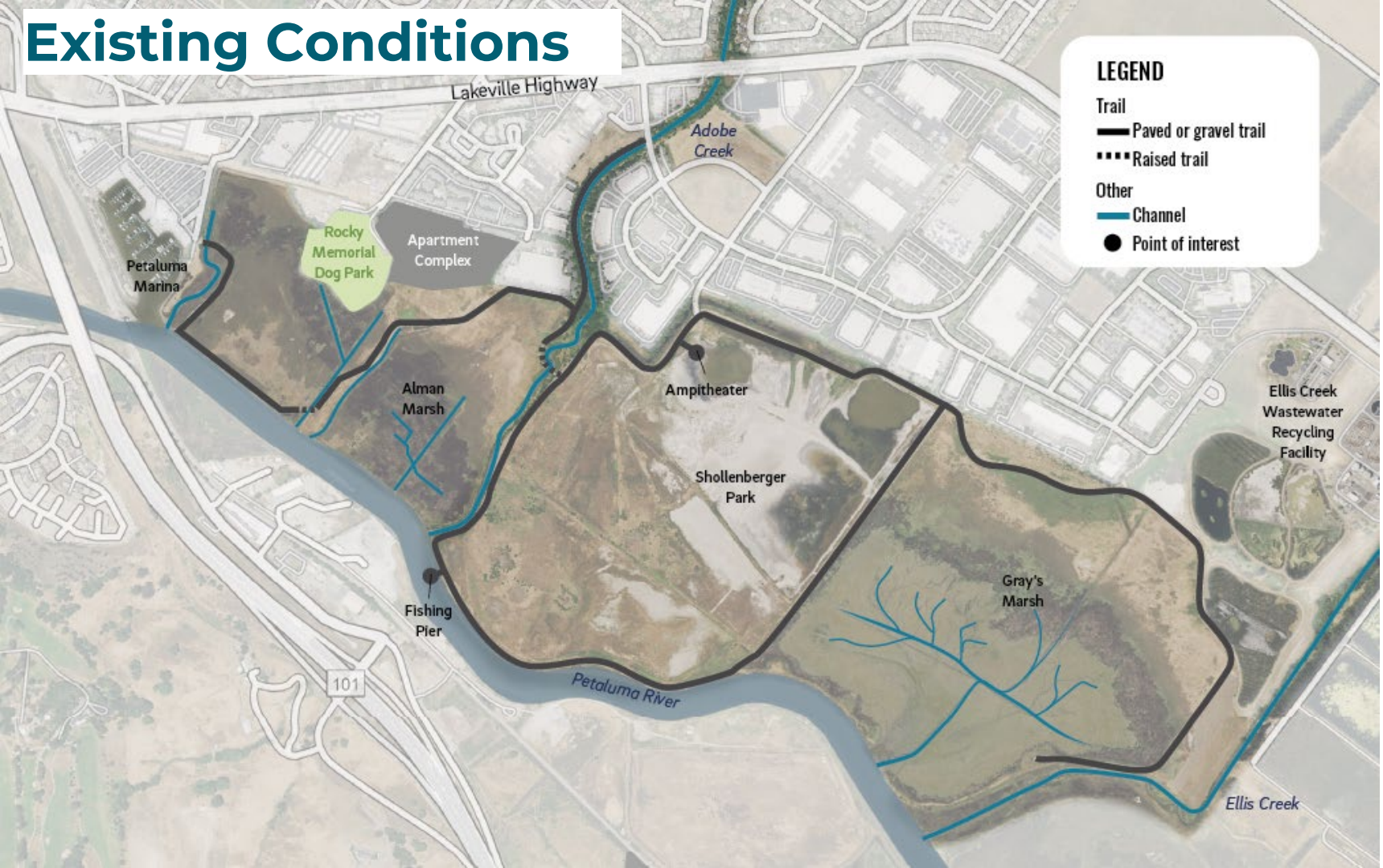
Management Objectives

1. Optimize the natural **delivery of water, nutrients and sediments** to tidal habitats
2. Expand the size and improve the **connectivity of tidal wetland areas**
3. Identify **nature-based solutions** for managing flood risks
4. Beneficially **reuse local sediment**
5. Facilitate **Tribal access and stewardship** of culturally significant resources
6. Realign and improve **public access** infrastructure

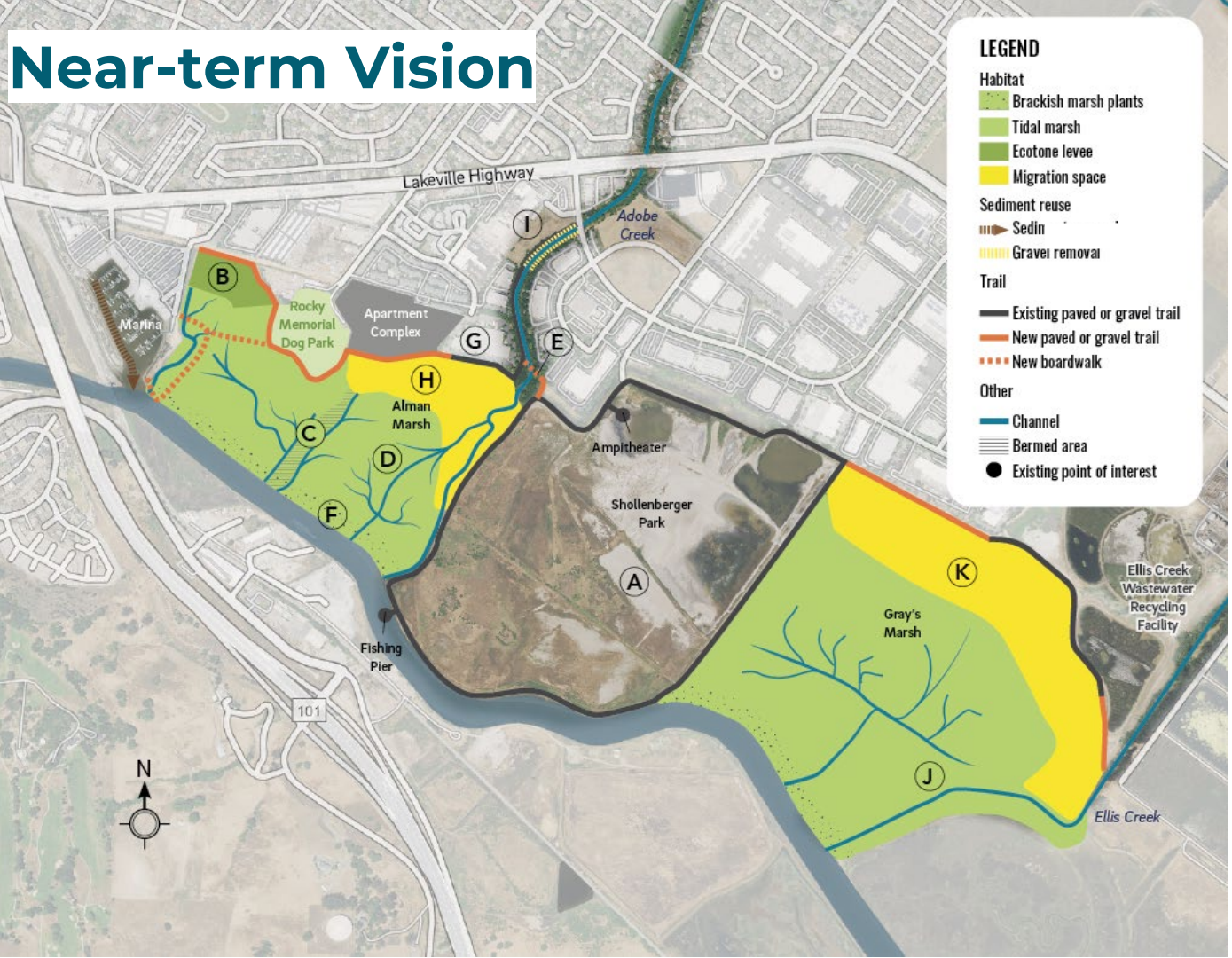
SFEI

Management Objectives	Management Goals: Improve the overall ecosystem functions and services of the baylands of Adobe and Ellis creeks for people and wildlife	Management Goals: Increase the resilience of the baylands of Adobe and Ellis creeks to a rising sea level	Management Goals: Support and enhance recreational, educational, and cultural benefits and uses of the landscape
 **1. Optimize the natural delivery of water, nutrients, and sediments to tidal habitats** to help them build in elevation and be resilient to a rising sea level in a manner that minimizes flood risks	●	●	
 **2. Expand the size and improve the connectivity of tidal wetland areas** to better support native plants, fish, and wildlife	●	●	
 **3. Identify nature-based solutions for managing flood risks** for the built environment and infrastructure adjacent to the study area		●	
 **4. Beneficially reuse local sediment sources** for supporting ecosystem resilience and building flood risk management features	●	●	
 **5. Facilitate tribal access and stewardship of culturally significant resources,** promoting the protection, restoration, and enhancement of landscapes vital to cultural practices and heritage	●	●	●
 **6. Realign and improve public access infrastructure** to minimize ecosystem impacts, enhance educational features, and ensure long-term resiliency			●

Existing Conditions



Near-term Vision



A. **Reuse dredged sediment** from stored at Shollenberger as cover material for ecotone levees*

B. **Construct ecotone levees** to protect development and support wildlife

C. **Remove berm** between marsh patches

D. **Create channel** between Adobe Crk & Alman Marsh to increase connectivity*

E. **Move pedestrian bridge** upstream

F. **Place thin layers of coarse sediment** along Petaluma River banks

G. **Realign recreational trails** & activities

H. **Prepare marsh migration space**

I. **Reuse gravel from the sediment basin** at Lakeville Hwy for ecotone foundation material

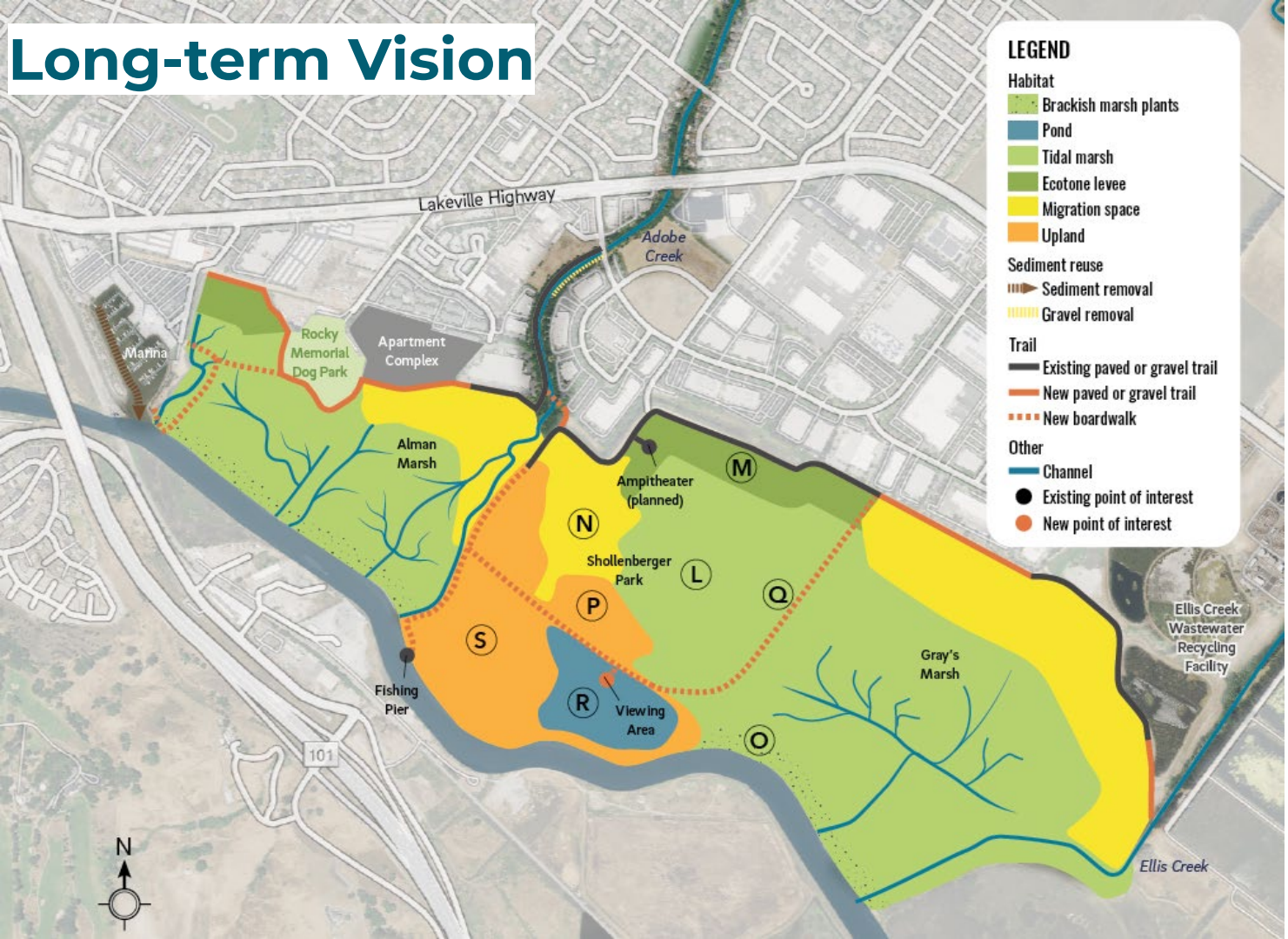
J. **Enhance Gray's Marsh***

K. **Enable Tribal use** for culturally important activities

*More study needed

SFEI

Long-term Vision



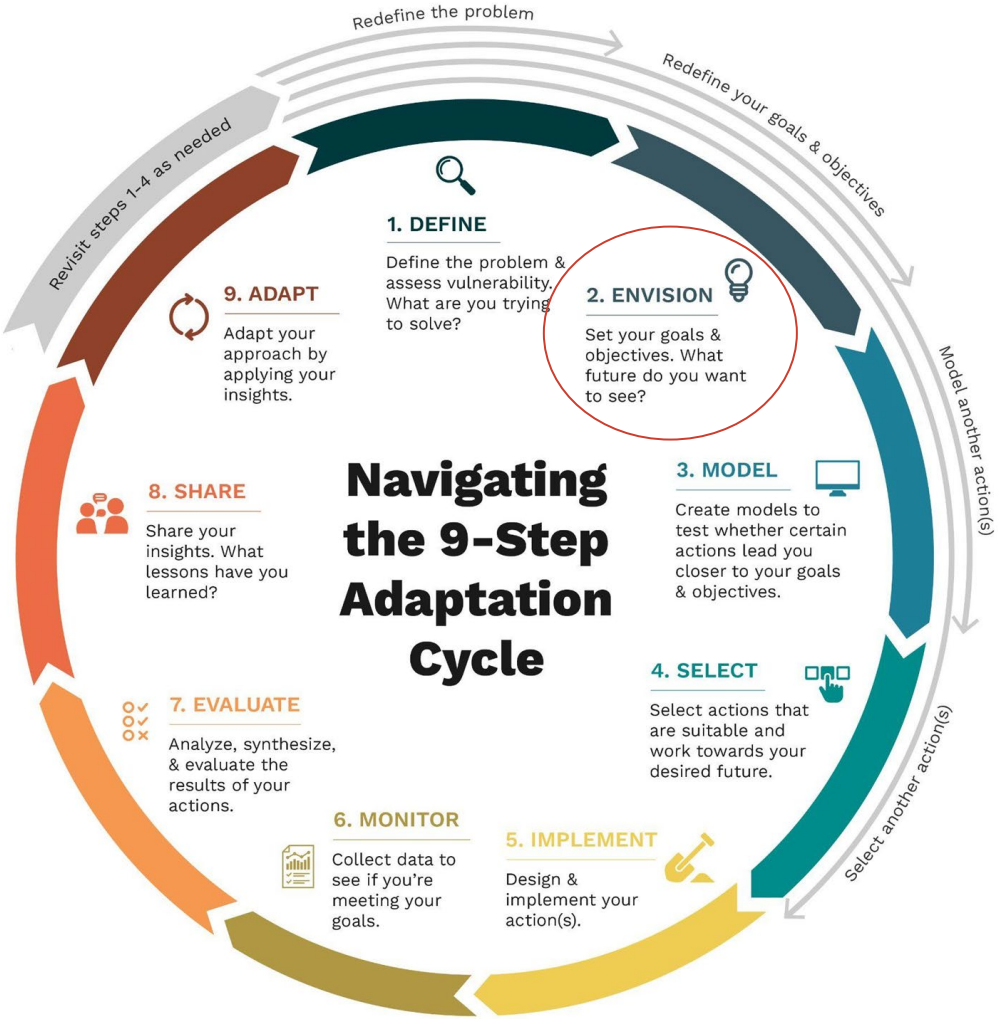
- **L. Restore tidal marsh***
- **M. Construct ecotone levees**
- **N. Prepare marsh migration space**
- **O. Place thin layers of coarse sediment** along Petaluma River banks
- **P. Enable Tribal use** for culturally important activities (e.g., plant tule and alkali bulrush, maintain access)
- **Q. Realign recreational trails** & activities
- **R. Create seasonal pond** with viewing platform*
- **S. Prepare and preserve upland area** for future high marsh island

**More study needed*

SFEI

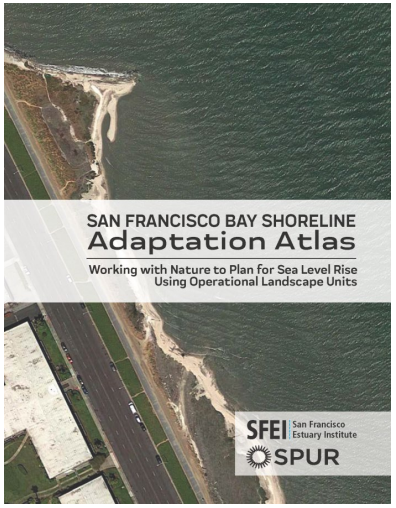
Next steps:

- We are at the “Envision” step
- Modeling is the next step to help understand which actions to select
- Report will be available in ~December 2025

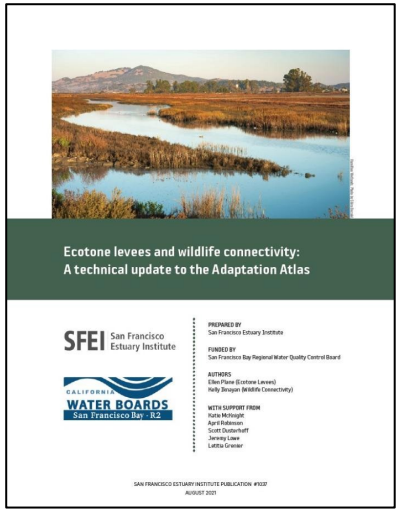


Read our reports:

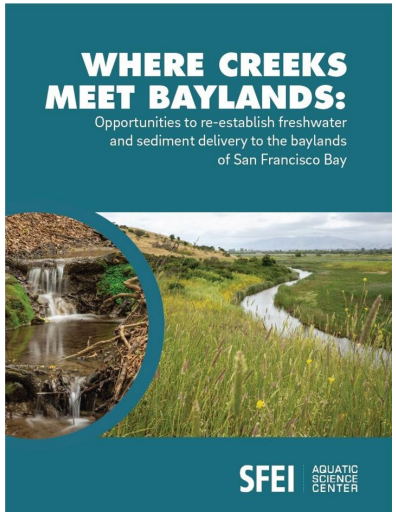
Adaptation Atlas Data Download Page:



adaptationatlas.sfei.org



sfei.org/publications?term=753#gsc.tab=0



sfei.org/publications?term=753#gsc.tab=0

SFEI

A big thanks to our funders and partners!

Thank You

Katie McKnight (katiem@sfei.org)

SFEI San Francisco Estuary Institute

Thank you to the rest of our team:
Ellen Plane, Kelly Iknayan, Annie Sneed, Alex Braud, Jeremy Lowe, Melissa Foley, Scott Dusterhoff, Ruth Askevold