South Bay Salt Pond Restoration Project

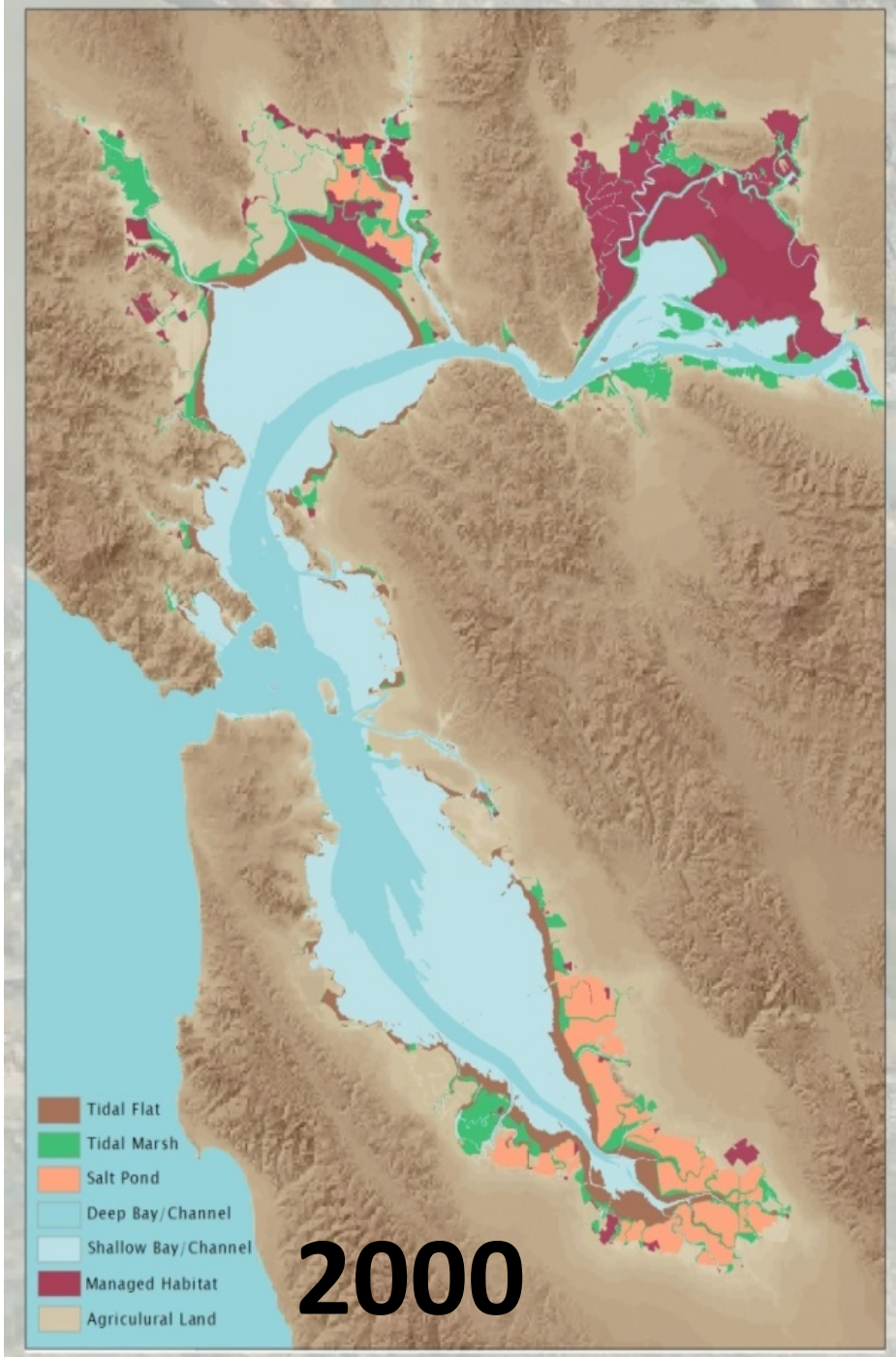
*Restoring the Wild Heart of the South Bay*

# Large Scale and Long Term: The Role of Science and Collaboration in Large Ecosystem Restoration Projects

*Natural and Nature Based Features Symposium*
*Santa Cruz, CA*
*September 20, 2018*

Anne Morkill
U.S. Fish & Wildlife Service
San Francisco Bay National Wildlife Refuge Complex

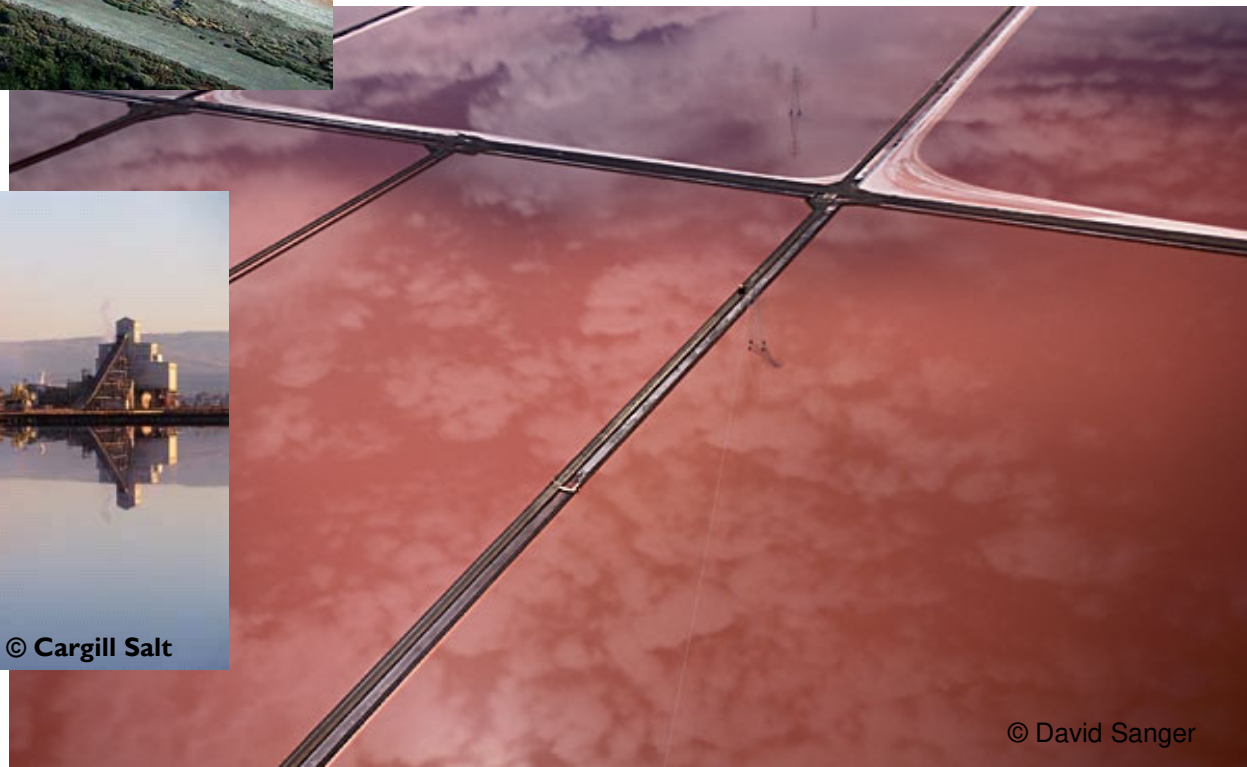

Tidal Flat
Tidal Marsh
Salt Pond
Deep Bay/Channel
Shallow Bay/Channel
1850


Tidal Flat
Tidal Marsh
Salt Pond
Deep Bay/Channel
Shallow Bay/Channel
Managed Habitat
Agricultural Land
2000

# San Francisco Bay today

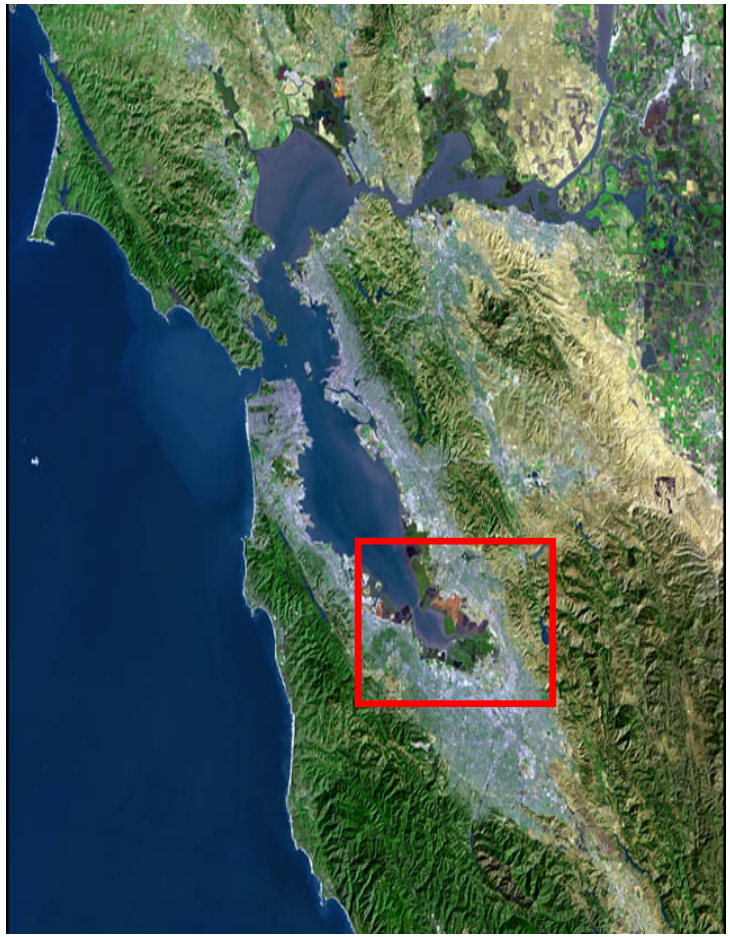
# San Francisco Bay today

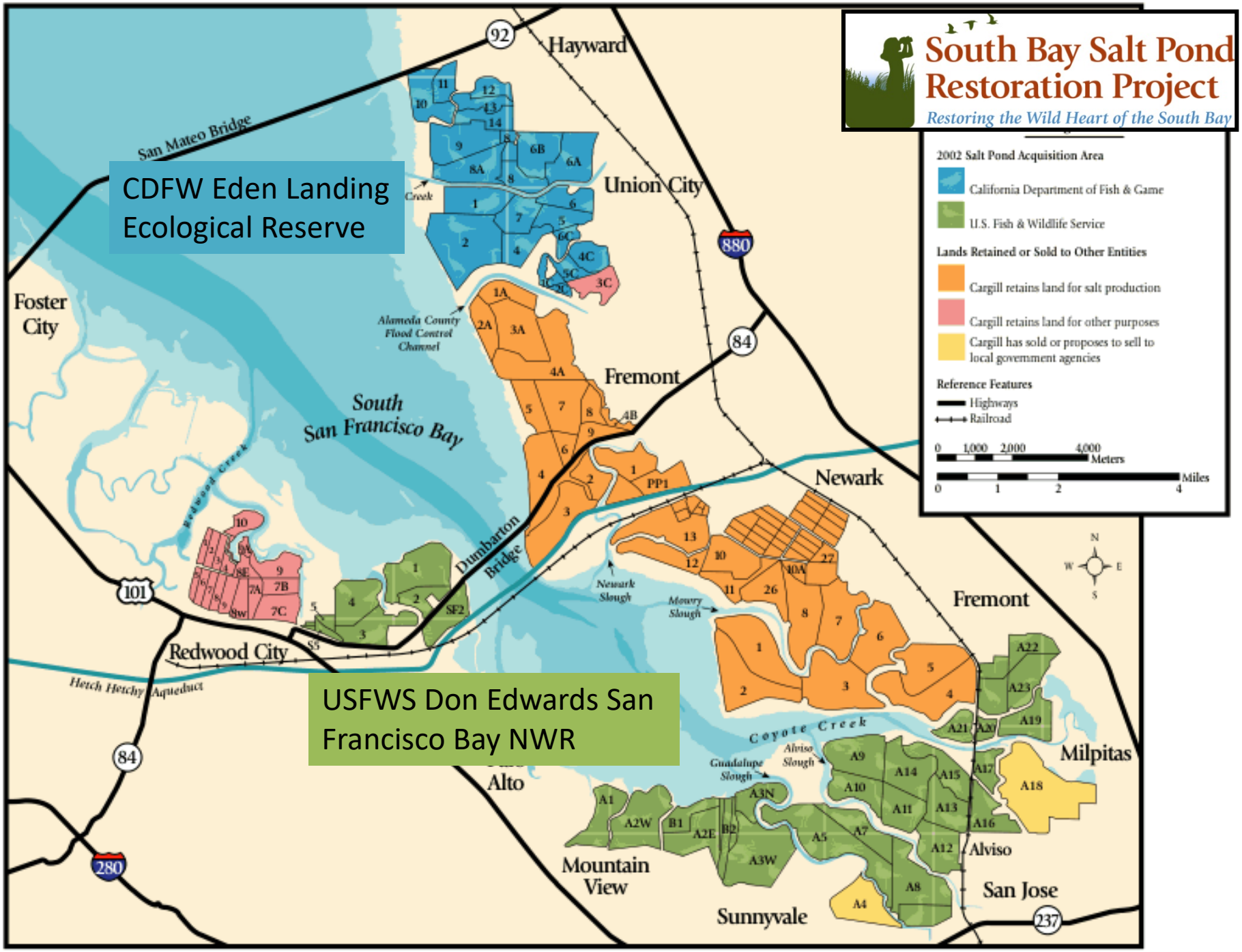

Salt production has left us with a dramatically altered Bay ecosystem.

# Salt Pond Acquisition in 2003

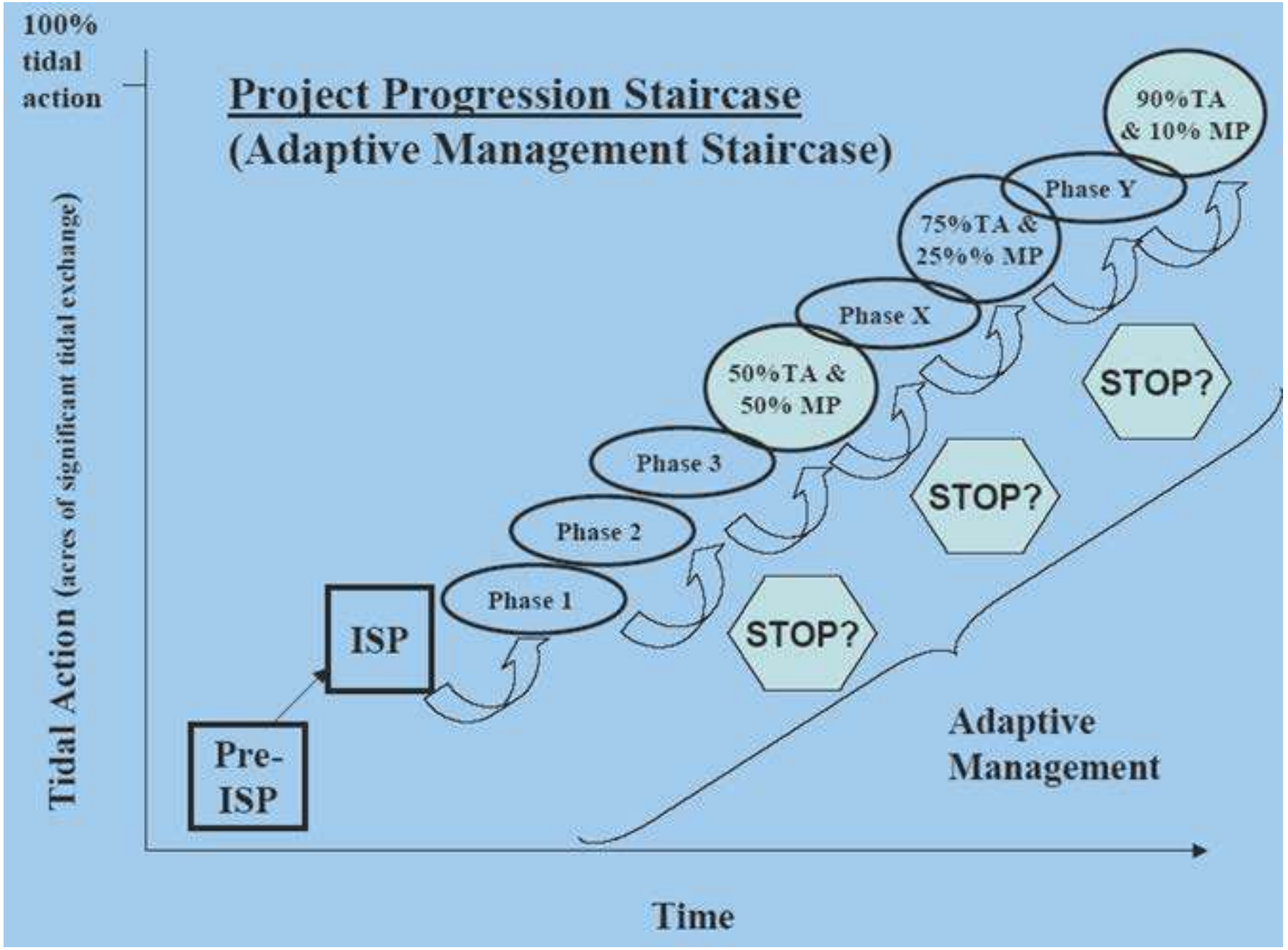
- 16,500 acres
  - 15,100 in South Bay
  - 1,400 in North Bay
- Public/Private Partnership
  - $100 million
  - State, Federal and Private dollars

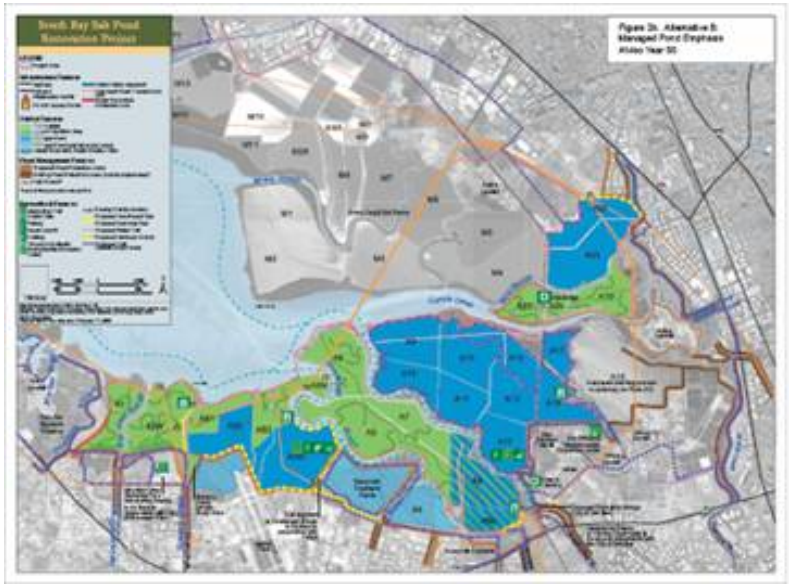



South Bay Salt Pond Restoration Project
Restoring the Wild Heart of the South Bay
CDFW Eden Landing Ecological Reserve
USFWS Don Edwards San Francisco Bay NWR
2002 Salt Pond Acquisition Area
California Department of Fish & Game
U.S. Fish & Wildlife Service
Lands Retained or Sold to Other Entities
Cargill retains land for salt production
Cargill retains land for other purposes
Cargill has sold or proposes to sell to local government agencies
Reference Features
Highways
Railroad
Meters
Miles
Hayward
Union City
Fremont
Newark
Foster City
Redwood City
Alto
Mountain View
Sunnyvale
San Jose
Alviso
Milpitas
South San Francisco Bay
San Mateo Bridge
Dumbarton Bridge
Alameda County Flood Control Channel
Newark Slough
Mowry Slough
Guadalupe Slough
Alviso Slough
Coyote Creek
Redwood Creek
Hetch Hetchy Aqueduct
92
880
84
101
280
237

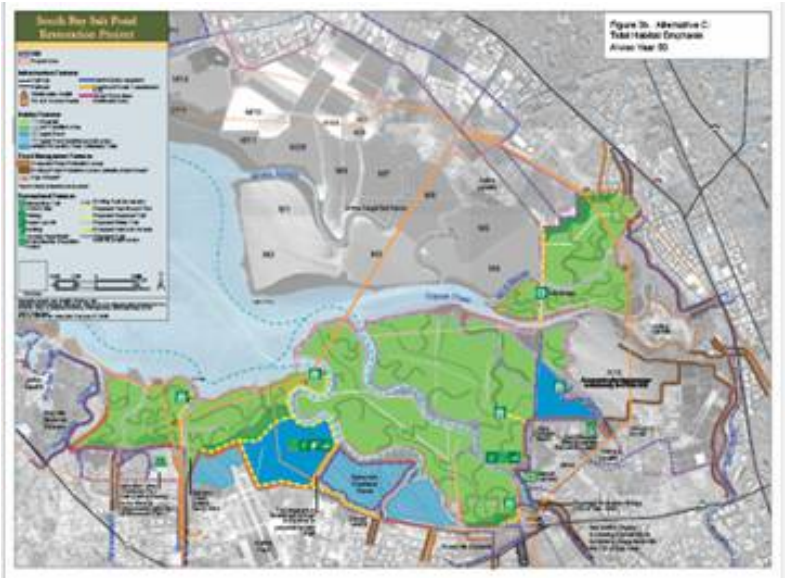
# Balancing Multiple Objectives

- Restoration of fish and wildlife and their habitats
- Recreation access for 4+ million people
- Flood protection for Silicon Valley



100% tidal action
Project Progression Staircase
(Adaptive Management Staircase)
90%TA & 10% MP
Phase Y
75%TA & 25%% MP
Phase X
50%TA & 50% MP
Phase 3
Phase 2
Phase 1
ISP
Pre-ISP
STOP?
STOP?
STOP?
Adaptive Management
Tidal Action (acres of significant tidal exchange)
Time



Managed Pond Emphasis



Tidal Marsh Emphasis


# Key Uncertainties

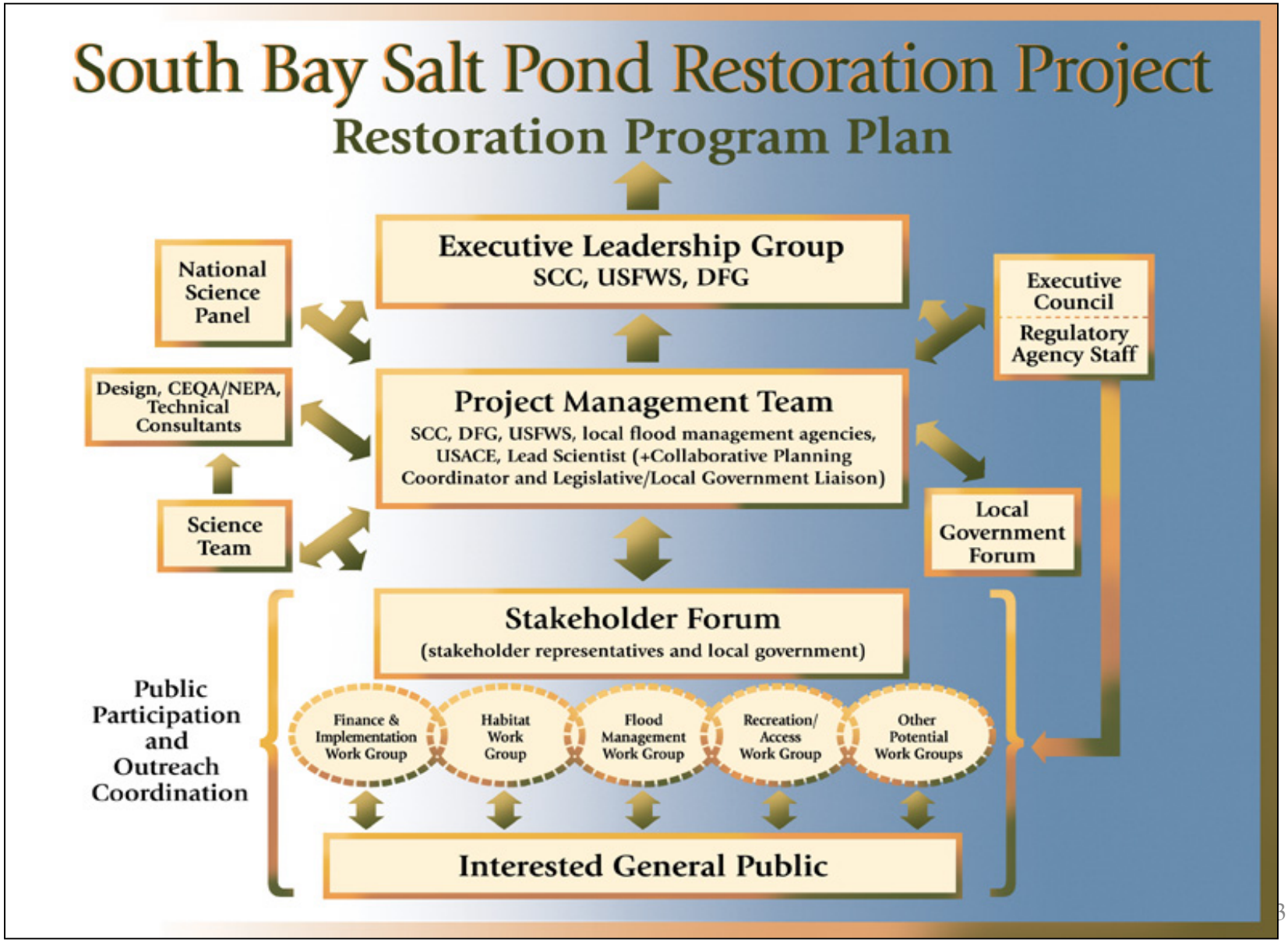
Key Uncertainties

- Wildlife use of changing habitats
- Habitat evolution and sediment dynamics
- Mercury methylation
- Water quality
- Invasive species
- Public access & wildlife disturbance
- Infrastructure support
- Sea level rise and climate change


# Excerpt from South Bay Salt Pond Restoration Project Adaptive Management Plan

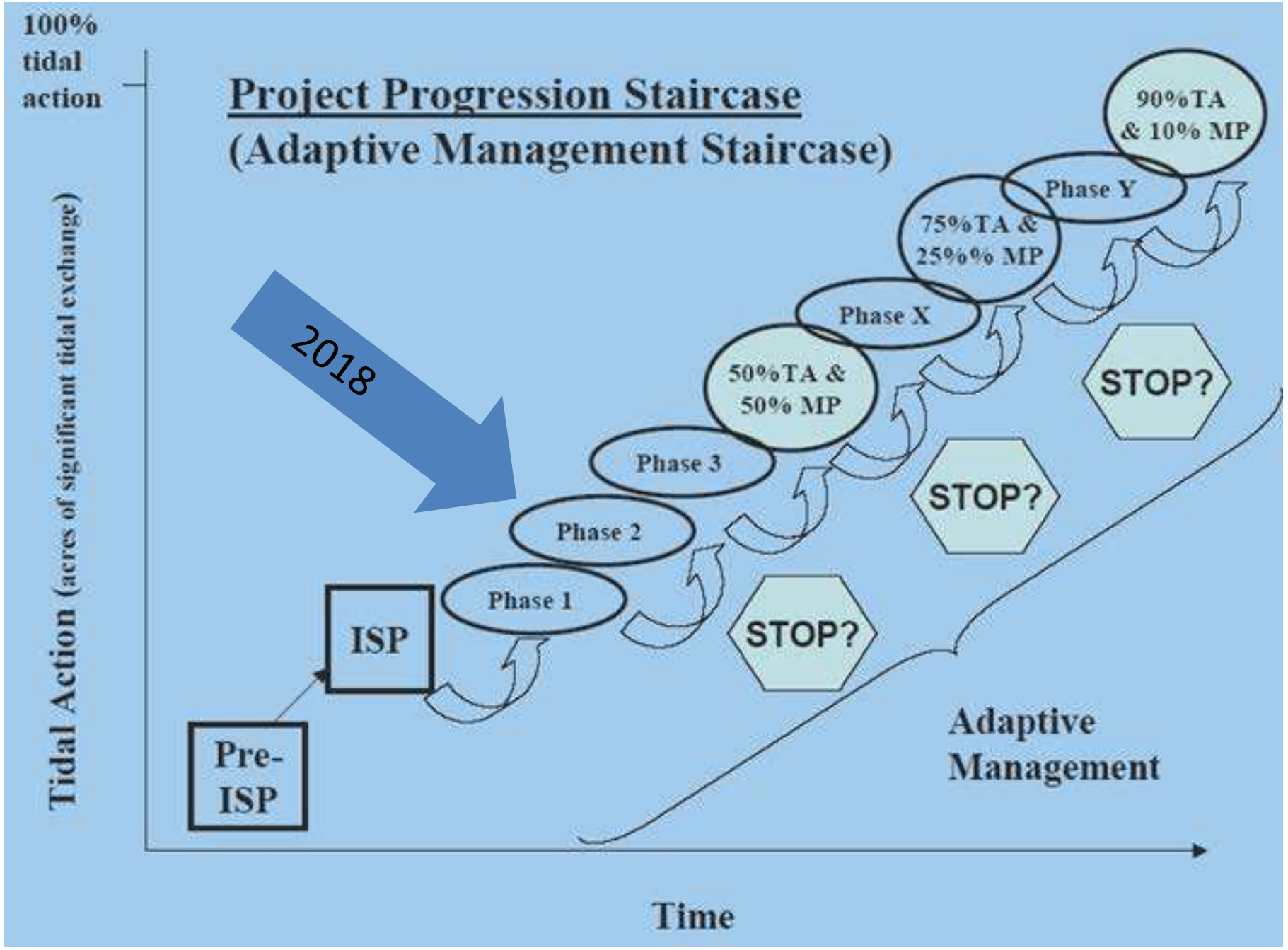
| CATEGORY/ | RESTORATION TARGET | MONITORING PARAMETER (METHOD) | SPATIAL SCALE FOR MONITORING RESULTS | EXPECTED TIME FRAME FOR DECISION-MAKING | MANAGEMENT TRIGGER | APPLIED STUDIES | POTENTIAL MANAGEMENT ACTION |
|---|---|---|---|---|---|---|---|
| **Sediment Dynamics** Project Objective 1 | 1. No decrease in mudflat or subtidal channel habitat | 1. Area of mudflats | 1. Pond Complex level and South Bay | 1. 10-20 years for mudflats; 0-5 years for channels | 1. Mudflat decreases greater than natural variability | 1. Will sediment move from mudflats to restored areas; will this impact biota? | 1. Studies; slow restoration; redesign restorations. |
| | 2. Accretion rate of ponds is sufficient to create marsh | 2.Sedimentation rate inside breached ponds | 2. Pond scale | 2. Two to 10 years depending on initial elevation | 2. Projected accretion rates | 2. Is there enough sediment to create new marsh? | 2. Studies; slow restoration; redesign restorations. |
| | 3. No long-term net loss of tidal marsh in S. Bay | 3. Total area of marsh in S. Bay | 3. Pond Complex level and South Bay | 3. 10 to 20 years | 3. Observed net loss of marsh greater than natural variability | 3. Is there enough sediment to maintain existing marsh and create new? | 3. Studies; slow restoration; redesign restorations. |

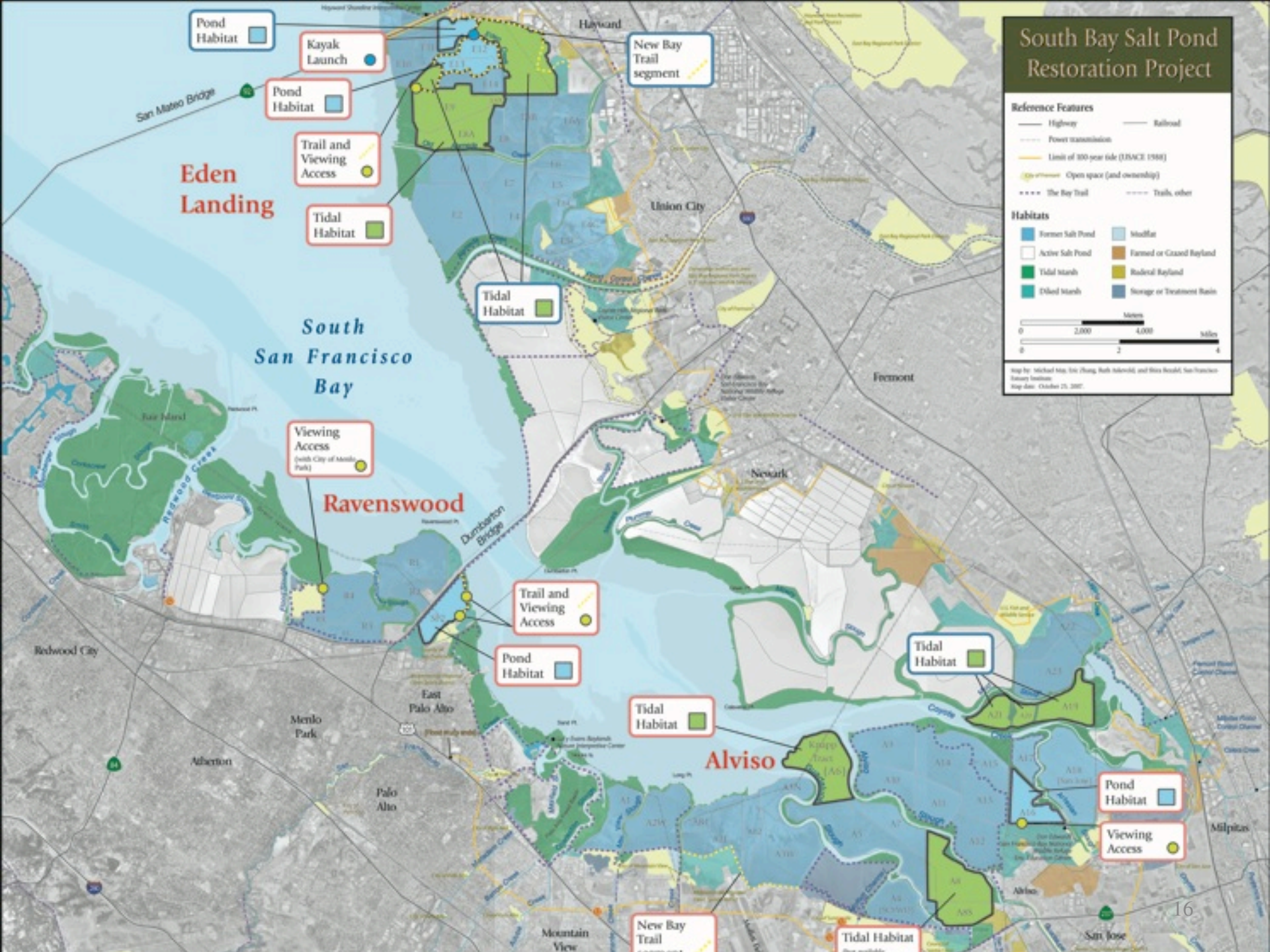
# Stakeholder Engagement



# South Bay Salt Pond Restoration Project

*Restoring the Wild Heart of the South Bay*


100% tidal action
Project Progression Staircase
(Adaptive Management Staircase)
Tidal Action (acres of significant tidal exchange)
2018
Pre-ISP
ISP
Phase 1
Phase 2
Phase 3
50%TA & 50% MP
Phase X
75%TA & 25%% MP
Phase Y
90%TA & 10% MP
STOP?
STOP?
STOP?
Adaptive Management
Time

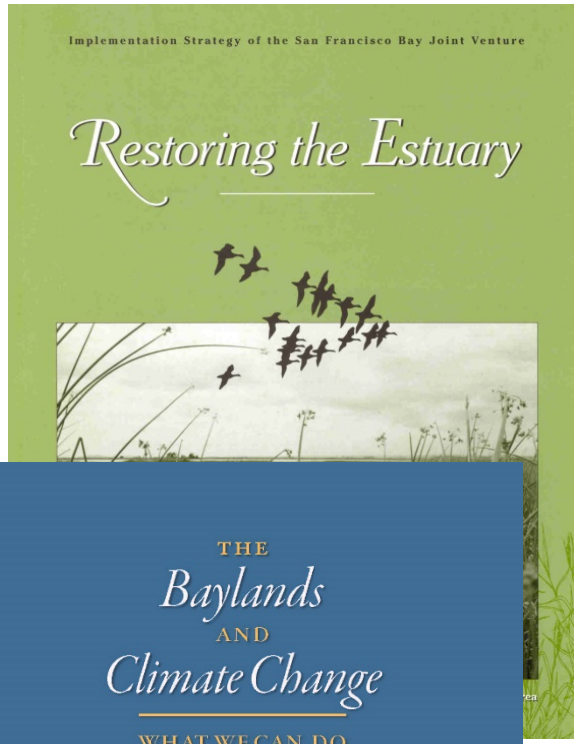

South Bay Salt Pond Restoration Project
Reference Features
Highway
Railroad
Power transmission
Limit of 100-year tide (USACE 1988)
Open space (and ownership)
The Bay Trail
Trails, other
Habitats
Former Salt Pond
Active Salt Pond
Tidal Marsh
Diked Marsh
Mudflat
Farmed or Grazed Bayland
Ruderal Bayland
Storage or Treatment Basin
Meters
0
2,000
4,000
Miles
0
2
4
Pond Habitat
Kayak Launch
Pond Habitat
Trail and Viewing Access
Tidal Habitat
New Bay Trail segment
Tidal Habitat
Viewing Access (with City of Menlo Park)
Trail and Viewing Access
Pond Habitat
Tidal Habitat
Tidal Habitat
Pond Habitat
Viewing Access
New Bay Trail
Tidal Habitat
Eden Landing
Ravenswood
Alviso
South San Francisco Bay
San Mateo Bridge
Dumbarton Bridge
Hayward
Union City
Fremont
Newark
Redwood City
East Palo Alto
Menlo Park
Atherton
Palo Alto
Mountain View
Alviso
Milpitas
San Jose

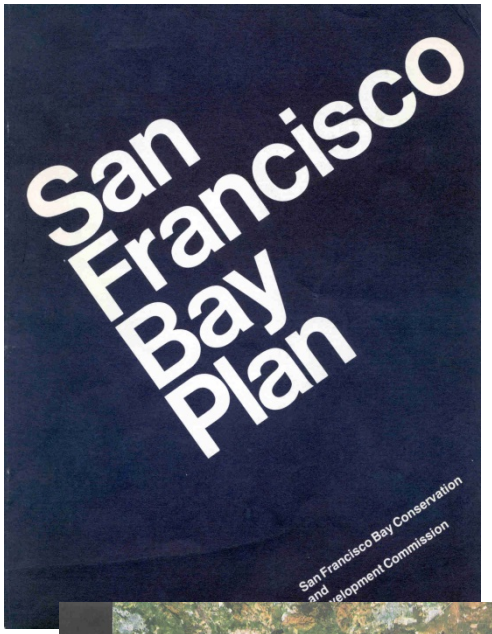

2007/03/26

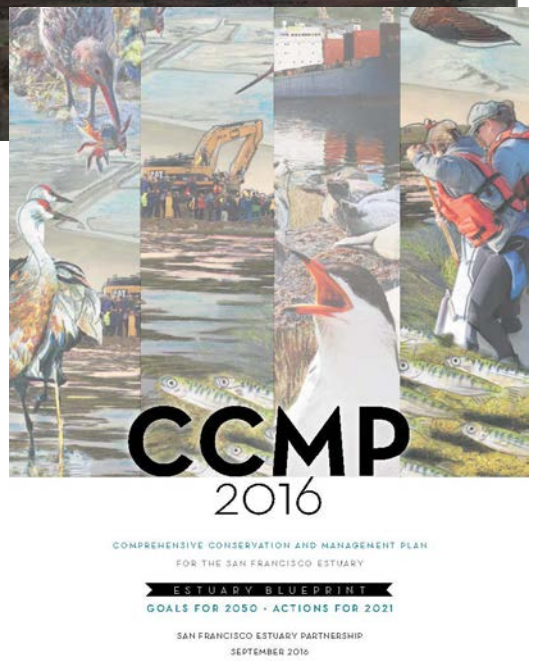

2006
2014

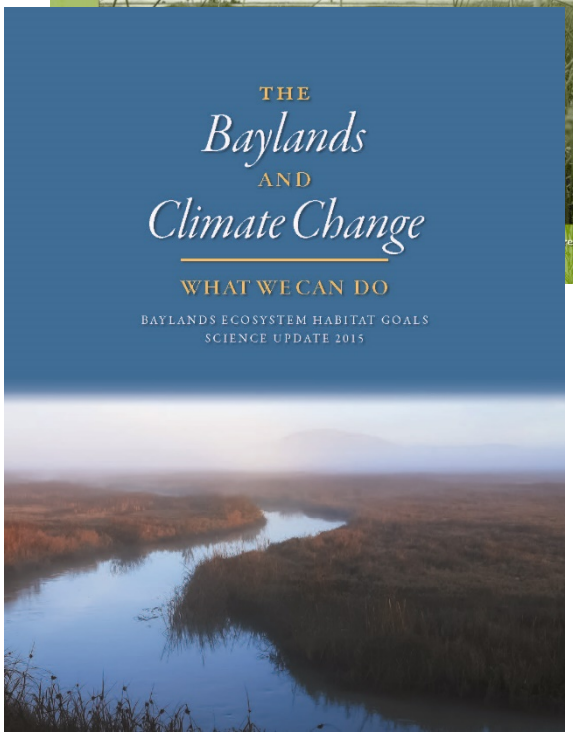
| | South Bay Salt Pond Restoration Project: Restoration Tracking | Phase 1 | Phase 2 |
|---|---|---|---|
| *Topic* | *Restoration Target* | Score | Score |
| Sediment | **a) Current vegetated tidal marsh is** maintained or increased in the South Bay. | | |
| | **b)** Sediment **accretion rate** in restored tidal areas is sufficient to create and support emergent tidal habitat ecosystems within the projected 50-year timeframe. | | |
| | **c)** Sediment movement into restored tidal areas will not significantly decrease **mudflat habitat**. | | |
| Mercury | **d)** Pond management will not **increase methylmercury levels in ponds** and pond-associated sentinel species **during or immediately after construction**. | | |
| | **e)** Pond management will not **increase methylmercury levels in ponds** and pond-associated sentinel species **post-construction**. | | |
| | **f)** Tidal habitat restoration and associated channel scour will not **increase methylmercury levels** in marsh, sloughs and Bay-associated sentinel species. | | |
| Marsh, mice, rails | **g) Tidal marsh vegetation and habitat** are trending toward reference marsh quality. | | |
| | **h)** Tidal marsh **habitat for Ridgway's rails** within the Project area meets recovery plan criteria. | | |
| | **i)** The **number of Ridgway's rails** within the Project area meets recovery plan criteria. | | |
| | **j)** Tidal marsh **habitat for salt marsh harvest mice** within the Project area meets recovery plan criteria. | | |
| | **k)** The **number of salt marsh harvest mice** within the Project area meets recovery plan criteria. | | |
| Birds | **l) Diving duck numbers** are maintained compared to pre-Project numbers. | | |
| | **m) Ruddy duck numbers** are maintained compared to pre-Project numbers. | | |
| | **n)** Managed ponds will provide foraging and roosting habitat for **migratory shorebirds** and maintain numbers compared to pre-Project levels. | | |
| | **o)** Managed ponds provide breeding habitat to support sustainable densities of **snowy plovers**. | | |
| | **p)** The creation of large isolated pond **islands** will maintain the numbers and breeding success of **terns, avocet and stilts** compared to pre-Project numbers. | | |
| | **q) California gulls** will not adversely affect nesting birds in managed ponds. | | |
| | **r)** Reconfigured and managed ponds will significantly increase the prey base, and maintain pond use by **waterfowl, shorebirds and phalaropes/grebes** at pre-Project levels. | | |
| | **s)** The number of **California least terns** in the Project area is maintained. | | |
| Fish and water quality | **t)** South Bay **water quality** remained above baseline quality levels. | | |
| | **u)** The Project avoided releasing nuisance and invasive species of **algae** to the Bay and avoided producing **algal blooms** that caused low dissolved oxygen in managed ponds. | | |
| | **v)** The number of **steelhead and other salmonids**, including juveniles, increased in rearing and foraging habitats. | | |
| | **w)** The number of **native adult and juvenile fish** increased in estuarine rearing and foraging habitats. | | |
| | **x)** Increased tidal habitats increased survival, growth and reproduction of **harbor seals**. | | |
| Public access | **y)** Public access features will provide the **recreation and access experiences** visitors and the public want over short or long timescales. | | |
| | **z)** Public access will not **significantly affect birds** or other target species on short or long timescales. | | |

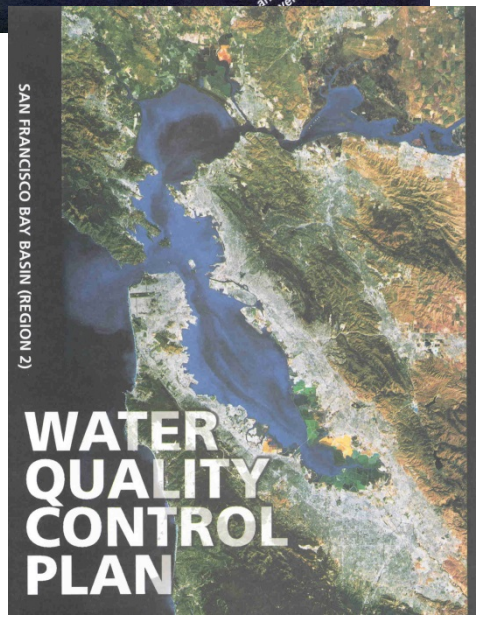
# Regional Planning Efforts

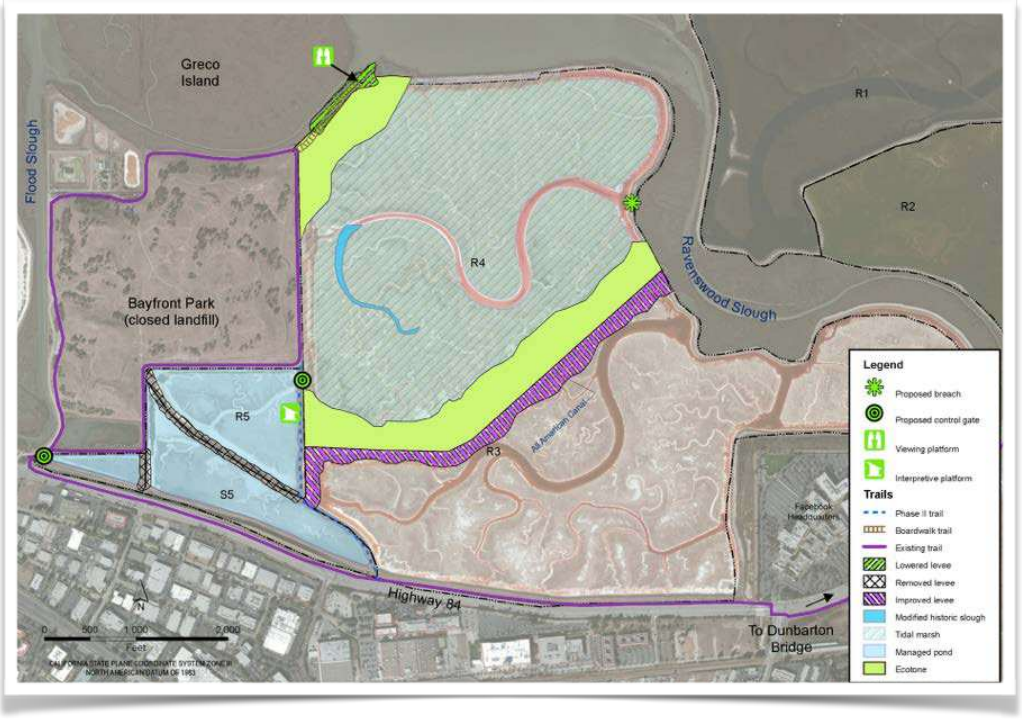



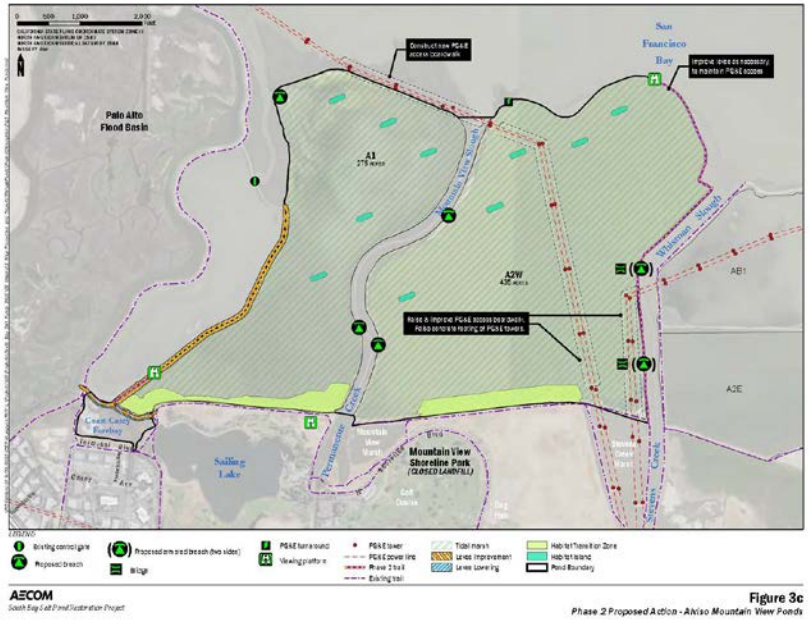



# Breaching a levee is the "easy" part…

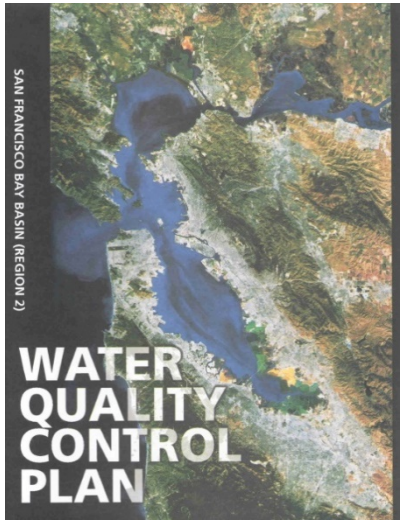
Considerations for site selection

- Infrastructure (levees, roads/rails, utilities)
- Flood risk
- Habitat connectivity
- Resilience to sea level rise (pond depth; sediment availability; etc.)
- Tidal marsh vs. managed pond









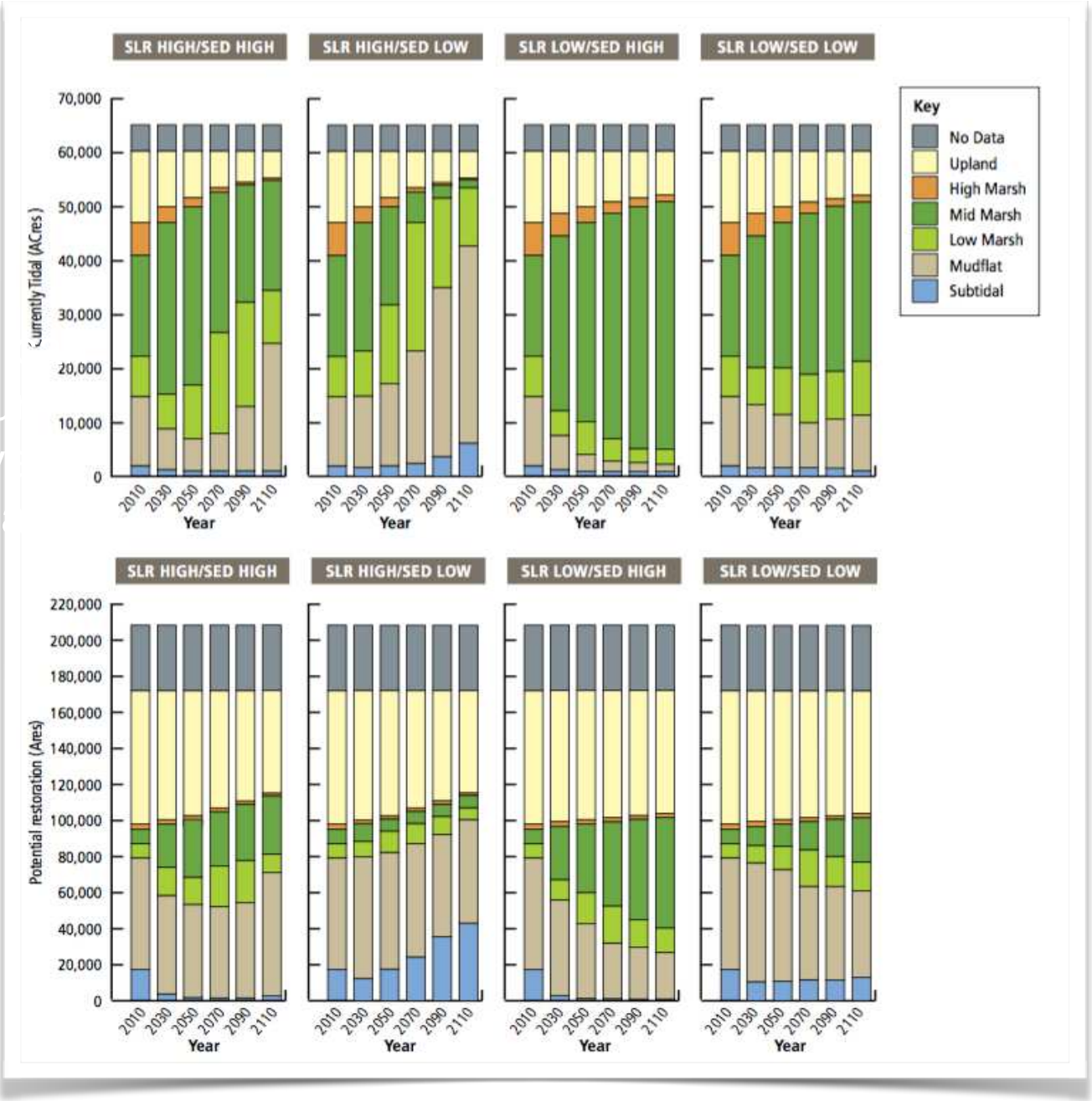

San Francisco Bay Restoration Authority

Need to realign regulations that were written in the 1960-70s to prevent filling of the Bay for development to address today's needs to facilitate innovative adaptation strategies to restore habitats in the face of sea level rise


# Climate-Smart Adaptation Strategies

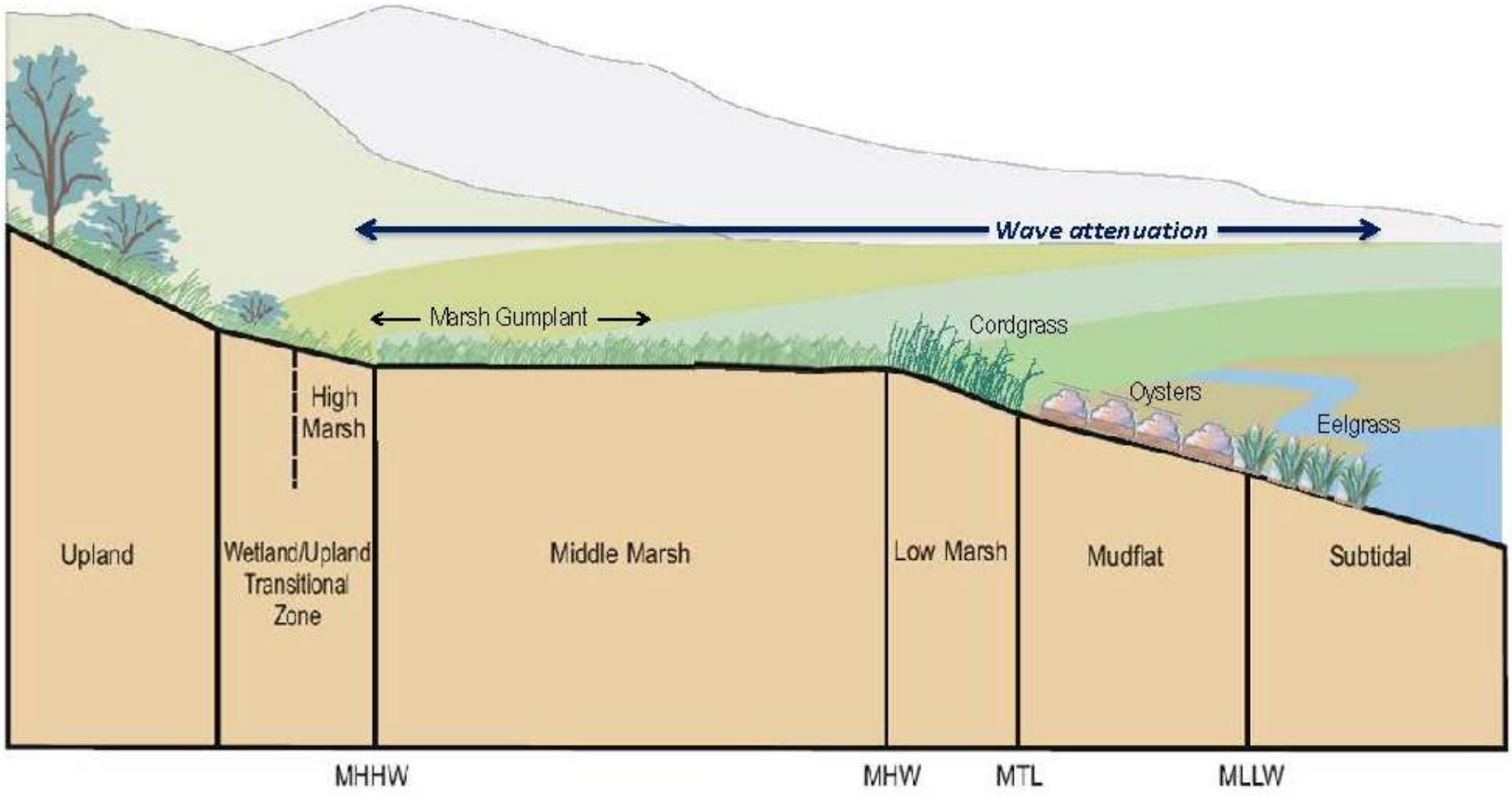
- Restore wetlands sooner rather than later
- Restore complete tidal wetland system from subtidal to upland transition zones
- Use of upland fill or beneficial reuse dredge material to increase elevation & accelerate marsh plain development
- Create high tide refugia – planting upland transition zones and creating marsh islands
- Eradicate and control invasive species

If we act quickly, we can save over 80% of our existing wetlands over the next hundred years




Graphic from *The Baylands and Climate Change: What We Can Do*

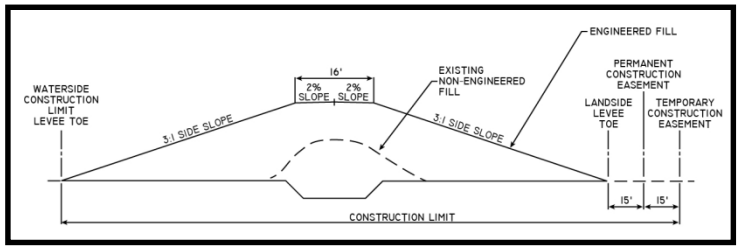
# Restoring the complete tidal wetland system



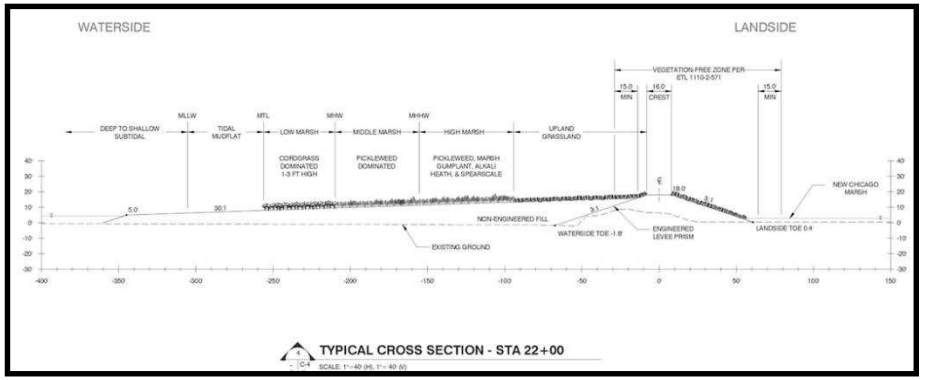

ESA PWA

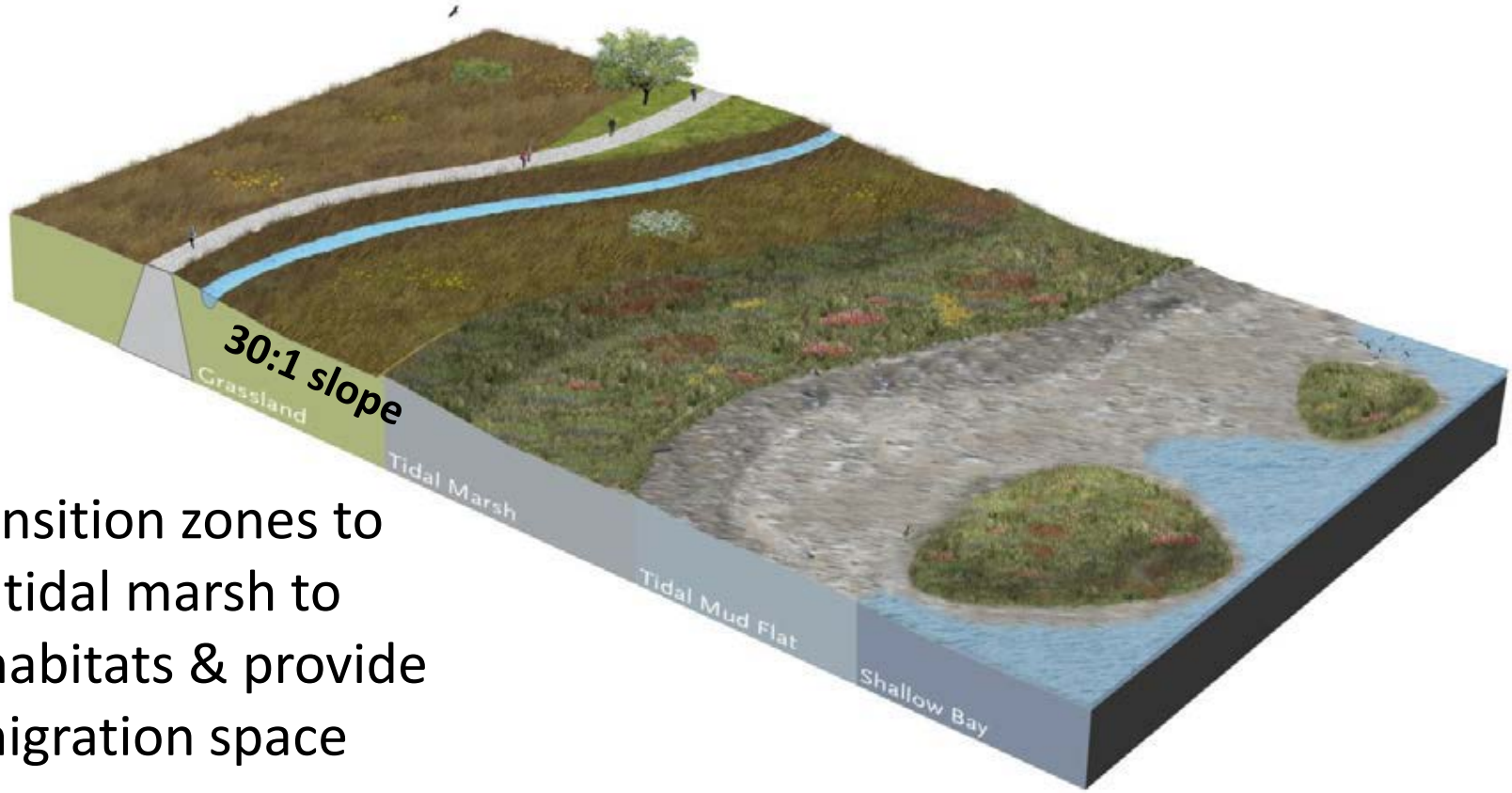
Coastal Conservancy

Traditional 3:1 sloped levee




"Horizontal" 30:1 sloped levee




Build transition zones to connect tidal marsh to upland habitats & provide marsh migration space

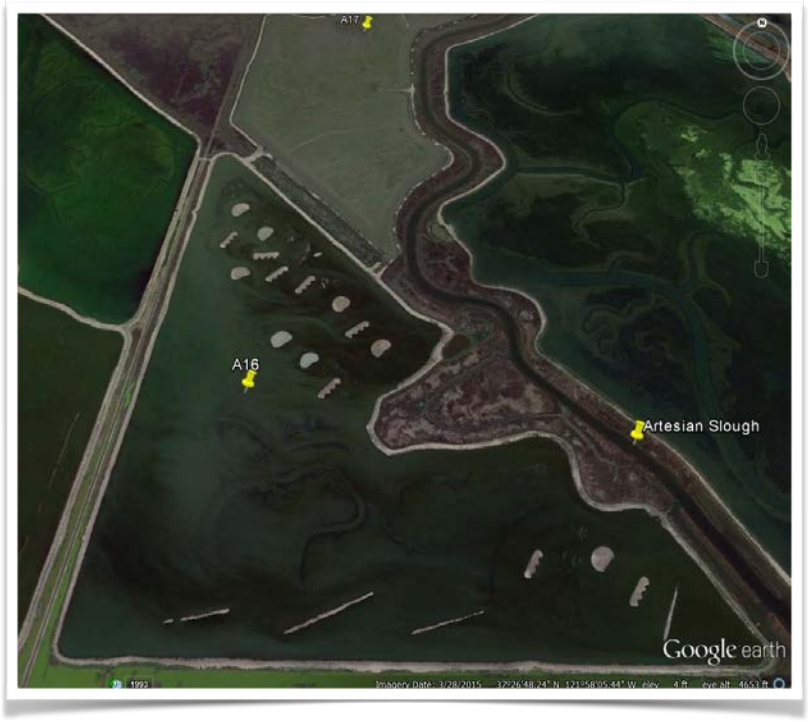
*Horizontal levee graphic courtesy of Bay Institute*

Import clean upland fill material to
build high marsh-upland transition zone


Example: Inner Bair Island Restoration


- ✓ Raise subsided areas to accelerate marsh development by pumping in dredge sediment or upland fill prior to breaching

- ✓ Strategic placement of islands to enhance nesting, foraging and roosting habitat for diversity of waterbirds
- ✓ Include marsh mounds to serve as wave breaks and sediment catchers



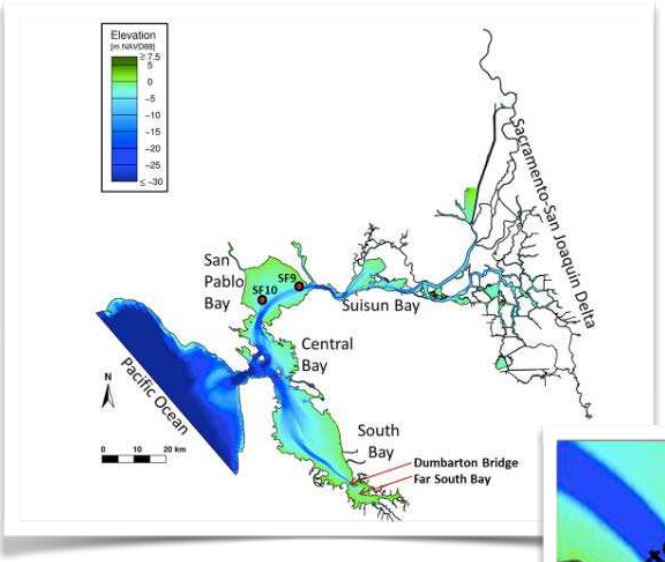

Enhance marsh benefits for wildlife by building high-tide refuge islands and planting native species

*Photos courtesy of the Invasive Spartina Project*

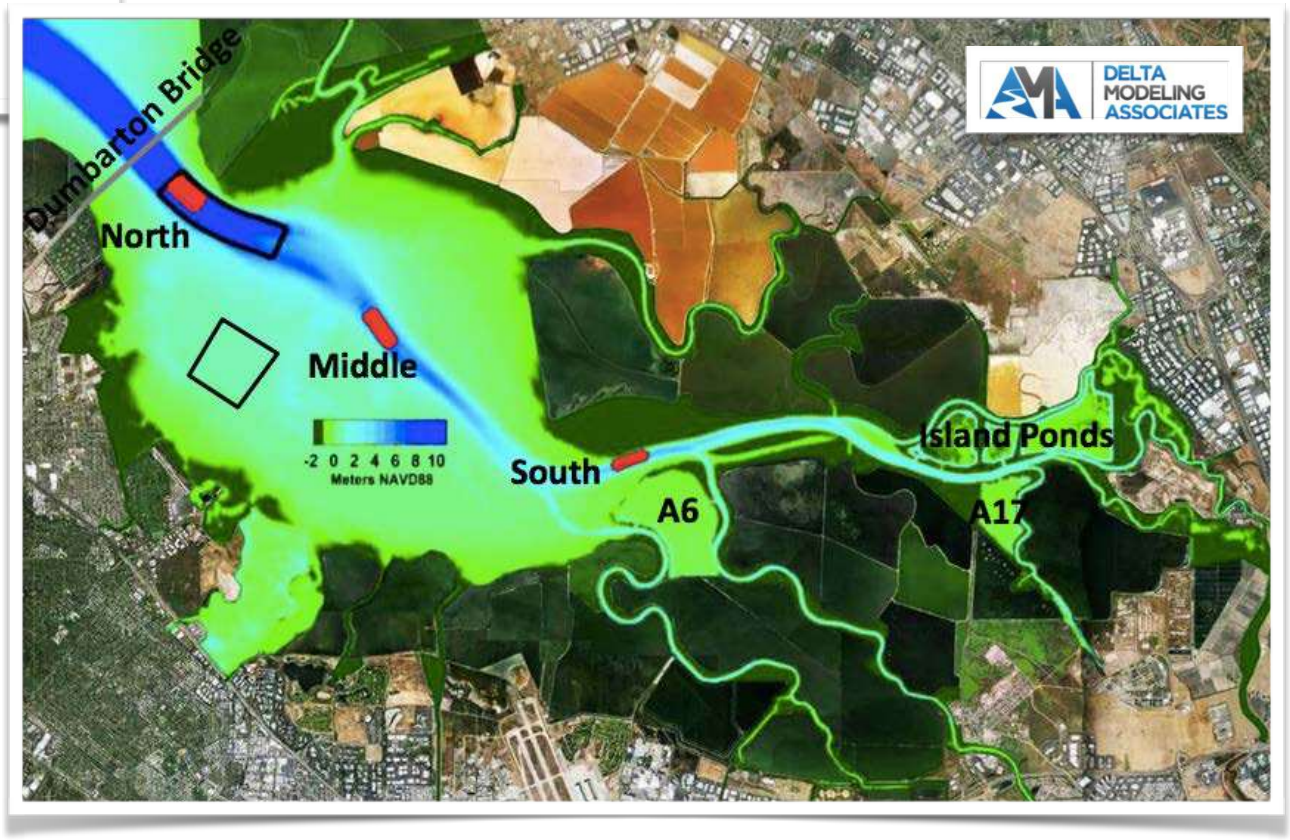
## Eradicating invasive *Spartina*

97% reduction since 2005 (805 acres reduced to less than 28 acres today

- ✓ Ensure best management practices for native plant restoration using appropriate native sources
- ✓ Prevent invasion of newly restored tidal areas




Augment natural sediment supply to mudflats and breached ponds with in-Bay placement of dredged sediment




*UnTRIM San Francisco Bay-Delta Hydrodynamic Model graphics from: Bever et al. 2014*

# Future tools?

Thin layer sediment augmentation in existing marshes to keep pace with sea level rise

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