



# ADAPTATION PLANNING USING NATURE'S BOUNDARIES

**SF Regional Water Quality Control Board**

Oakland | April 10, 2019

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# Outline

- An update on the Waterboard funded **Adaptation Atlas**
- Applications of the **Adaptation Atlas** and **Operational Landscape Units** that are underway
- Plans for **Phase 2** of the project



**As sea levels continue to rise, SF Bay communities will need to adapt in order to build social and ecological resilience**





# In this urbanized estuary

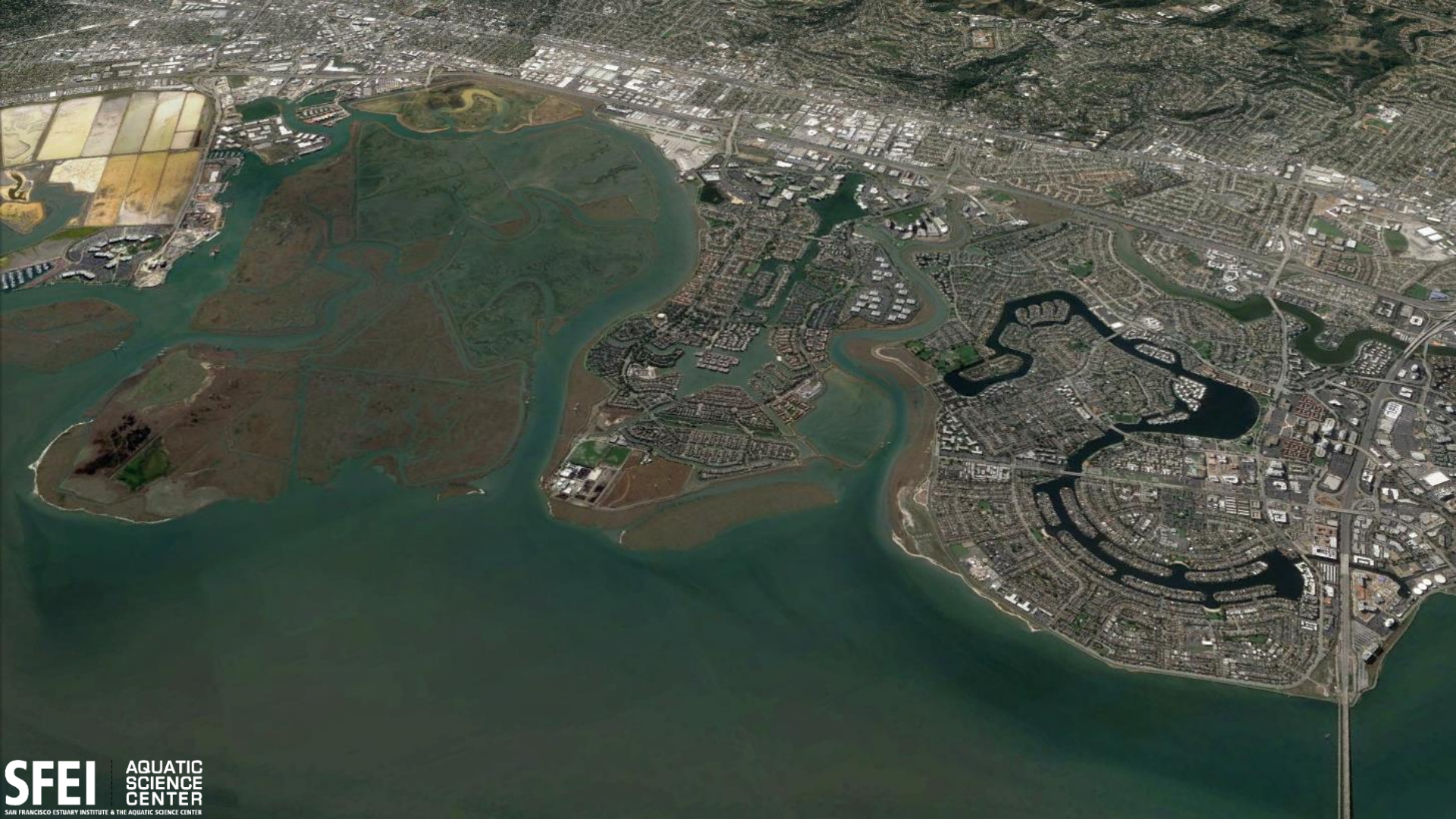
- The Bay and shoreline are **heterogeneous and dynamic**
- There is **no one-size-fits-all approach** for SLR adaptation
- We can make our shoreline and communities more resilient **by working with people and nature and at the right scale** to implement sea-level rise solutions.
  - Where are nature-based strategies most appropriate?

















# Traditional Jurisdictions

- 9 counties
- 101 cities
- Multiple special districts
- Regulatory jurisdictions
- Frontline communities in low-lying areas





Physical processes that govern the shoreline happen at the **Bay scale**.

Too large and complex for individual projects.

OCEAN / BAY PROCESSES

ESTUARINE PROCESSES

WATERSHED PROCESSES



**Sea-level rise  
will not stop at  
city boundaries.**



# Addressing this challenge by:

- Dividing up the Bay into manageable units that respond to the **physical and ecological processes**
- Mapping **suitability for nature-based adaptation measures**
- **Integrating across the land-water divide**, and connecting bayside measures with landside measures





## STEP 1

**Plan using  
nature's  
boundaries**

*(instead of traditional  
boundaries)*

## STEP 2

**Identify  
adaptation  
measures that  
could work well  
in a given place**

*(and use nature as much  
as you can)*

## STEP 3

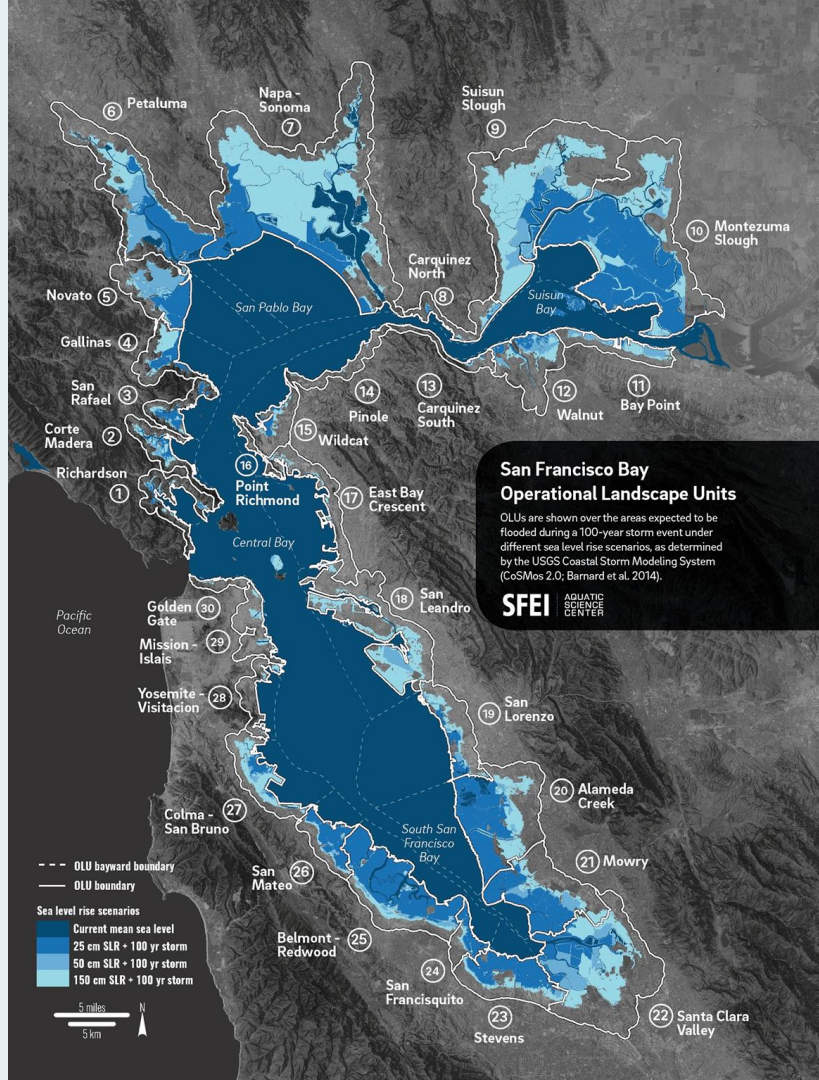
**Use when  
bringing  
stakeholders  
together to  
envision a  
resilient future**

# Nature's Boundaries

## Operational Landscape Units

Areas with shared geophysical and land use characteristics *suited for a particular suite of nature-based measures*

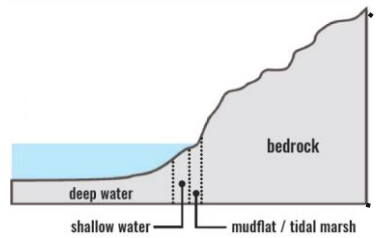
- *Bigger than a project*
- *Bigger than a City*
- *Smaller than a County*



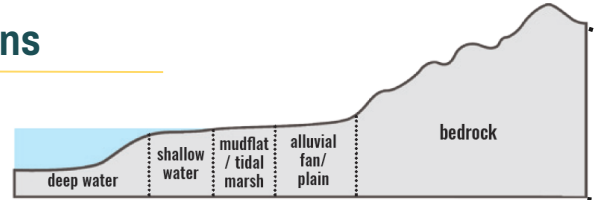


# Geomorphic Unit Types

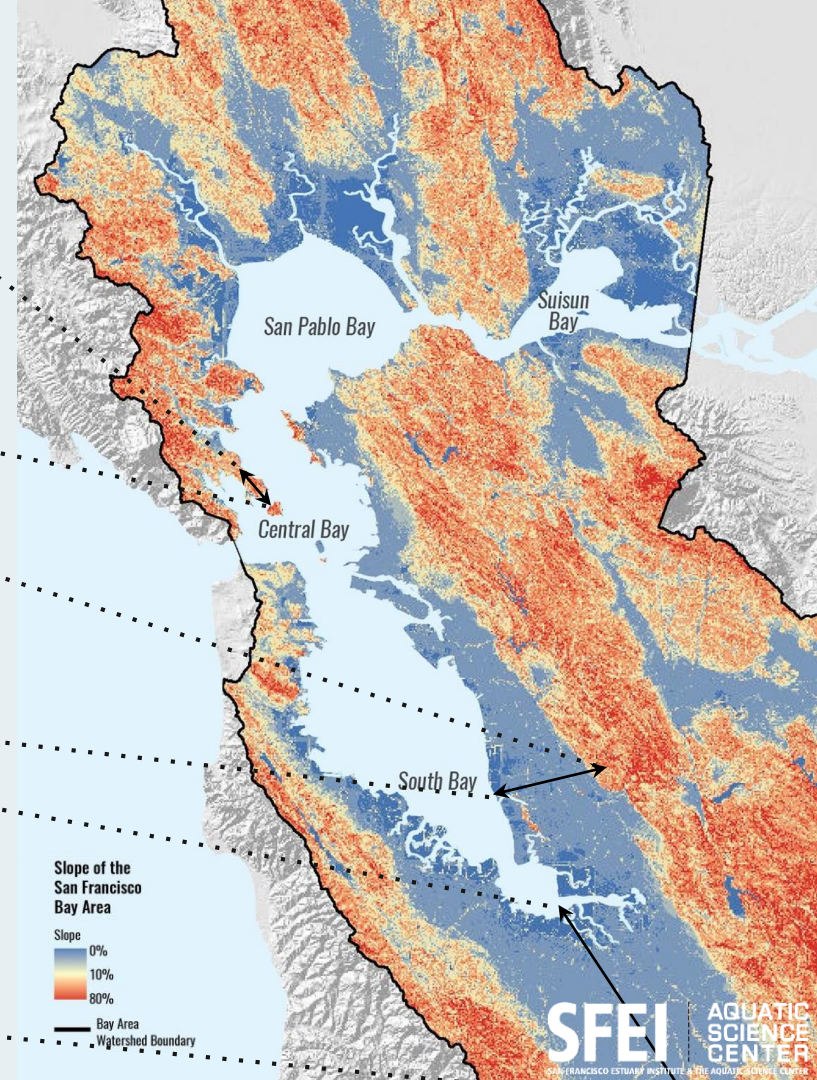
## 1 Headlands & small valleys

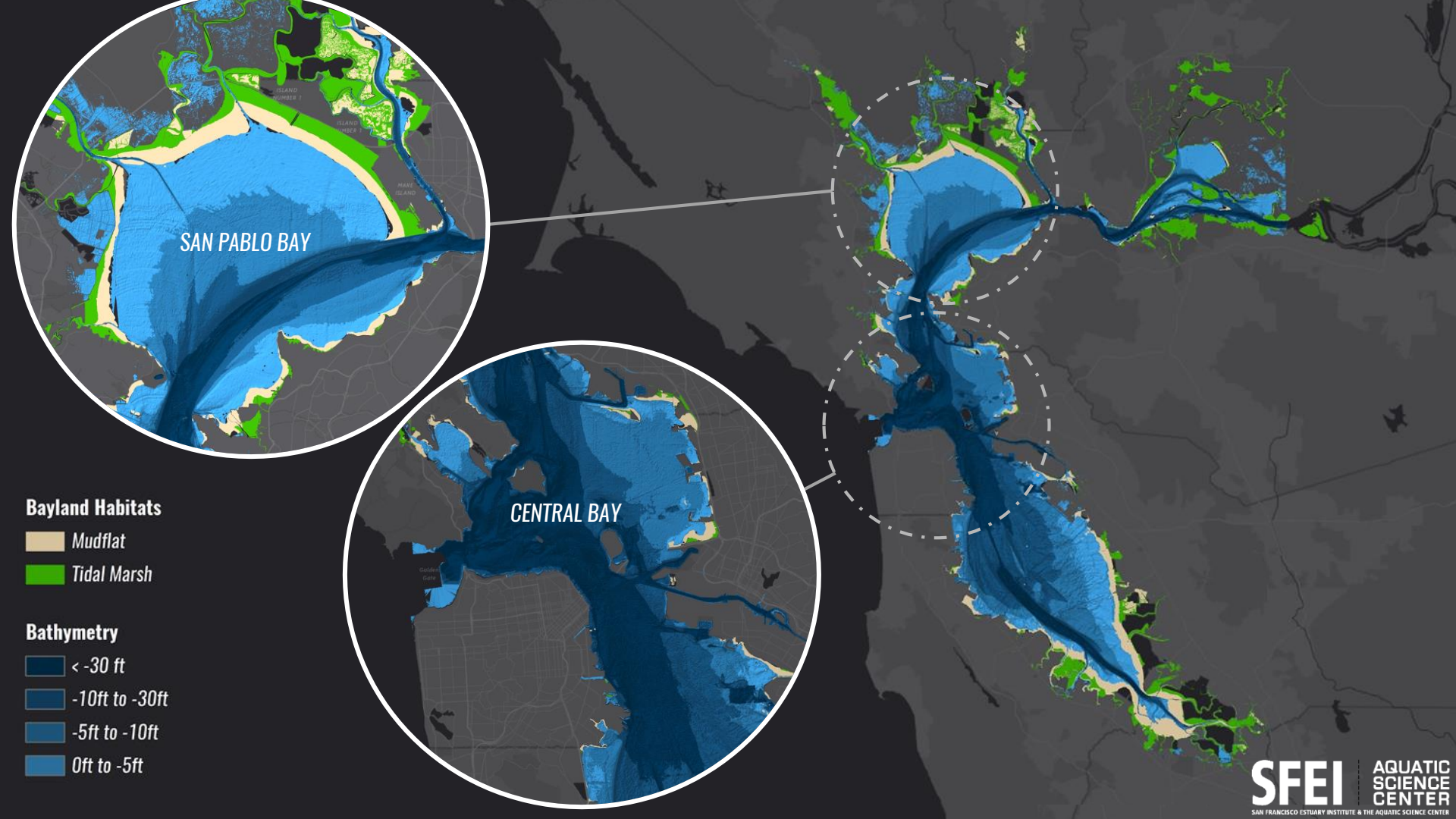


## 2 Alluvial fans & plains



## 3 Wide alluvial valleys





SAN PABLO BAY

CENTRAL BAY

**Bayland Habitats**

-  Mudflat
-  Tidal Marsh

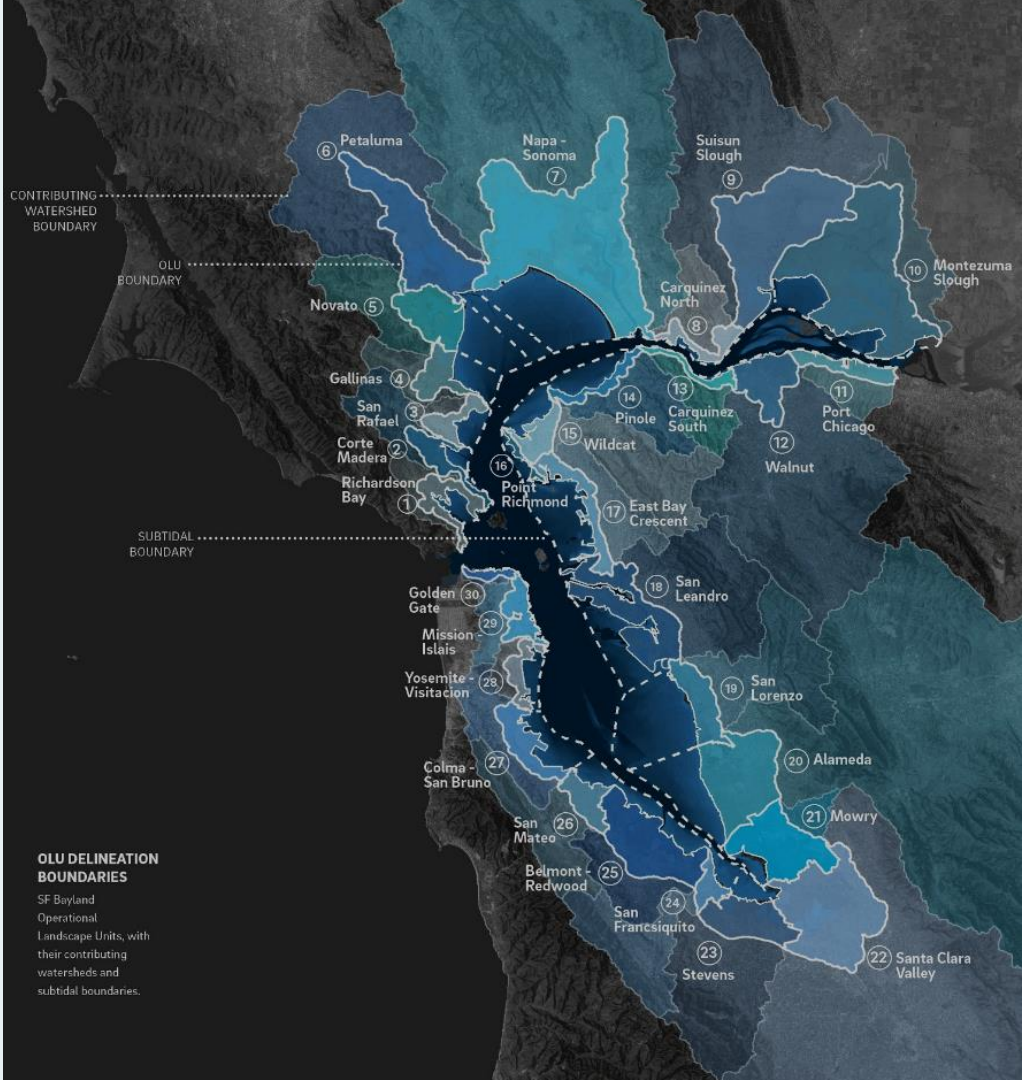
**Bathymetry**

-  < -30 ft
-  -10ft to -30ft
-  -5ft to -10ft
-  0ft to -5ft



# Data inputs

- Defined by geomorphic units & bathymetry
- Characterized by
  - Physical and ecological factors
  - Built environment patterns
  - Key vulnerabilities

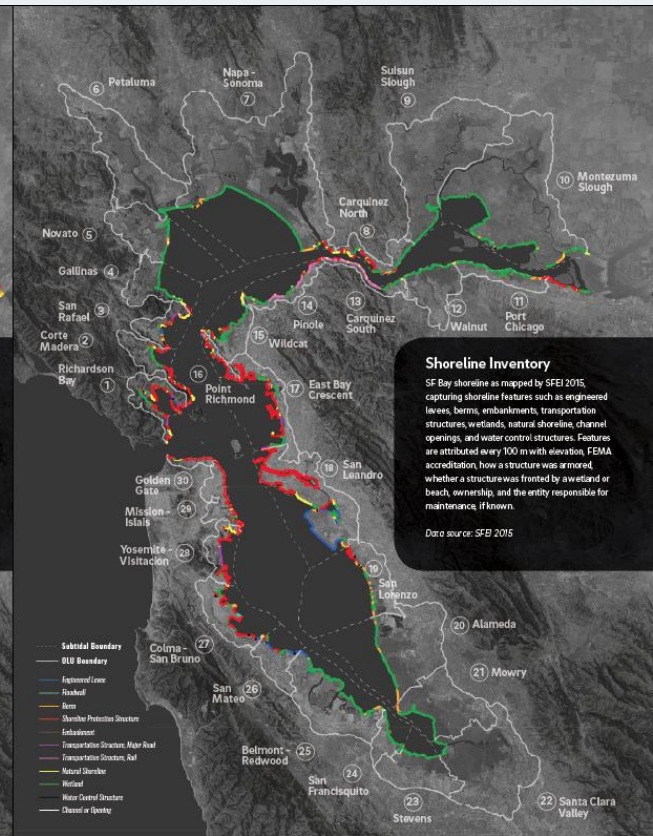


# Shoreline characteristics

## Tidal range

## Wind-wave heights

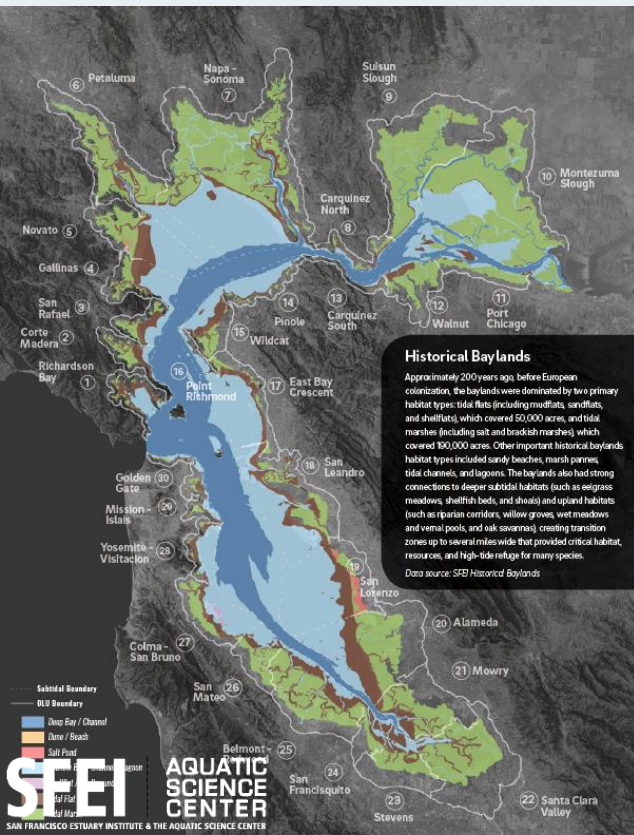
## Shoreline composition



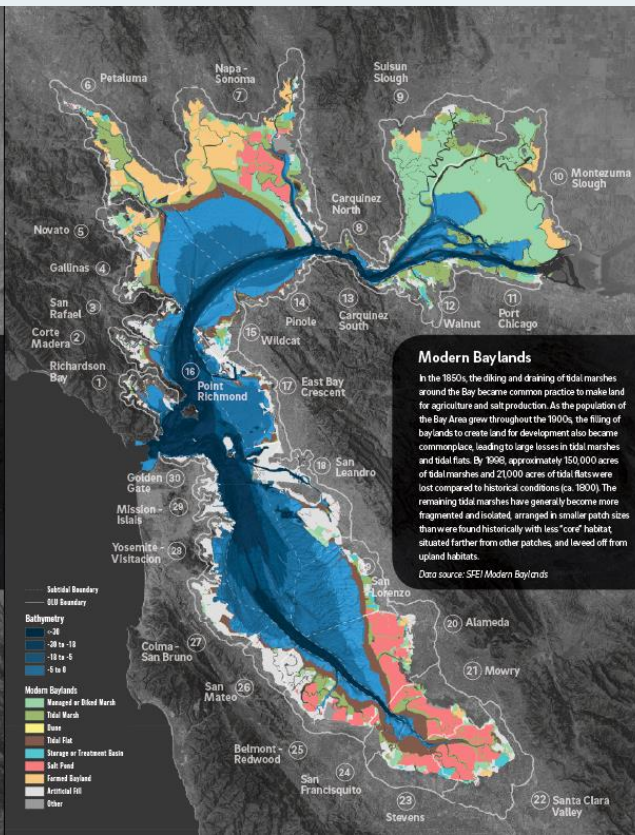


# Baylands

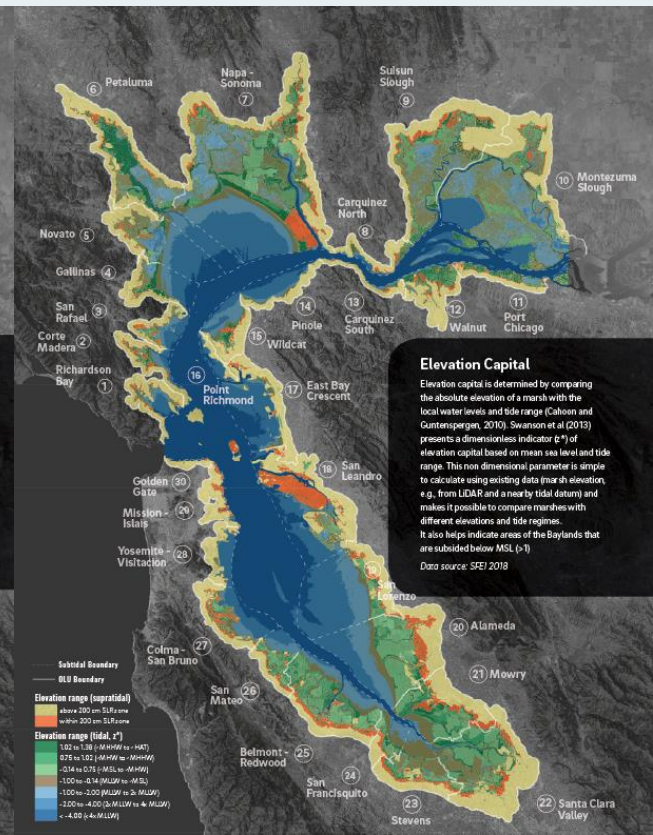
## Historical baylands



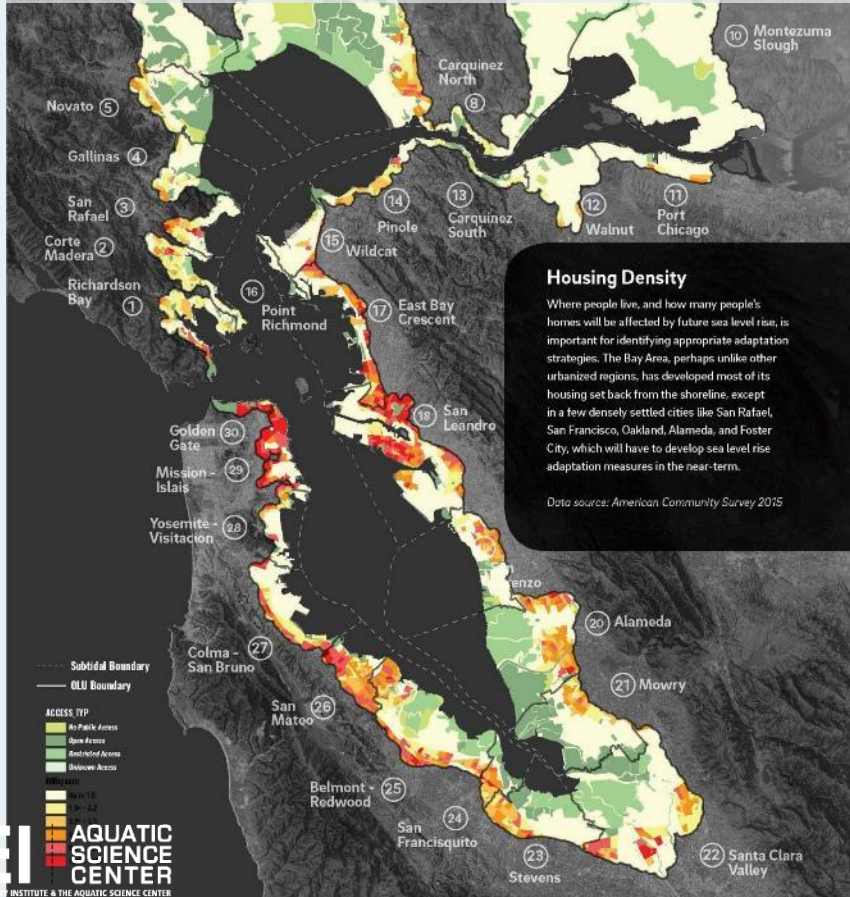
## Modern baylands



## Elevation capital



# Housing density



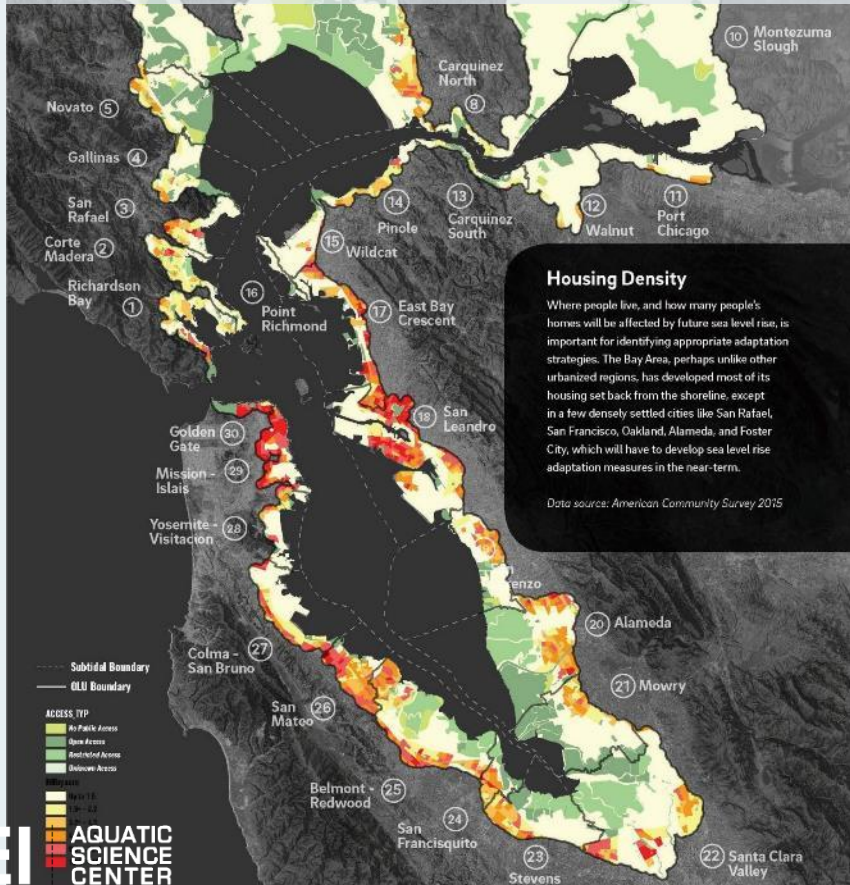
## Housing Density

Where people live, and how many people's homes will be affected by future sea level rise, is important for identifying appropriate adaptation strategies. The Bay Area, perhaps unlike other urbanized regions, has developed most of its housing set back from the shoreline, except in a few densely settled cities like San Rafael, San Francisco, Oakland, Alameda, and Foster City, which will have to develop sea level rise adaptation measures in the near-term.

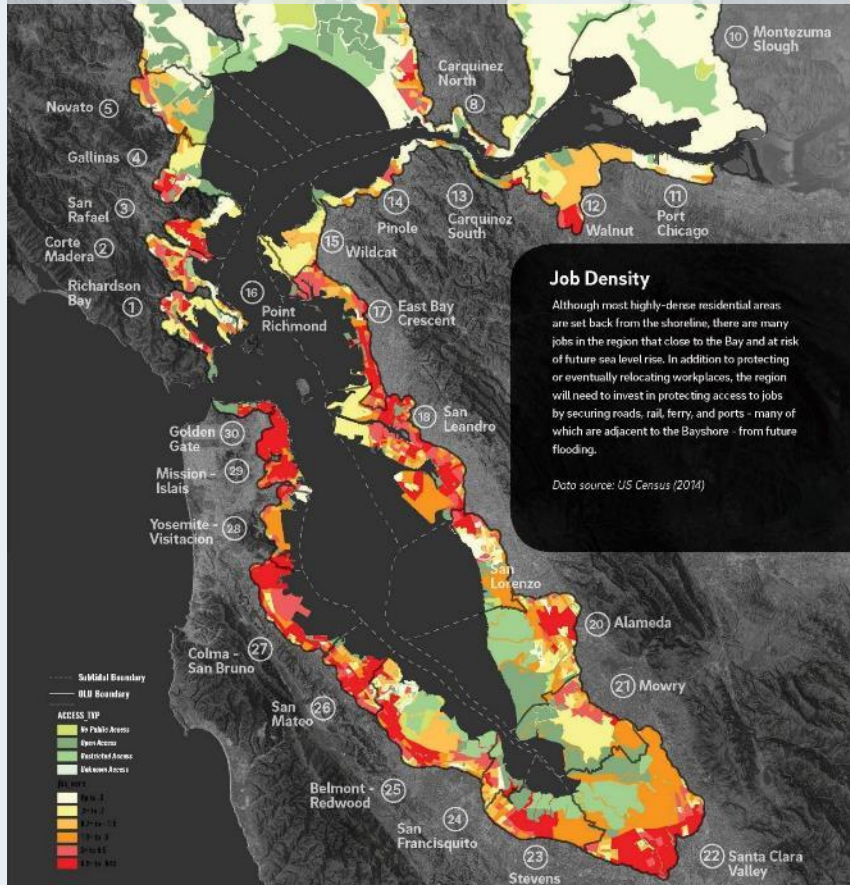
Data source: American Community Survey 2015



# Housing density



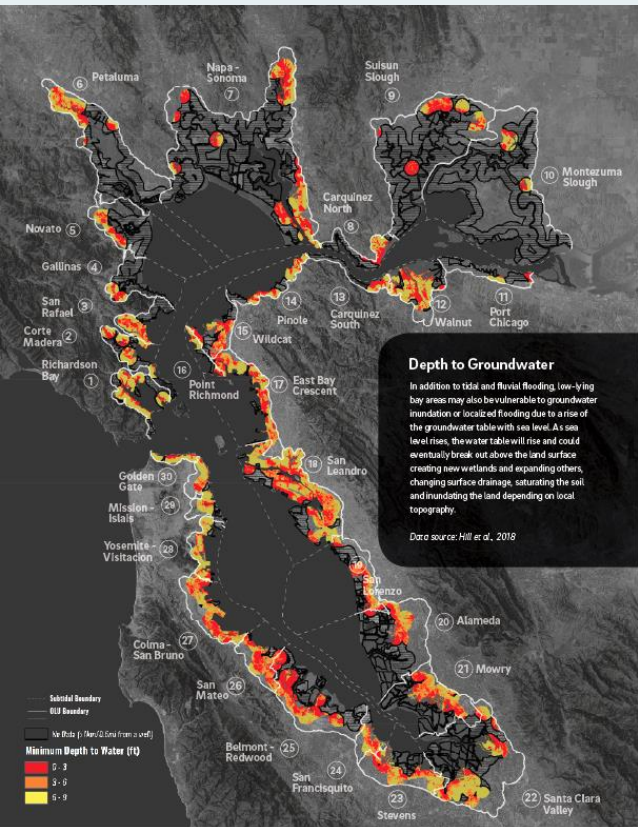
# Job density



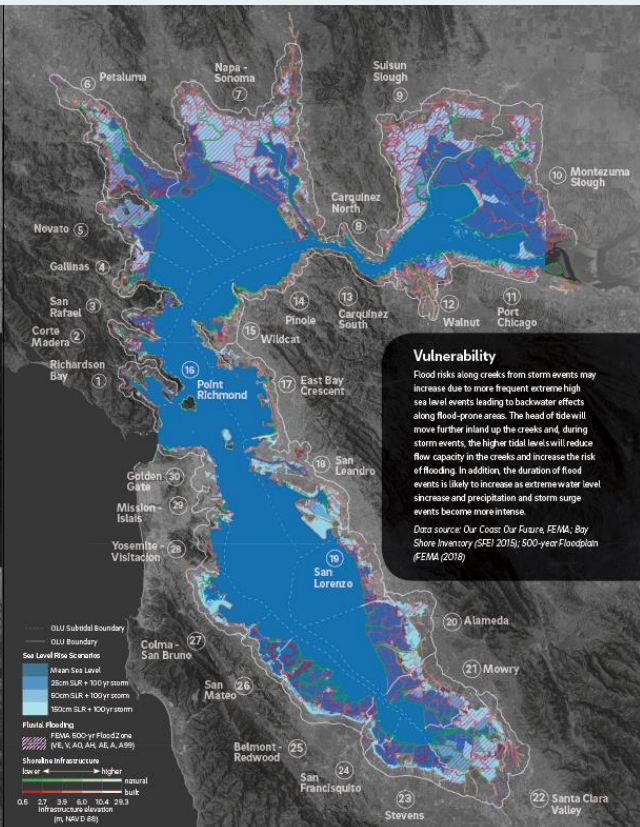


# Vulnerability

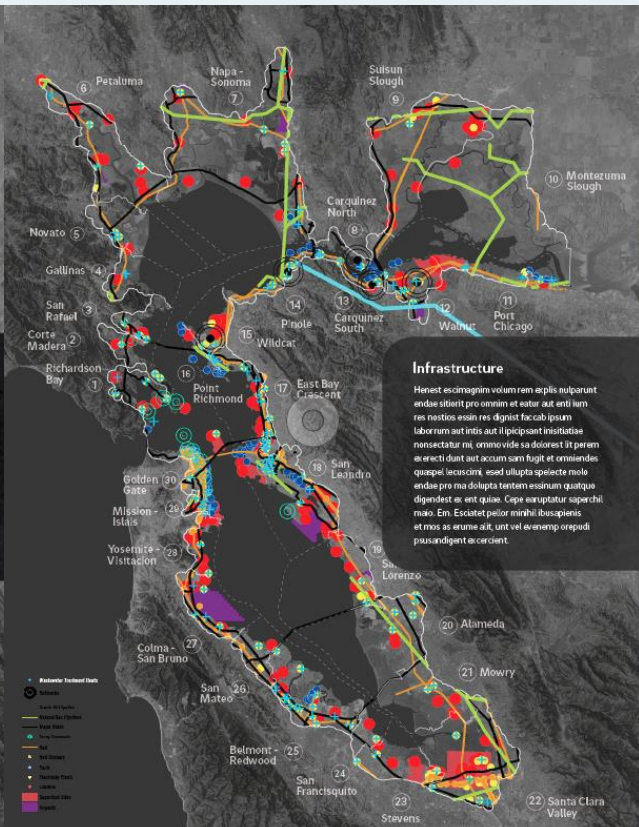
## Depth to groundwater



## SLR + Bay shore inventory + FEMA 500-yr flood zone



## Infrastructure







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Photo: Mike Lowery





*7.12 ft NAVD - King Tide, 2019  
Crab Cove Alameda*

# Adaptation measures

## Nature-based measures

- Nearshore reefs
- Submerged aquatic vegetation (eelgrass)
- Beaches (sand, cobble, shell)
- Tidal marshes
- Polder management
- Ecotone levees
- Migration space preparation
- Creek-to-bayland reconnections
- Green stormwater infrastructure

## Regulatory, financial, policy tools

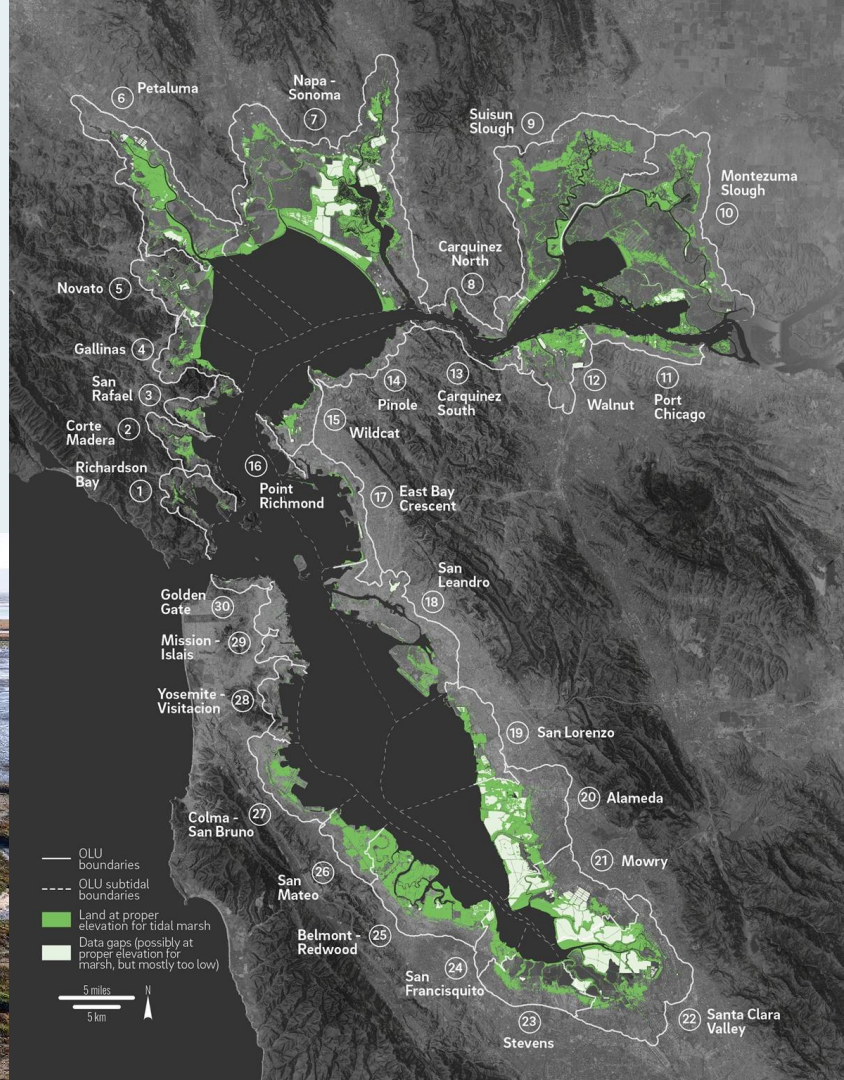
- Zoning and overlay zones
- Setbacks, buffers, and clustering
- Building codes and building retrofits
- Rebuilding and redevelopment restrictions
- Conservation easements
- Tax incentives and special assessments
- Geologic Hazard Abatement District
- Transfer of Development Rights
- Buyouts



# Marsh restoration

## Methods:

- Identify areas currently at the right elevation to potentially support tidal marshes using  $z^*$  (  $\sim$ MSL and  $\sim$ HAT)
- Assess width of marsh needed to knock 100-year waves down to  $\sim$ 1 ft (0.3 m)

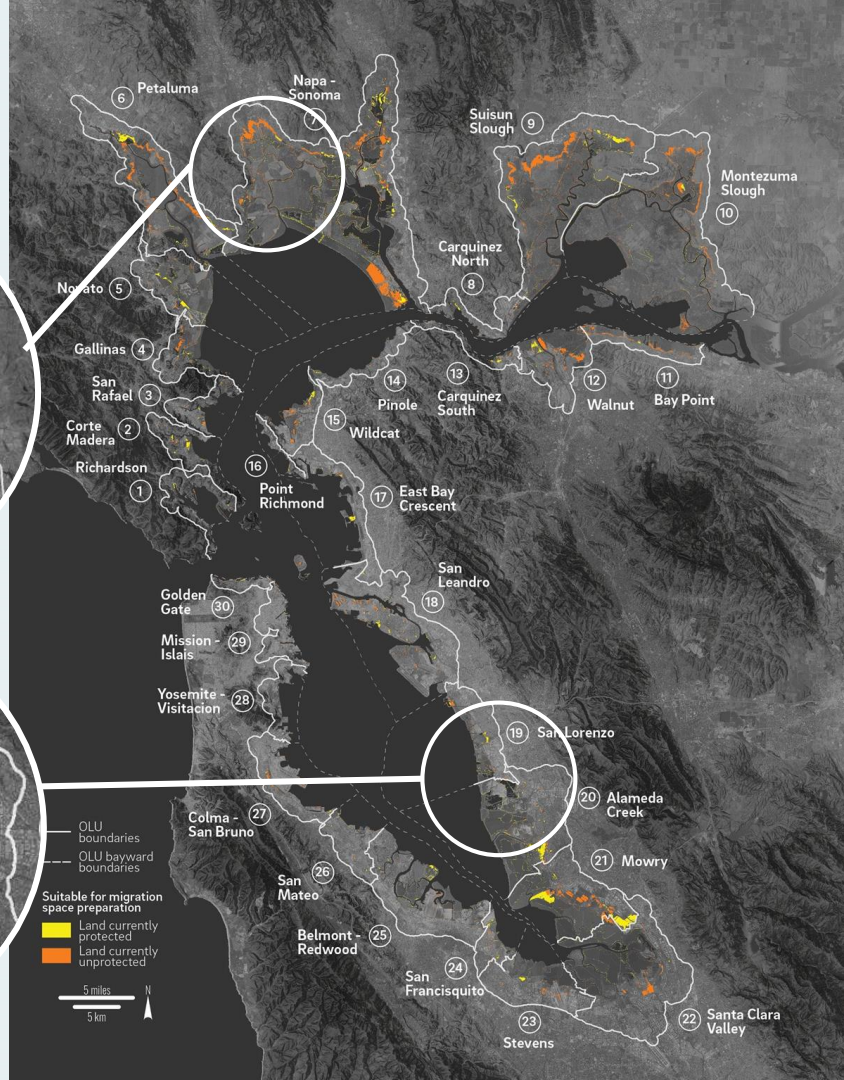
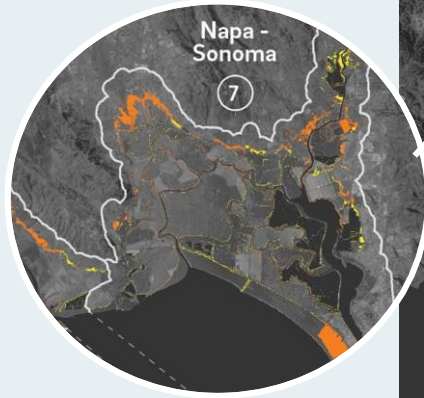




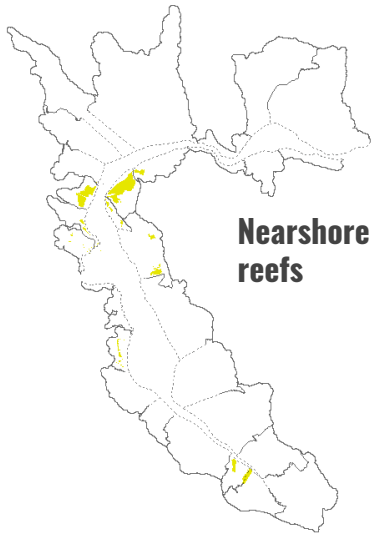
# Migration Space

## Methods:

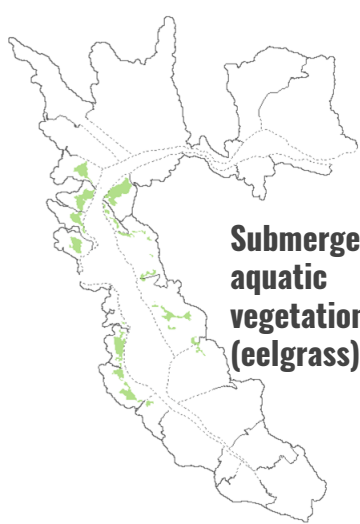
- Identify areas that are above tidal range now, but will be within tidal range in the future (areas where wetlands could migrate)







**Nearshore reefs**



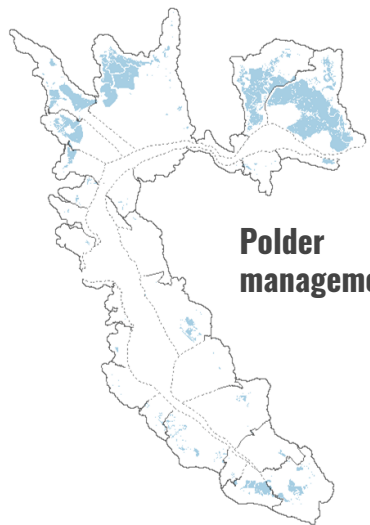
**Submerged aquatic vegetation (eelgrass)**



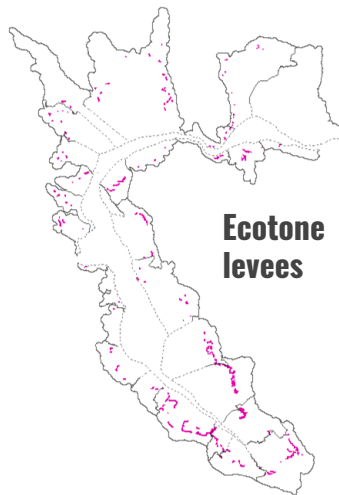
**Beaches**



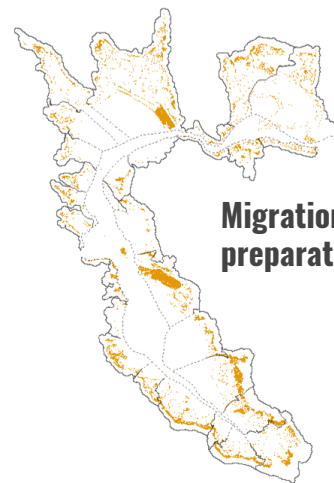
**Tidal marshes**



**Polder management**



**Ecotone levees**



**Migration space preparation**

# Suitability of nature-based measures

## Suitability Rating

○ Limited suitability

◐ Some suitability

● High suitability

	Nearshore reefs	Submerged aquatic vegetation (eelgrass)	Beaches	Tidal marshes	Polder management	Ecotone levees	Migration space preparation
1. Richardson	●	●	●	◐	○	◐	○
2. Corte Madera	●	●	●	◐	◐	◐	◐
3. San Rafael	●	●	●	◐	◐	◐	○
4. Gallinas	◐	●	○	●	●	◐	●
5. Novato	○	○	○	●	●	◐	●
6. Petaluma	○	○	○	●	●	○	●
7. Napa - Sonoma	○	○	○	●	●	◐	●
8. Carquinez North	○	○	○	●	○	◐	●
9. Suisun Slough	○	○	○	●	●	◐	●
10. Montezuma Slough	○	○	○	●	●	○	●
11. Bay Point	○	○	○	●	●	◐	●
12. Walnut	○	○	○	●	●	●	●
13. Carquinez South	○	○	○	◐	○	●	●
14. Pinole	●	○	●	◐	○	◐	○
15. Wildcat	●	●	●	●	◐	●	●
16. Point Richmond	●	●	●	○	○	○	○
17. East Bay Crescent	●	●	●	◐	○	●	○
18. San Leandro	○	●	●	◐	◐	○	○
19. San Lorenzo	○	●	●	●	◐	●	◐
20. Alameda Creek	○	○	●	●	●	●	●
21. Mowry	○	○	○	●	●	●	●
22. Santa Clara Valley	○	○	○	●	●	●	●
23. Stevens	◐	○	○	●	●	◐	◐
24. San Francisquito	●	○	○	●	◐	●	◐
25. Belmont - Redwood	○	○	●	●	●	●	○
26. San Mateo	○	●	●	◐	◐	◐	○
27. Colma - San Bruno	○	●	●	◐	◐	◐	○
28. Yosemite - Visitacion	●	●	●	○	◐	○	○
29. Mission - Islais	○	●	●	○	○	○	○
30. Golden Gate	○	○	●	○	○	○	○



# When the water crosses over (the horizontal levee)

- What is the landscape like in the **'dry land'** part of the OLU?
- What are the **land uses** that may be potentially **inundated**?
- What is the **'menu'** of available **structural, policy, financial, and regulatory** measures?















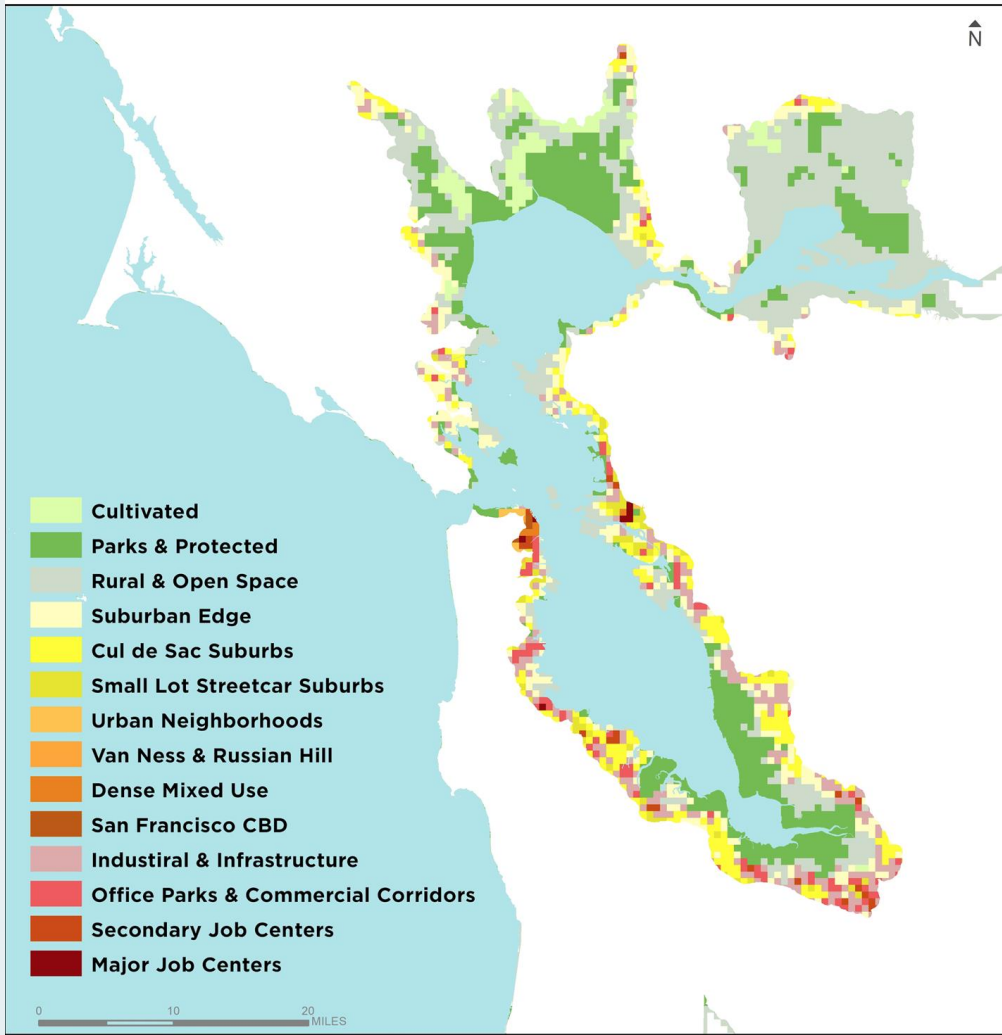
# Place-Types Index

Five factors in characterizing land uses as place-types:

- Intersection density
- Permeability
- Housing unit density
- Job density
- Land use mix

Open space categories additionally classified using CPAD, NLCD

## SPUR Place Types in OLU





**Open space**

**Suburban edge**



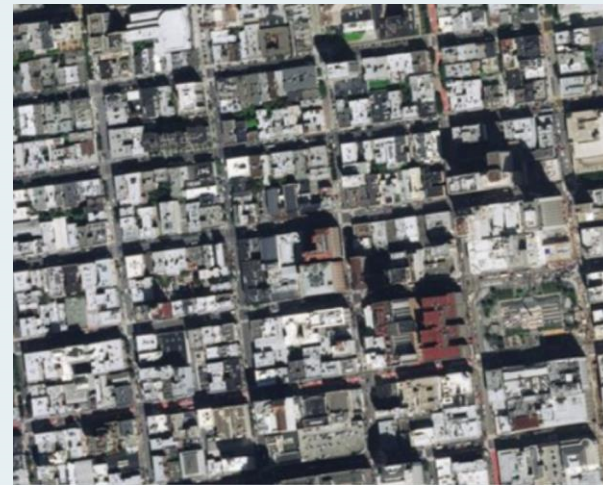
**Urban neighborhoods**

**Office parks and commercial**



**Secondary job centers**

**Dense mixed use**





# Adaptation measures

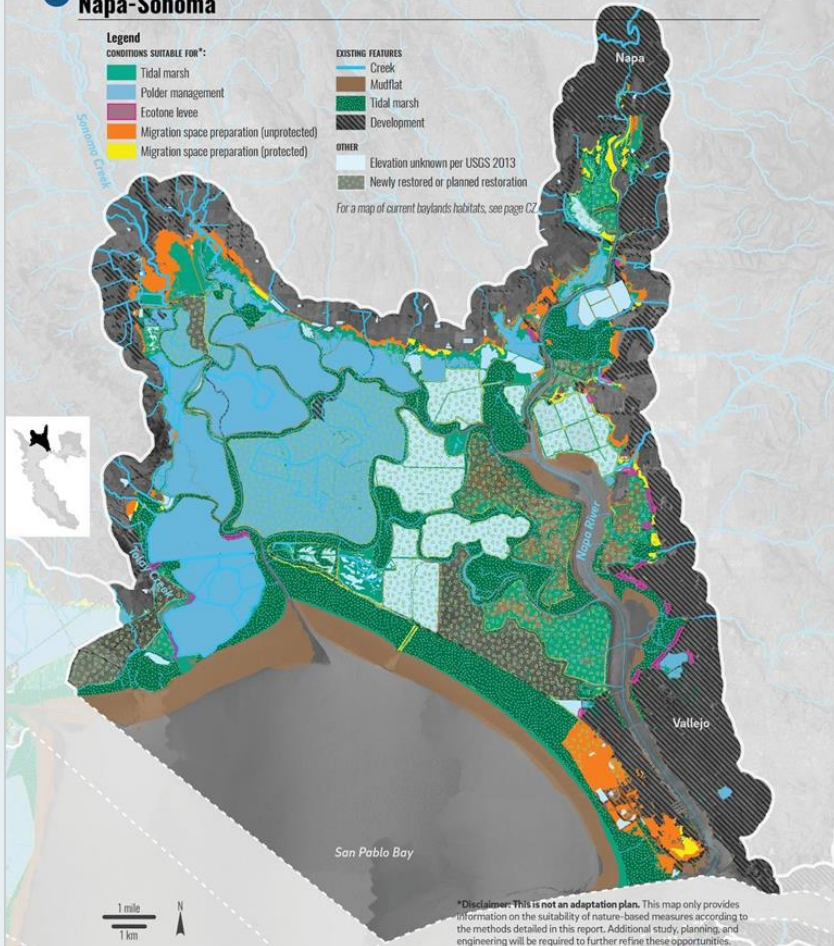
## Nature-based measures

- Nearshore reefs
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- Beaches (sand, cobble, shell)
- Tidal marshes
- Polder management
- Ecotone levees
- Migration space preparation
- Creek-to-bayland reconnections
- Green stormwater infrastructure

## Regulatory, financial, policy tools

- Zoning and overlay zones
- Setbacks, buffers, and clustering
- Building codes and building retrofits
- Rebuilding and development restrictions
- Conservation easements
- Tax incentives and special assessments
- Geologic Hazard Abatement District
- Transfer of Development Rights
- Buyouts

7 NATURE-BASED ADAPTATION OPPORTUNITIES MAP  
**Napa-Sonoma**



\*Disclaimer: This is not an adaptation plan. This map only provides information on the suitability of nature-based measures according to the methods detailed in this report. Additional study, planning, and engineering will be required to further refine these opportunities.

7 NAPA - SONOMA

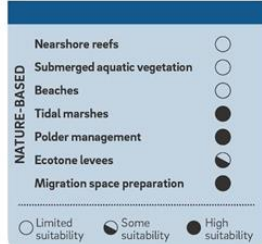
**Nature-based Adaptation Measures**

**Polder management**  
**Marsh Restoration**  
**Migration Space**  
**Creek connections**

In the Napa-Sonoma OLU there has been significant landscape-scale marsh restoration in areas such as the Napa-Sonoma Salt Ponds and other areas. There are considerable opportunities to restore large connected patches of tidal marsh in the remaining diked baylands closer to Sonoma Creek. Road and rail corridors that cross the marshes create considerable constraints to the restoration of the marshes: they need existing levees to protect them from flooding, their creek crossings are narrow, and the marshes are in a transition zone. All of the existing and planned marsh restoration from preparing migration space for the marsh to move upland as sea level rises. The majority of marsh restoration opportunities are in areas such as it being marsh restoration opportunities in these areas will be key to creating marsh migration pathways. Much of the existing tidal marsh is adjacent to the creeks and is disconnected from undeveloped migration space by large and deep polders such as Skaggs Island. If raised to intertidal elevations, these polders could be converted to tidal marsh. However, the amount of sediment needed is considerable and realigning the shoreline may be more feasible. Significant opportunities exist to improve the delivery of freshwater, nutrients, and sediment from Sonoma Creek and the Napa River to build better elevation capital closer to upland in these subsided baylands, and to reduce flooding issues. There are also opportunities for widening the bridge crossings at Sonoma Creek and Tolay Creek if Highway 37 is raised on some combination of embankment and pilings. Ecotone levee creation is less critical in this OLU due to limited presence of development in need of protection, but ecotone levees could be incorporated into the design of embankments to raise Highway 37 or the railroads.

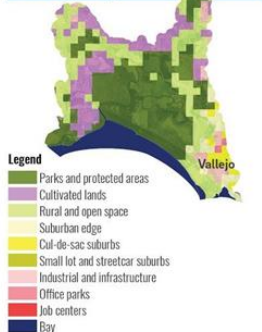
**Other Adaptation Opportunities**

Like Petaluma, the very large Napa-Sonoma OLU—by far the largest in the OLU Atlas—has a wide range of land uses, and candidate for adaptation measures that allow flooding to occur and that facilitate migration from recreational and agricultural uses to habitat or ecological uses over time, through restoration work, transition zone acquisition, and realigning public access. This OLU is not a good place for shoreline adaptations here can maximize nature-based solutions. A wide range of land uses and activities are present in the urban areas of the OLU that may experience sea level rise further in the future, but some of these areas might be suitable for adaptation measures depending on what the community prefers to invest in. Elevating Highway 37 to allow tidal action northwards toward formerly diked wetlands would significantly support the large areas of restoration possible in this OLU.



**Aerial view looking downstream of the Napa River towards the Napa-Sonoma baylands (Photo by WineCountry Media, CC BY 2.0)**

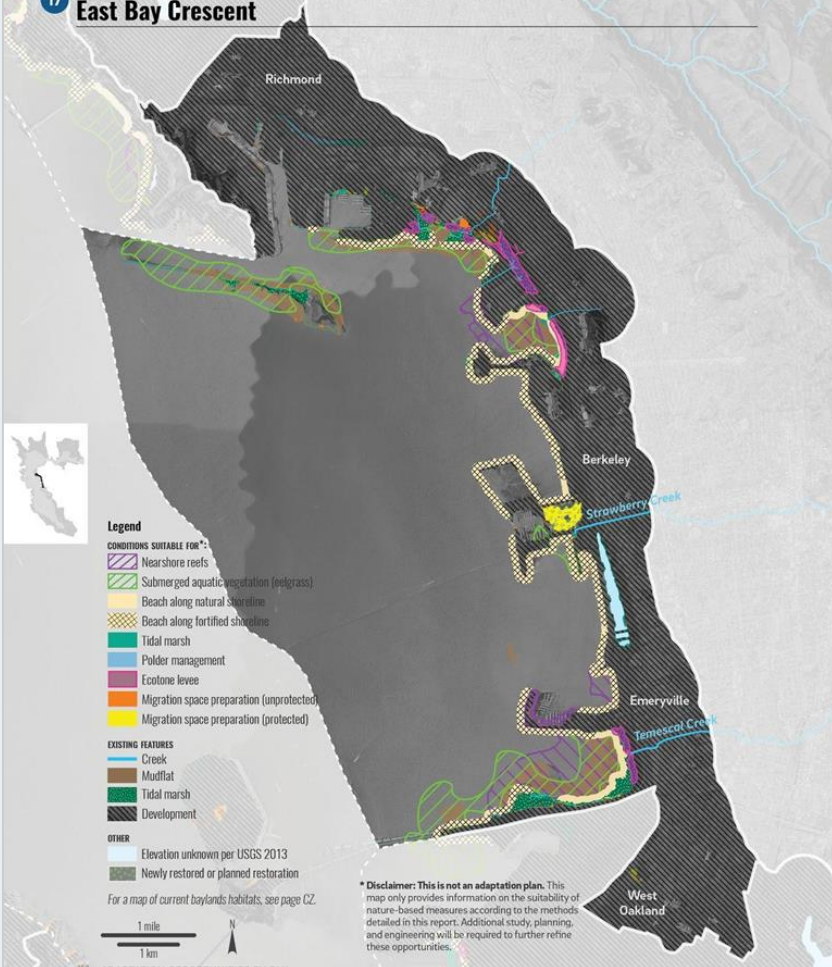
**Place Types Map**



draft



East Bay Crescent



Legend

CONDITIONS SUITABLE FOR\*

- Nearshore reefs
- Submerged aquatic vegetation (eelgrass)
- Beach along natural shoreline
- Beach along fortified shoreline
- Tidal marsh
- Polder management
- Ecotone levee
- Migration space preparation (unprotected)
- Migration space preparation (protected)

EXISTING FEATURES

- Creek
- Mudflat
- Tidal marsh
- Development

OTHER

- Elevation unknown per USGS 2013
- Newly restored or planned restoration

For a map of current baylands habitats, see page C2.



Nature-based Adaptation Measures

The East Bay Crescent is characterized by the headlands and landfills of Emeryville, Berkeley Marina, Albany Blvd, and Point Isabel. The I-80 corridor, including the historical Fleming Beach, constrained the present-day marshes, and limited opportunities for marsh migration. In the short term, opportunities are limited to nearshore reefs, eelgrass, and beach-focused natural and nature-based strategies. Both nearshore reefs and eelgrass beds are suitable. Creeks draining to the Bay, such as Temescal, Strawberry, Codornices, and Cerrito, have been modified by culverting and channelizing. Their connection to the bay marshes could be enhanced to direct sediment loads to support mudflats or beaches. Coarse or composite beaches are appropriate along the length of shoreline as an alternative to riprap, and could be stabilized by the artificial headlands. The small areas of marsh could be enhanced with ecotone or horizontal levees that back up to the roads. These measures are meant to be layered and have been shown to have more adaptation potential when used in combination.



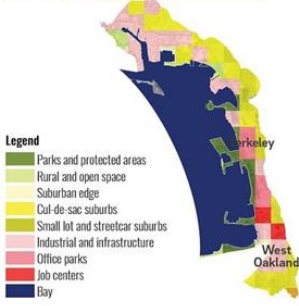
Highways I-80/1-80 located next to tidal marsh in the East Bay Crescent OLU (Photo by Jay Huang Photography, CC BY 2.0)

Other Adaptation Opportunities

This OLU has a mixed set of relatively intensive land uses, including a significant amount of low-density and moderate-density residential suburban, most small lot "streetcar" suburbs of any OLU—reflecting older neighborhoods—and it also has some suburban job centers, office parks, and industrial lands. As a result of these diverse uses, there are many opportunities for nature-based adaptation. A perimeter protection with grey or hybrid green/grey infrastructure, inland, and opening up floodable areas to retain water and reduce inland flooding—most likely with green infrastructure. This area is complex, with many parcels, landowners, tenants, and businesses. Opportunities for nature-based adaptation include: **GHAD** Transfer of development rights **Elevating roadways** Highways I-80/1-80 near the bayward edge of the OLU could be redesigned or elevated to a levee to provide upland flood protection.

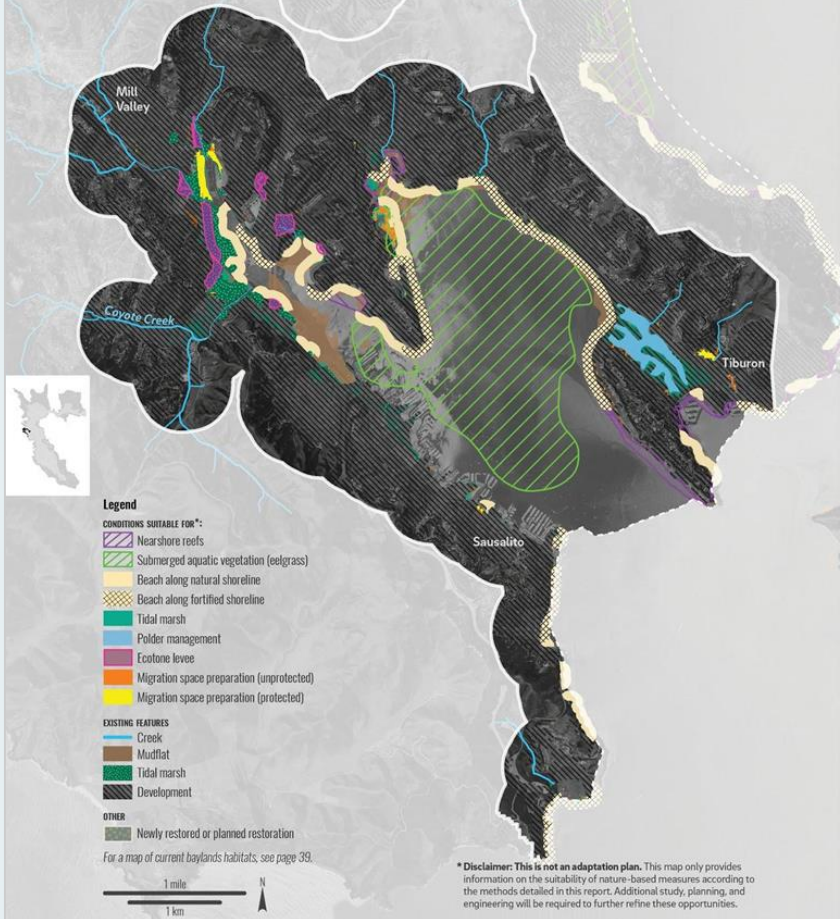
	Selected Measures	Suitability
NATURE-BASED	Nearshore reefs	●
	Submerged aquatic vegetation	●
	Beaches	●
	Tidal marshes	◐
	Polder management	○
	Ecotone levees	●
	Migration space preparation	○
		○ Limited suitability   ◐ Some suitability   ● High suitability

Place Types Map



draft

1 NATURE-BASED ADAPTATION OPPORTUNITIES MAP  
**Richardson**



- Legend**
- CONDITIONS SUITABLE FOR\*:
- Near shore reefs
  - Submerged aquatic vegetation (eelgrass)
  - Beach along natural shoreline
  - Beach along fortified shoreline
  - Tidal marsh
  - Polder management
  - Ecotone levee
  - Migration space preparation (unprotected)
  - Migration space preparation (protected)

- EXISTING FEATURES
- Creek
  - Mudflat
  - Tidal marsh
  - Development

OTHER

- Newly restored or planned restoration

For a map of current baylands habitats, see page 39.



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1 RICHARDSON

**Nature-based Adaptation Measures**

The Richardson OLU has limited space near the Bay with steep headlands confining a small valley that restricts bayward expansion. There are also opportunities for natural and nature-based adaptation such as marshes. The mouth of Coyote Creek is an area prone to flooding and erosion. Sediment supply to the marsh and for creating an ecotone levee. Sediment supply to the marsh has been impeded by the presence of levees as well as low sediment concentrations in the Bay and the placement of sediment should be considered. Setting back the levees near the mouth of the creek to reduce backwater effects along the floodplain. Nearshore reefs and submerged aquatic vegetation would provide habitat while eroding wave energy. Beaches could replace eroding shorelines, or along eroding shorelines such as has been piloted at Aramburu Island. Coarse beach faces could also be used to protect existing marsh scarps from wave erosion. Green stormwater infrastructure could be implemented in the upper watershed to slow down runoff, reduce fluvial flooding in the developed valleys, and slow the conveyance of floodwater to the Bay.

- Oyster reefs**
- Horizontal Levees**
- Beaches**
- Eelgrass**
- Creek connections**

Selected Measures	Suitability	
NATURE-BASED	Nearshore reefs	●
	Submerged aquatic vegetation	●
	Beaches	●
	Tidal marshes	◐
	Polder management	○
	Ecotone levees	◐
Migration space preparation		○
○ Limited suitability   ◐ Some suitability   ● High suitability		



Housing along Sausalito's shoreline in Richardson OLU (Photo by Shira Bezael, SFEI)

**Other Adaptation Opportunities**

The predominant place types in Richardson are suburban edge, rural and open space, and cul-de-sac suburbs (20% and 10% and 10% respectively). Over time, the place types most vulnerable to sea level rise are rural and open space, cul-de-sac suburbs, and parks and protected areas. For parks and protected areas, suitable adaptation strategies include securing wetlands transition zone through easements or buyouts, allowing sea level rise to take its course. For industrial and infrastructure, and single-family residential areas—suitable areas include not intensifying development, elevating roads and buildings, re-zoning, elevating roads, buildings, re-zoning.

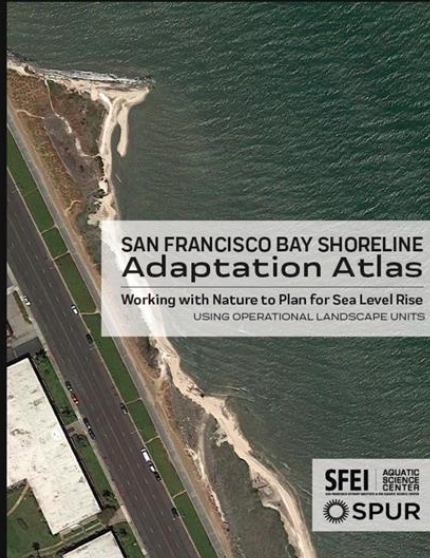


- Legend**
- Parks and protected areas
  - Rural and open space
  - Suburban edge
  - Cul-de-sac suburbs
  - Industrial and infrastructure
  - Bay

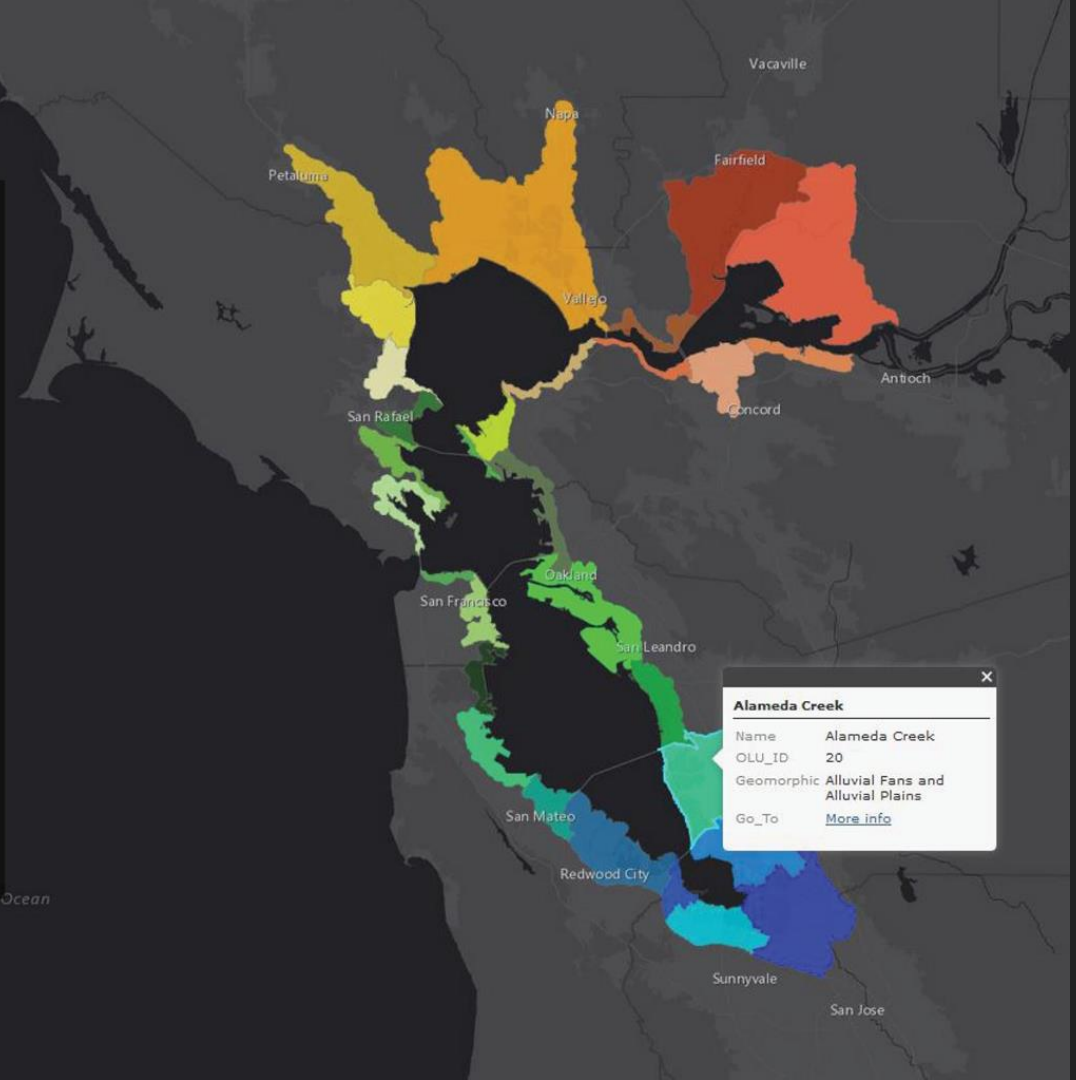
draft



For more information on the OLU framework, [click here](#) to download the PDF. To view the opportunity maps for each OLU, scroll down to enable the interactive map.



Pacific Ocean





## STEP 1

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*(instead of traditional  
boundaries)*

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*(and use nature as much  
as you can)*

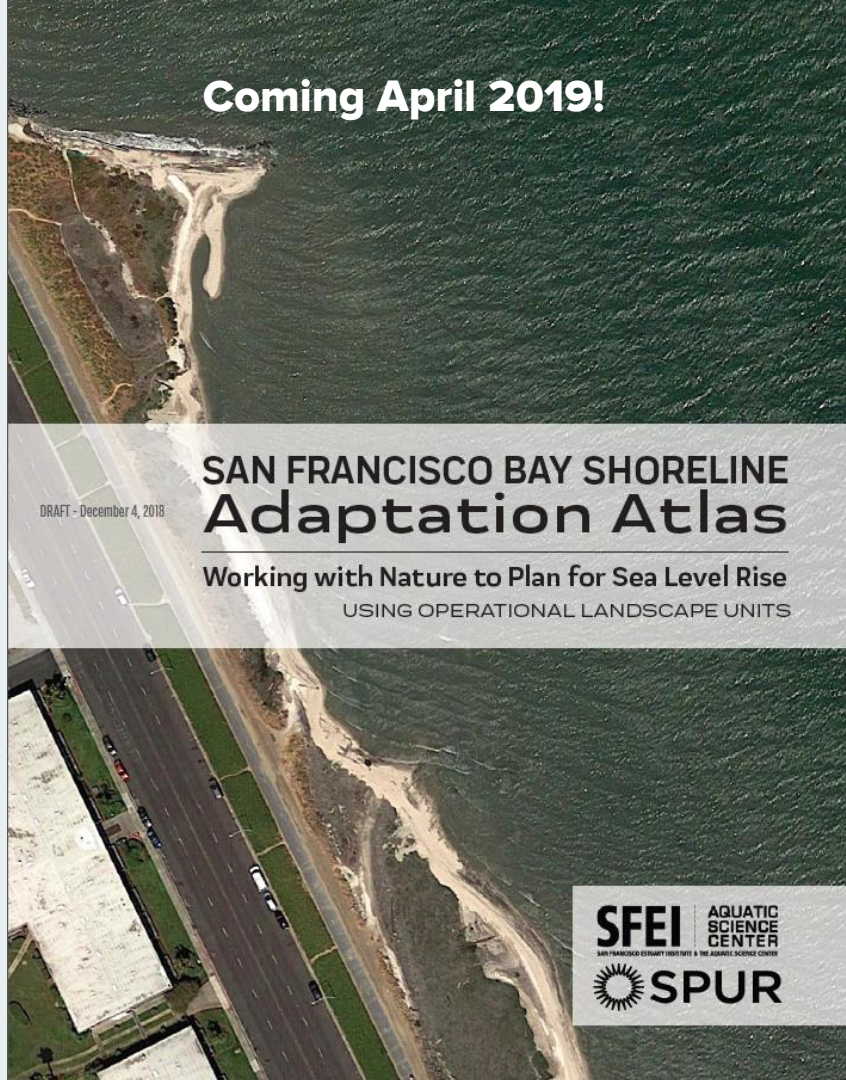
## STEP 3

**Use when  
bringing  
stakeholders  
together to  
envision a  
resilient future**



# Who is using this?

- **BCDC** using OLU as their unit of analysis for ART Bay Area
- **MTC** staff using OLU to build scenarios for Horizons (precursor to Plan Bay Area 2050)
- **San Mateo and Marin Counties** using OLU to gather stakeholders, begin adaptation planning
- **Local cities** doing adaptation planning
- **National networks:** “Coastal Collaborative” with Jamaica Bay





**OLU Profile Sheet – 15. Wildcat**

Date Updated: 02/27/19

Lead: Todd Hallenbeck (todd.hallenbeck@bcdcc.ca.gov)

# ART Bay Area

- **BCDC using OLUs as their unit of analysis for ART Bay Area**
- **Analyzing 4 asset classes by OLUs**
- **Summarizing ecosystem services by OLU and regionally**
- **Using as a framework as they transition to adaptation planning**

*I. OLU – Introduction, Set the Stage, Where Are We? What’s Here, Who’s Here*

*\*LEAD TO-DO: Write a **new** description for 2. OLU, and pull information together for additional que*

<b>1. OLU NUMBER. NAME</b>	15. Wildcat							
<b>2. OLU Description/Overview:</b>  Short paragraph: where is it generally (use features), what is the shoreline type, unique characteristics/ urban trends, what are general uses within?	Located in the Western portion of Contra Costa County, the Wildcat OLU stretches from Point Pinole to Point San Pablo. This OLU is characterized by tidal wetlands, numerous tidal creeks and channels, treatment ponds, light industrial parcels, heavy industrial parcels associated with the Chevron Refinery, railyards, and some residential uses primarily in unincorporated North Richmond. Current and historic industrial uses have left a legacy of contamination along the shoreline. The shoreline is characterized by a mix of levees, berms, embankments, tidal marsh wetlands, transportation structures (e.g., rail and road beds), and other structures that provide flood mitigation for the City’s shoreline and creek channels.							
<b>3. OLU Typology</b>	Alluvial Fans and Plains							
<b>4. ASSETS BEING ASSESSED WITHIN EACH OLU</b>	<b>Transportation</b> <ul style="list-style-type: none"> <li>• Union Pacific Railroad (UPRR)</li> <li>• Burlington-Northern Santa Fe railroad (BNSF)</li> <li>• Richmond Pacific Railroad (RPRR)</li> </ul>	<b>PDAs</b> <ul style="list-style-type: none"> <li>• North Richmond</li> </ul>	<b>PCAs</b> <ul style="list-style-type: none"> <li>• San Francisco Bay Trail</li> </ul>	<b>Vulnerable Communities</b> <ul style="list-style-type: none"> <li>• North Richmond</li> </ul> <table border="1" data-bbox="1690 857 1932 1092"> <thead> <tr> <th data-bbox="1690 857 1932 889">Other Facilities</th> </tr> </thead> <tbody> <tr> <td data-bbox="1690 889 1932 922">• West Contra Costa Sanitary Landfill (W)</td> </tr> <tr> <td data-bbox="1690 922 1932 955">• Golden Bear Transit Station</td> </tr> <tr> <td data-bbox="1690 955 1932 1092">• Household Hazardous Waste Recycling</td> </tr> </tbody> </table>	Other Facilities	• West Contra Costa Sanitary Landfill (W)	• Golden Bear Transit Station	• Household Hazardous Waste Recycling
Other Facilities								
• West Contra Costa Sanitary Landfill (W)								
• Golden Bear Transit Station								
• Household Hazardous Waste Recycling								





# Marin Adaptation Framework

- Challenge of transitioning from vulnerability assessments to adaptation solutions
- Lots of interest in nature-based options, where are they appropriate?
- **Goal:** Develop a **framework process and set of tools** to support the transition from vulnerability assessment to adaptation strategies at a useful scale

\*With funding from Marin Community Foundation

# FRAMEWORK

## Planning within nature's boundaries

### STEP 1

#### **Assess vulnerability**

*what assets are vulnerable & where; what is the source of vulnerability*

### STEP 2

#### **Identify adaptation measures**

*that could work well in a given place and use nature as much as you can*

### STEP 3

#### **Envision desired future(s)**

*what are desired outcomes?  
Develop visions/themes*

### STEP 4

#### **Develop adaptation strategies**

*Strategy = a combination of "measures";  
Develop for each desired future or theme*

### STEP 5

#### **Evaluate and prioritize**

*assess benefits and tradeoffs among strategies*



## STEP 3

# Envision desired futures

*(What are desired outcomes? Articulate visions/themes for the future)*

- **A “strategy” combines adaptation measures within an OLU**

# Combining measures into a strategy





## STEP 3

# Envision desired futures

*(What are desired outcomes? Articulate visions/themes for the future)*

- **A “strategy” combines adaptation measures within an OLU**
- **A distinguishing goal/theme and criteria are needed to develop strategies**
- **Strategy themes should be developed with stakeholders**

## STEP 3

# Envision desired futures

*(What are desired outcomes? Articulate visions/themes for the future)*

- **Strategy 1: Hold the line**
- **Strategy 2: Buffer with public open space**
- **Strategy 3: Maximize habitat**



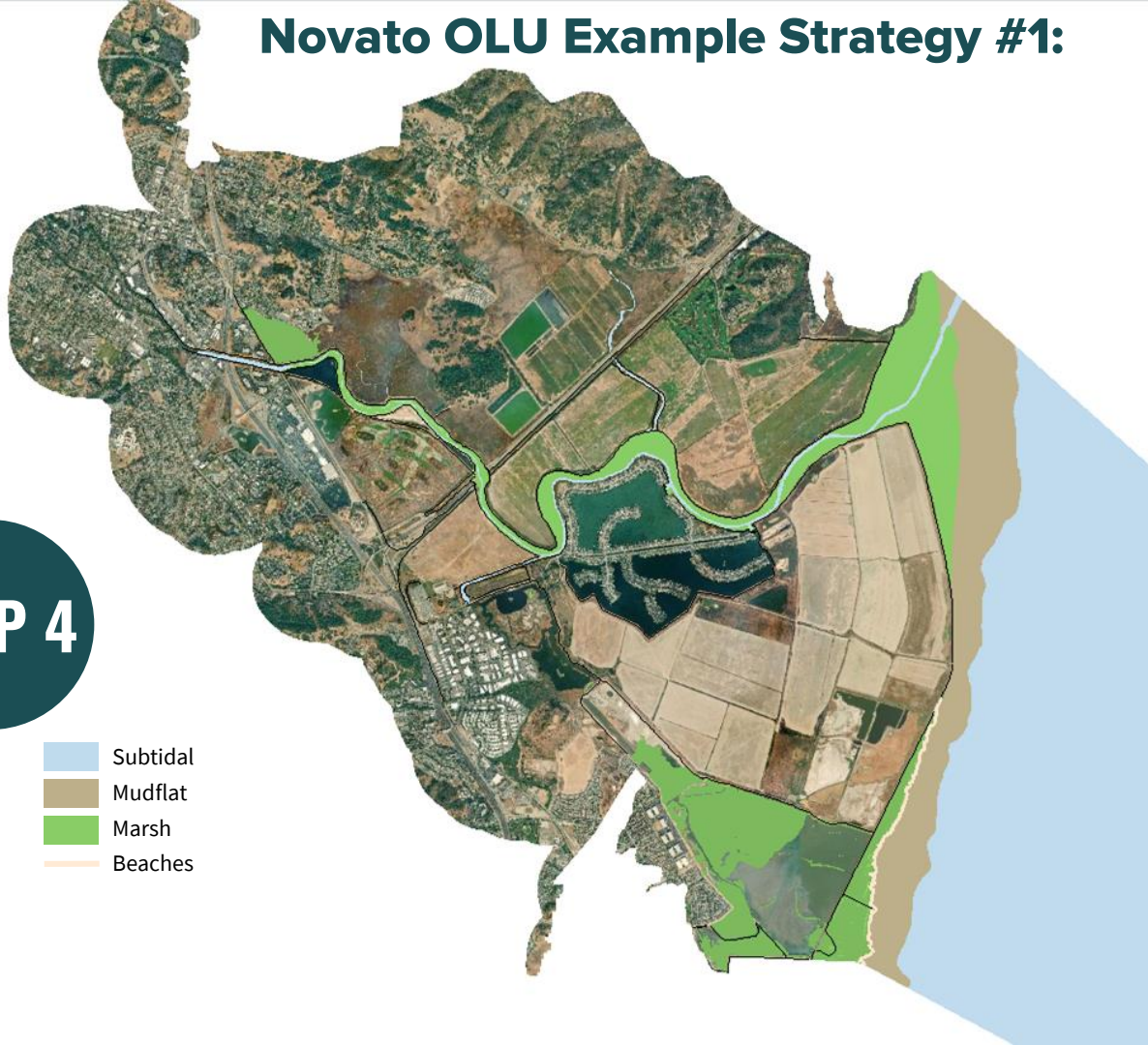
## STEP 3

### Example Theme #1 “Hold the line”

- Build up existing defenses
- Employ nature-based adaptation options bayward of existing first line of defense

## Novato OLU Example Strategy #1:

## STEP 4

- 
- The map displays the coastal area of Novato, California, with various land use zones highlighted. A legend in the bottom left corner identifies four categories: Subtidal (light blue), Mudflat (tan), Marsh (green), and Beaches (orange). The map shows a mix of urban development, agricultural fields, and natural coastal features. A prominent green marsh area is visible along the coastline, and a large tan mudflat area is situated inland. The ocean is shown in light blue on the right side of the map.
- Subtidal
  - Mudflat
  - Marsh
  - Beaches

# STEP 3

## Example Theme #2: "Buffer w/ public open space"

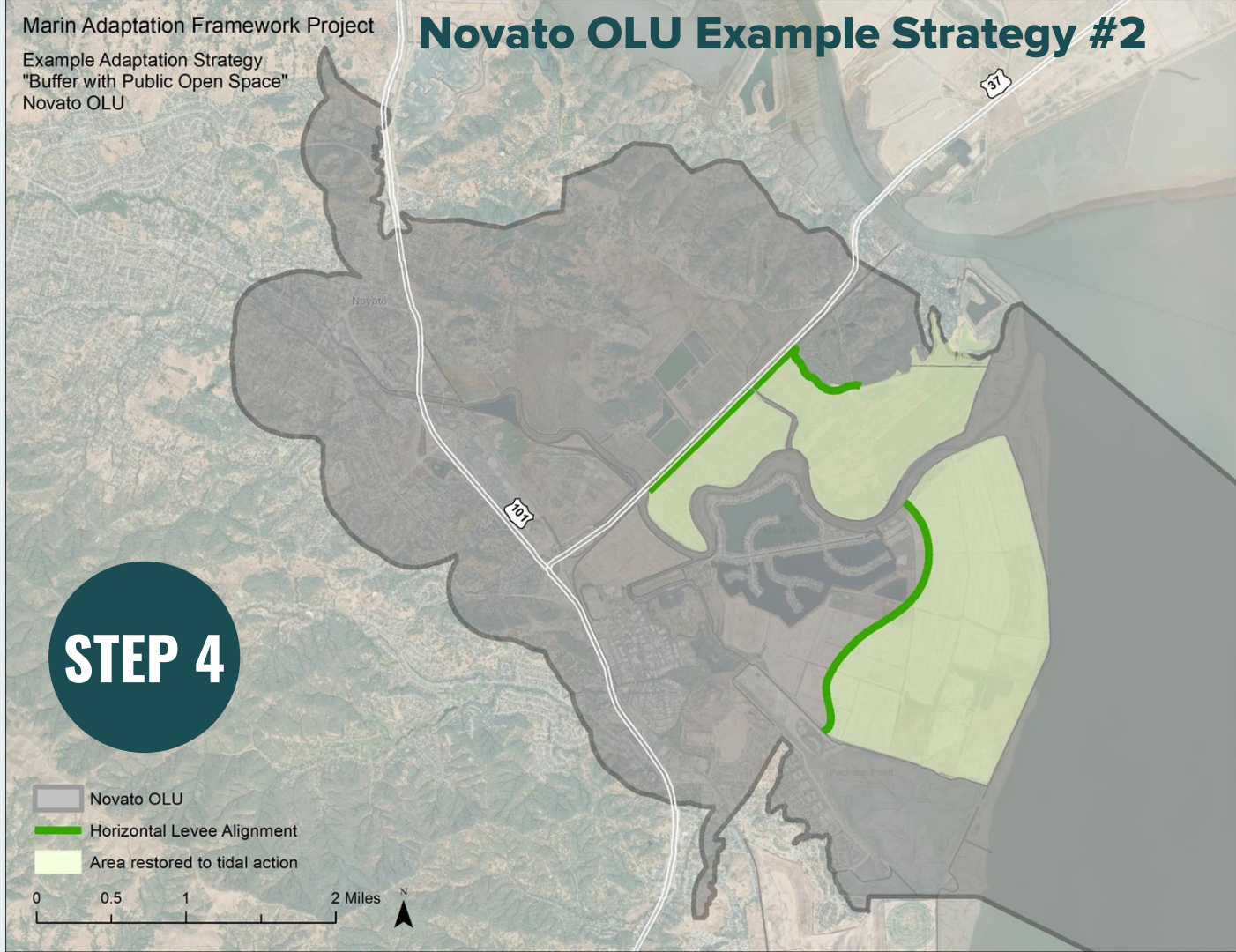
- Existing people and infrastructure remain protected in place
- Retreat first line of defense only on public open space
- Retreat allows more space for additional nature-based options

Marin Adaptation Framework Project  
Example Adaptation Strategy  
"Buffer with Public Open Space"  
Novato OLU

# Novato OLU Example Strategy #2

# STEP 4

- Novato OLU
- Horizontal Levee Alignment
- Area restored to tidal action





# STEP 3

## Example Theme #3: "Maximize habitat"

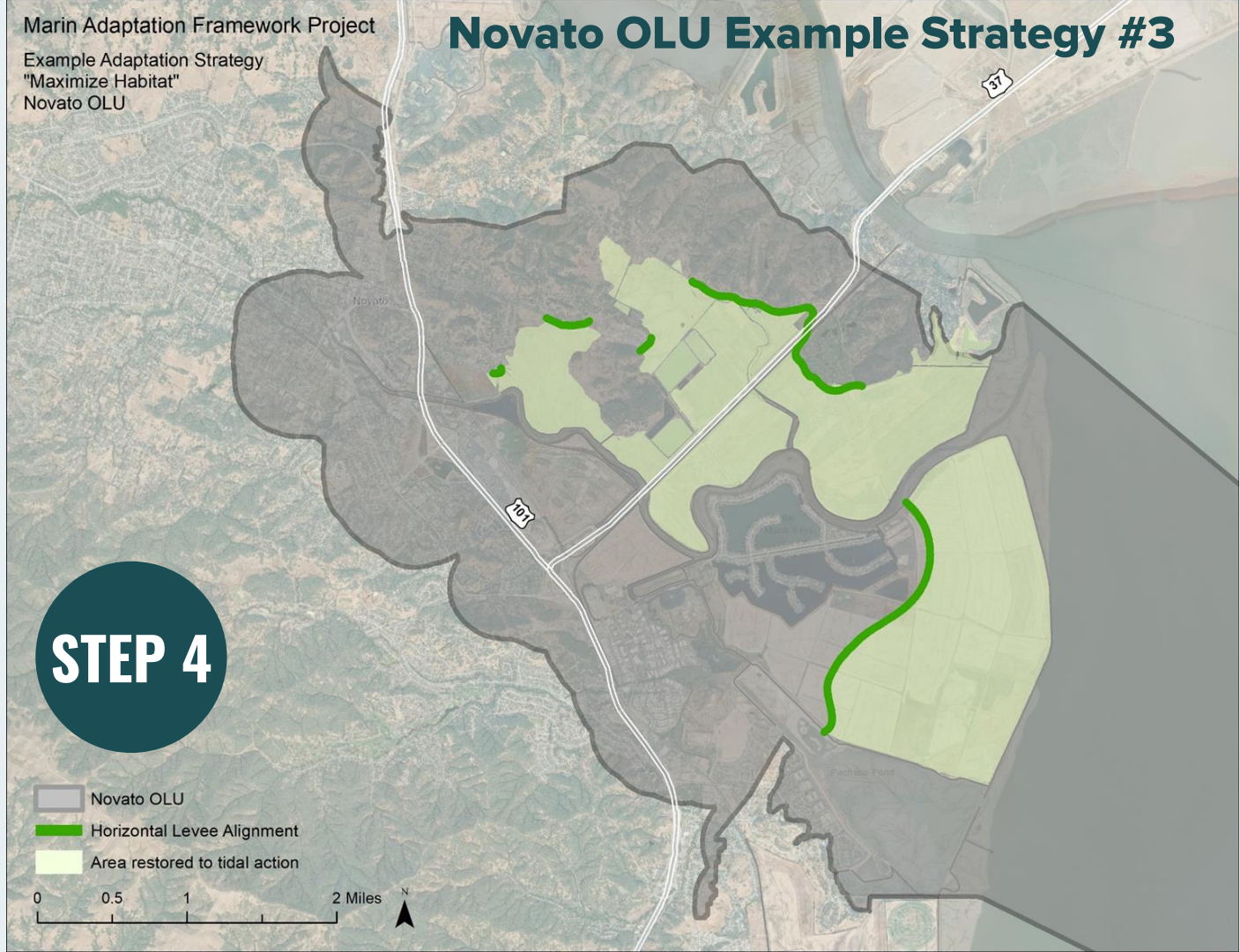
- Maximize opportunities for habitat enhancement
- Existing people/homes remain in place
- Key infrastructure may need to be re-aligned/ re-designed

Marin Adaptation Framework Project  
Example Adaptation Strategy  
"Maximize Habitat"  
Novato OLU

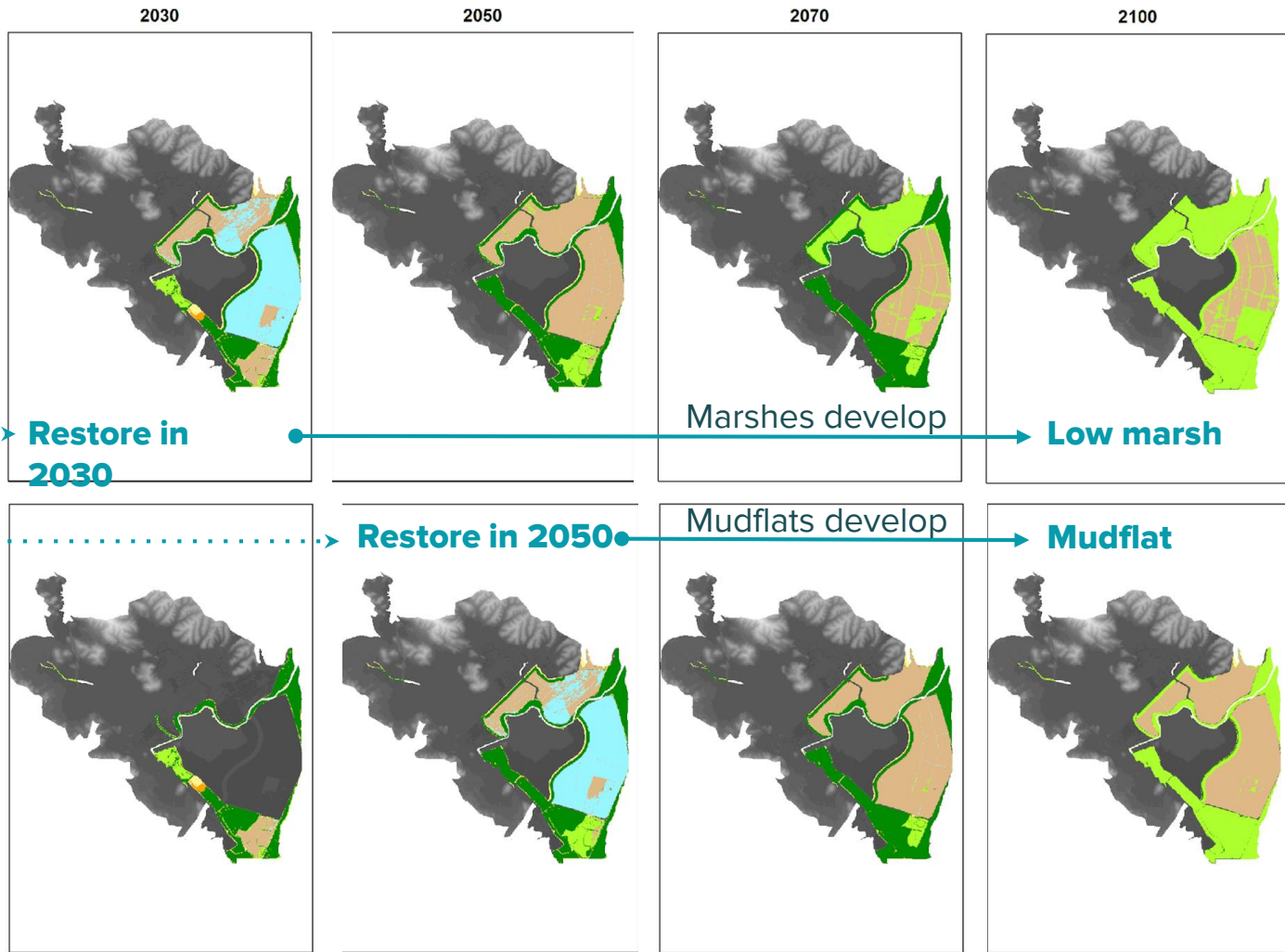
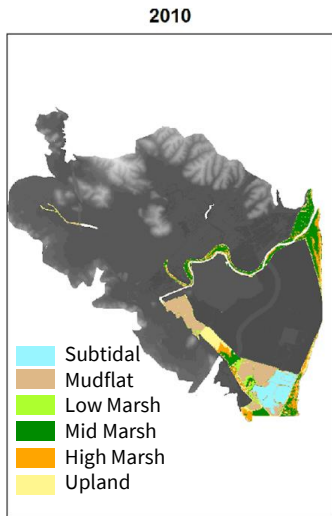
# Novato OLU Example Strategy #3

# STEP 4

- Novato OLU
- Horizontal Levee Alignment
- Area restored to tidal action



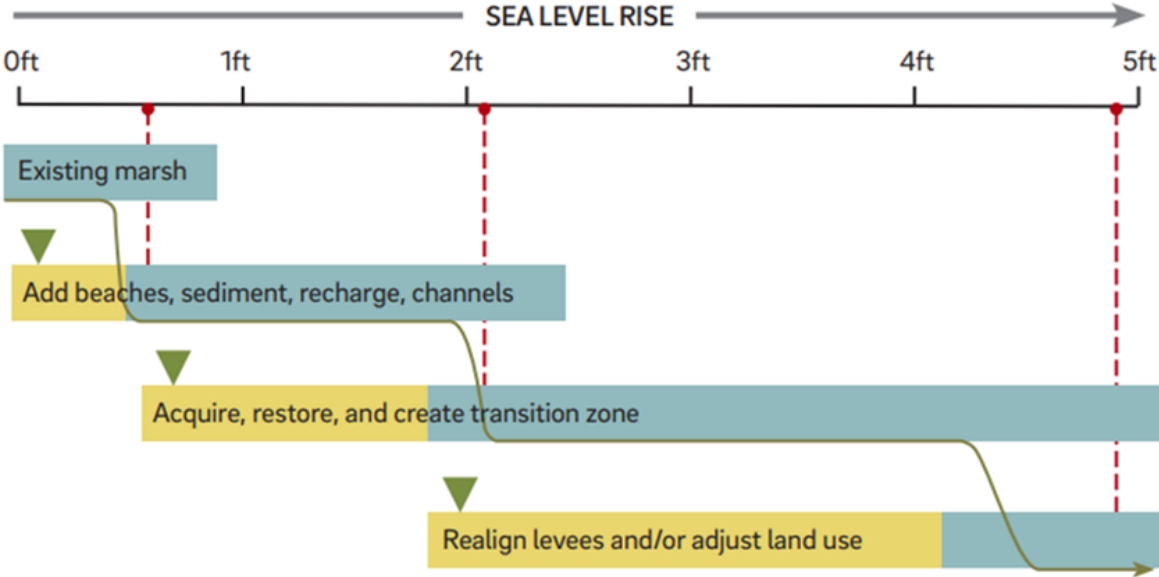
# Timing Matters



How might objectives change with SLR?



# Adaptation pathways



**KEY**

- Threshold
- Decision point
- Lead time required to implement
- Timing of actions to be effective

Conceptual phasing of measures triggered by sea-level rise, rather than a chronological timeline (adapted from Goals Project 2015).

# STEP 5

## Evaluate and Prioritize Strategies



- Higher values mean “more benefit”
- **Compare total benefits** of strategies, while still **seeing the tradeoffs**
- Can **weight** certain benefits more than others
- Supports an **informed choice**
- May lead to developing **alternative strategies**



# Next steps // RB2 Phase 2



## 1. Filling science data gaps

- Sediment supply and demand
- Mudflat shape/evolution
- Links to water quality data (contingencies)
- Development of phased approaches

## 2. Refinement of adaptation measures

- Watershed connections, stormwater
- Detail on beaches (orientation, grainsize etc.)
- Upland transition zone connectivity

# Next Steps // RB2 Phase 2



## 3. **Links** to Policies

- **Nutrients** Management Strategy
  - Integration with infrastructure ie. POTWs
  - SFEP WQIF grant
- **Supporting** Waterboard climate change policies



# THANK YOU

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Control Board

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Thanks to our team: **Jeremy Lowe, Katie McKnight, Sam Safran, Letitia Grenier, SFEI  
Laura Tam, Sarah Jo Szambelan, SPUR**

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