CLIMATE CHANGE AND THE RESTORATION OF TIDAL WETLANDS

Coastal Conservancy

CALIFORNIA STATE PARKS SINCE 1864

berkeley law
boalt hall
school of law

CCELP
CALIFORNIA CENTER FOR ENVIRONMENTAL LAW AND POLICY
UNIVERSITY OF CALIFORNIA, BERKELEY

California State Coastal Conservancy

Mission

To preserve, protect and restore the resources of the California Coast

- State agency created in 1976
- Non-regulatory arm of the State's coastal management program
- Uses entrepreneurial techniques to purchase, protect, restore, and enhance coastal resources, and to provide access to the shore

Coastal Conservancy

Number of acres saved: **200,000+**

Miles of Coastal Trail and Public Accessways Constructed: **600+**

Projects completed: 1000+

Urban waterfront projects completed: 100+


Restoration of coastal wetlands
Pictured: South San Francisco Bay Salt Ponds Restoration Project

Coastal Wetlands Restoration Projects

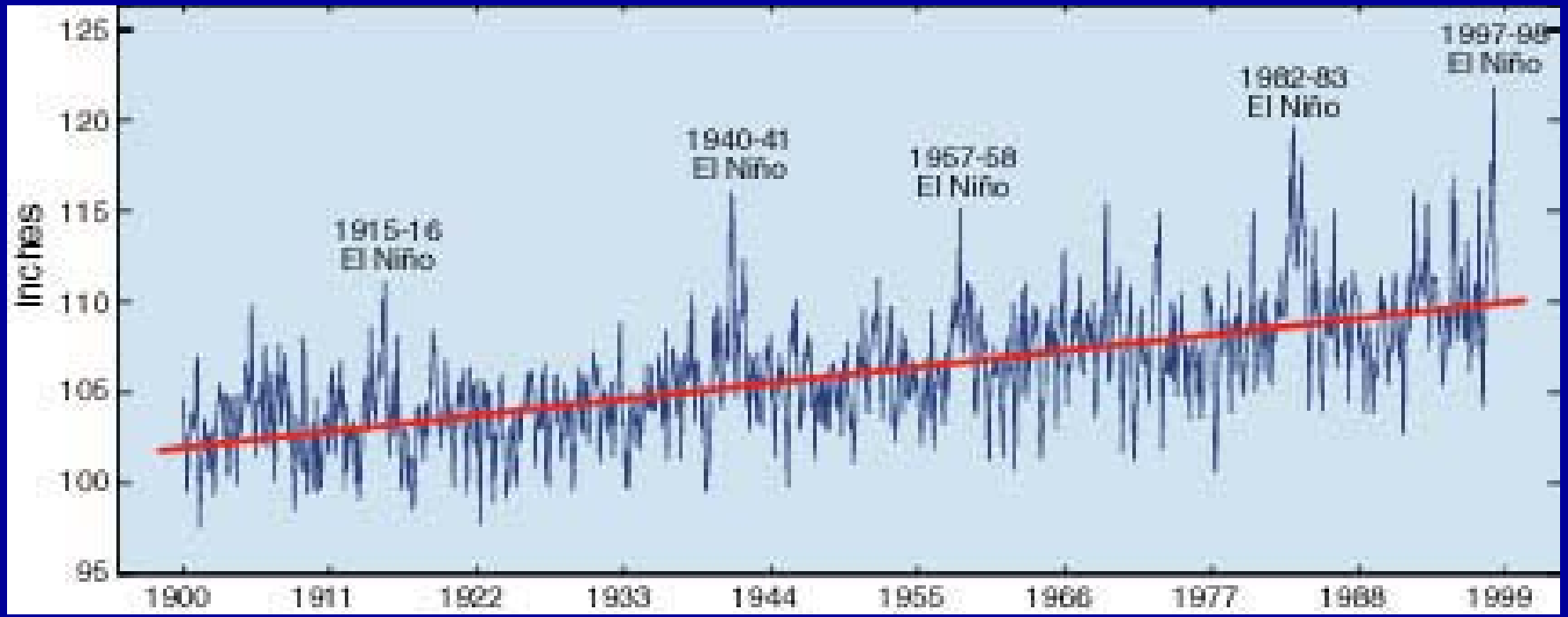
Arcata Marsh, Ormond Beach
Ballona Wetlands, Tijuana Marsh

Tidal Wetlands: 3 in 1

- Buffer levees
- Adapt to sea level rise
- Sequester carbon

Sea Level Rise: San Francisco

- Rate of sea level change 2.17 mm/yr (20th century)
- Higher than global average (1.5-2 mm/yr) because of local subsidence
- MHHW rising 19% faster than MSL (MHHW rate of rise = 2.6 mm/yr)



Historic Global Sea-Level Rise
IPCC (2007)

1.8 +/-0.3 mm/yr (1961-2003)

3.1 +/- 0.7 mm/yr (1993-2003)

Acceleration due to anthropogenic forcing or decadal-timescale climate variability?

IPCC (Feb 2007) Future Global Sea-Level Rise

0.18 – 0.59 m (1990-2100)

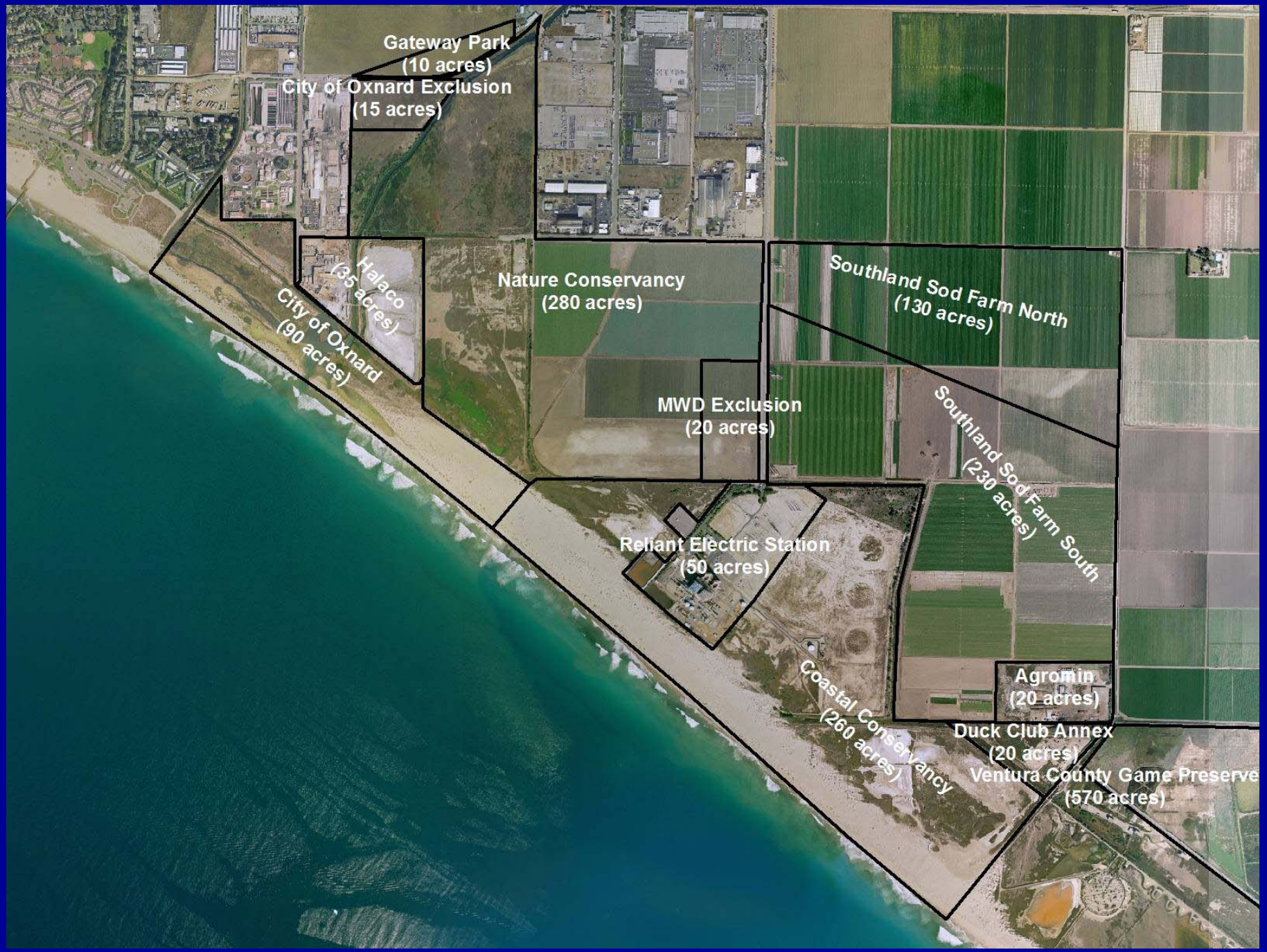
- Authoritative summary of scientific knowledge at time of preparation
- Authored by 30 leading scientists from around the world
- Thorough scientific review
- Additional governmental review

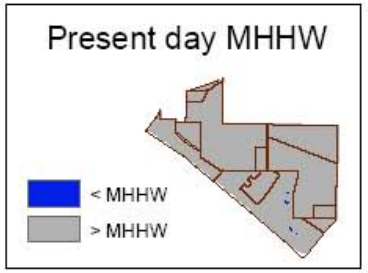
DRMS (June 2007) Critique of IPCC

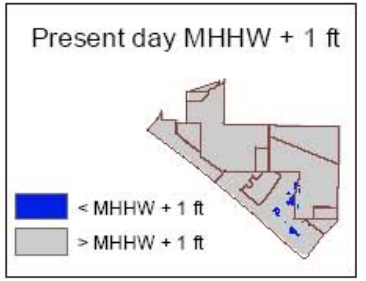
- Modeled projections of IPCC (2007) too low
  - Linear extrapolation of historical rates are higher than low-end IPCC (2007) projections
  - Models under-predict historical sea-level rise
  - Projections exclude significant contributions from future melting of the Greenland ice sheet
  - Rahmstorf (2006) used empirical relationships projected higher rates of sea-level rise

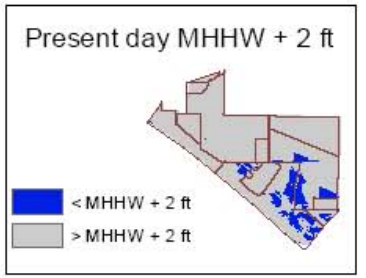
Ballona Wetlands, Marina del Rey

Ballona Wetlands, Marina del Rey
Effect of 5 m SLR


Gateway Park
(10 acres)
City of Oxnard Exclusion
(15 acres)
Halaco
(35 acres)
City of Oxnard
(90 acres)
Nature Conservancy
(280 acres)
Southland Sod Farm North
(130 acres)
MWD Exclusion
(20 acres)
Southland Sod Farm South
(230 acres)
Reliant Electric Station
(50 acres)
Coastal Conservancy
(260 acres)
Agromin
(20 acres)
Duck Club Annex
(20 acres)
Ventura County Game Preserve
(570 acres)







Source: Topography from LiDAR survey by Towill (2001)

Notes: The property boundaries depicted in this figure are for general planning purposes only. They have not been surveyed and may not coincide exactly with parcel-specific legal boundaries.

0 2,750 5,500 11,000 Feet

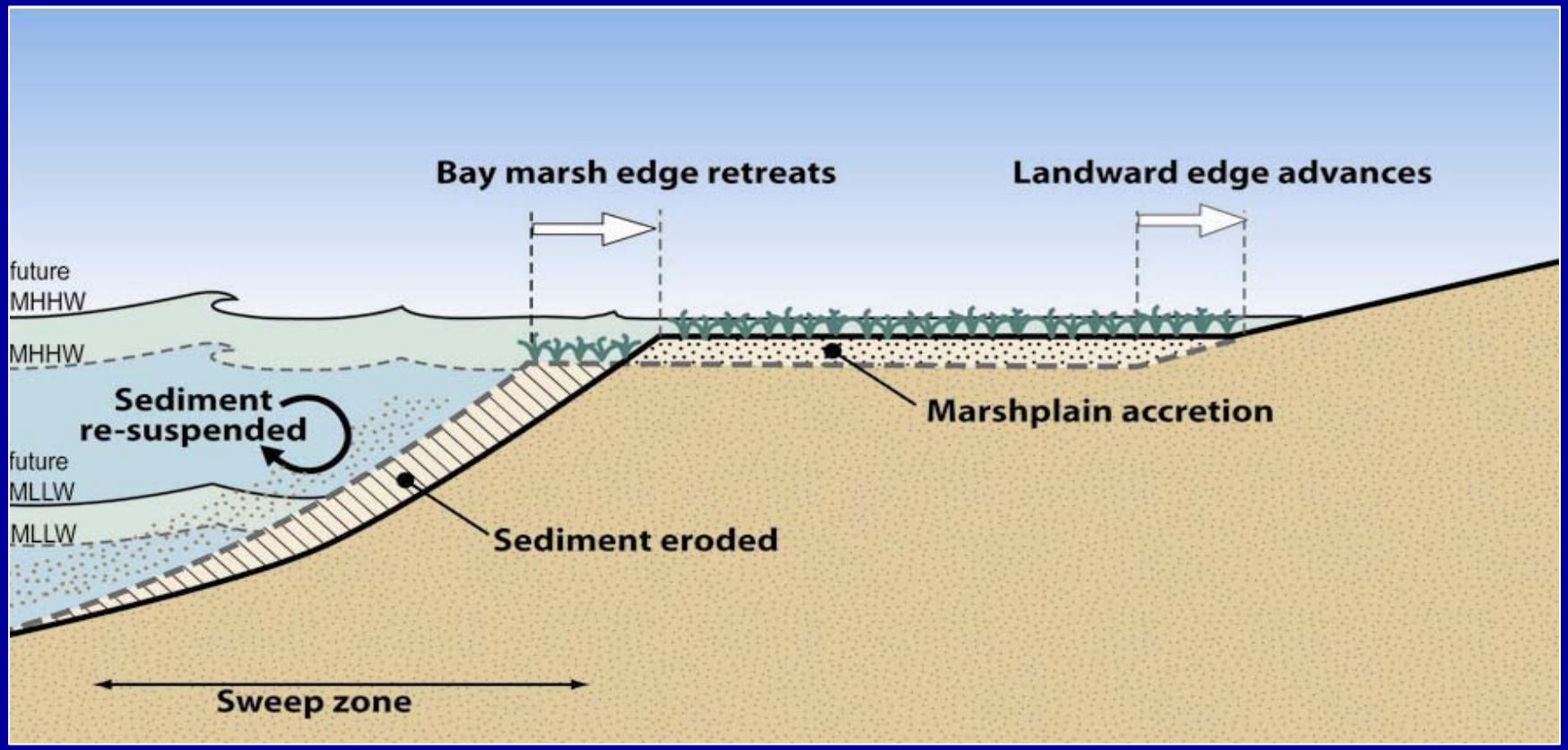
Ormond Beach Wetland Restoration Feasibility Study

Existing Site Topography

PWA Ref # - 1738.9

PWA

Transgression Processes

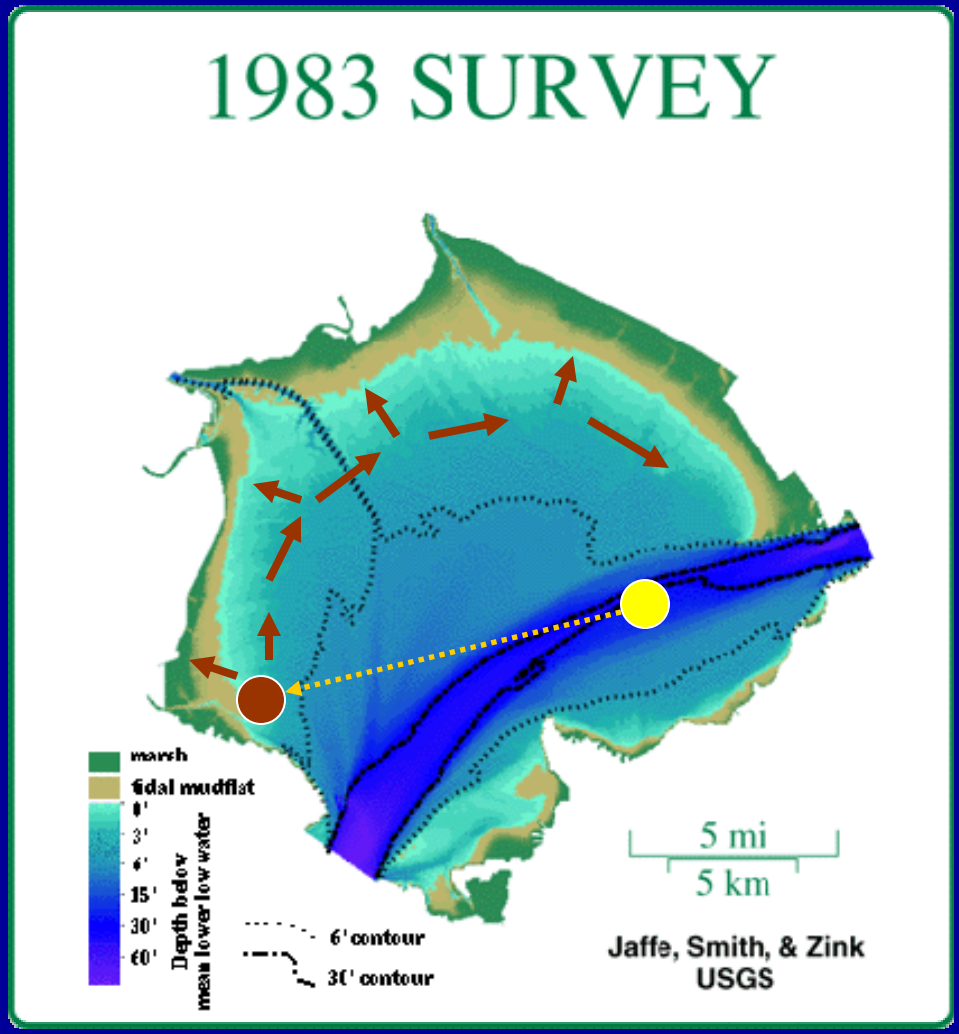


Feed the mudflats

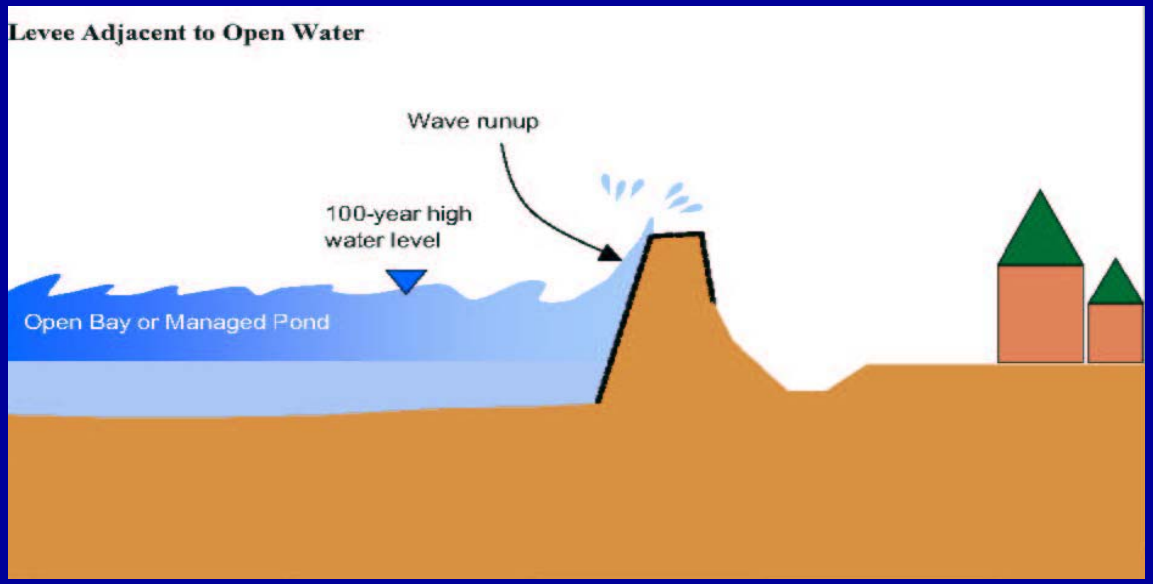
Feed the mudflats

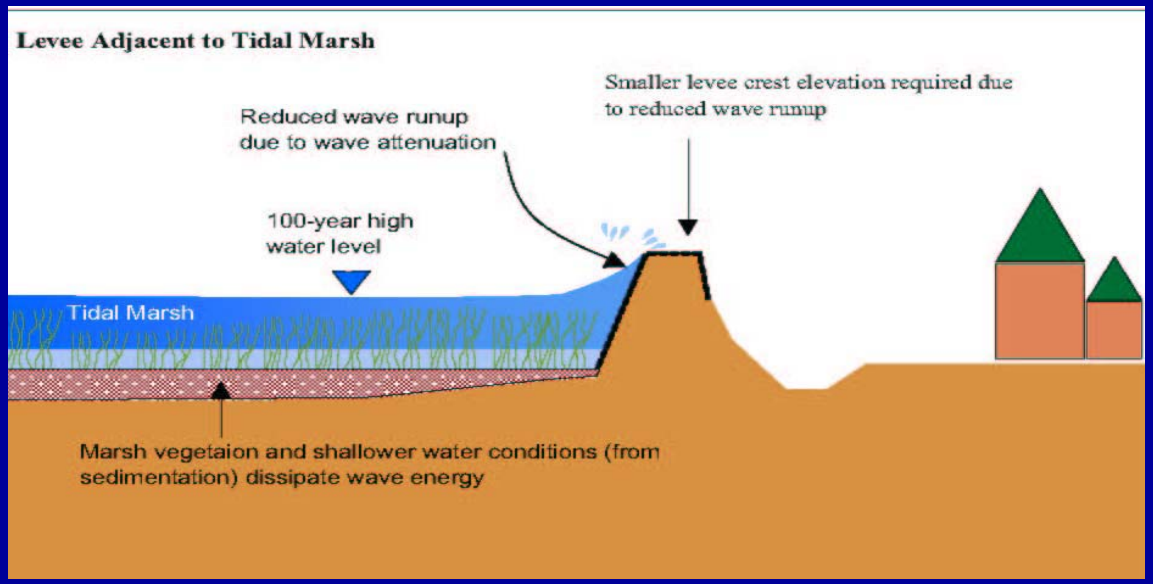
- **Benefits**
- Maintain sediment in circulation
- Reduce rate of wetland loss
- Feed restoration sites

- **Concerns**
- Over filling
- Sediment quality
- Unknown biological impacts

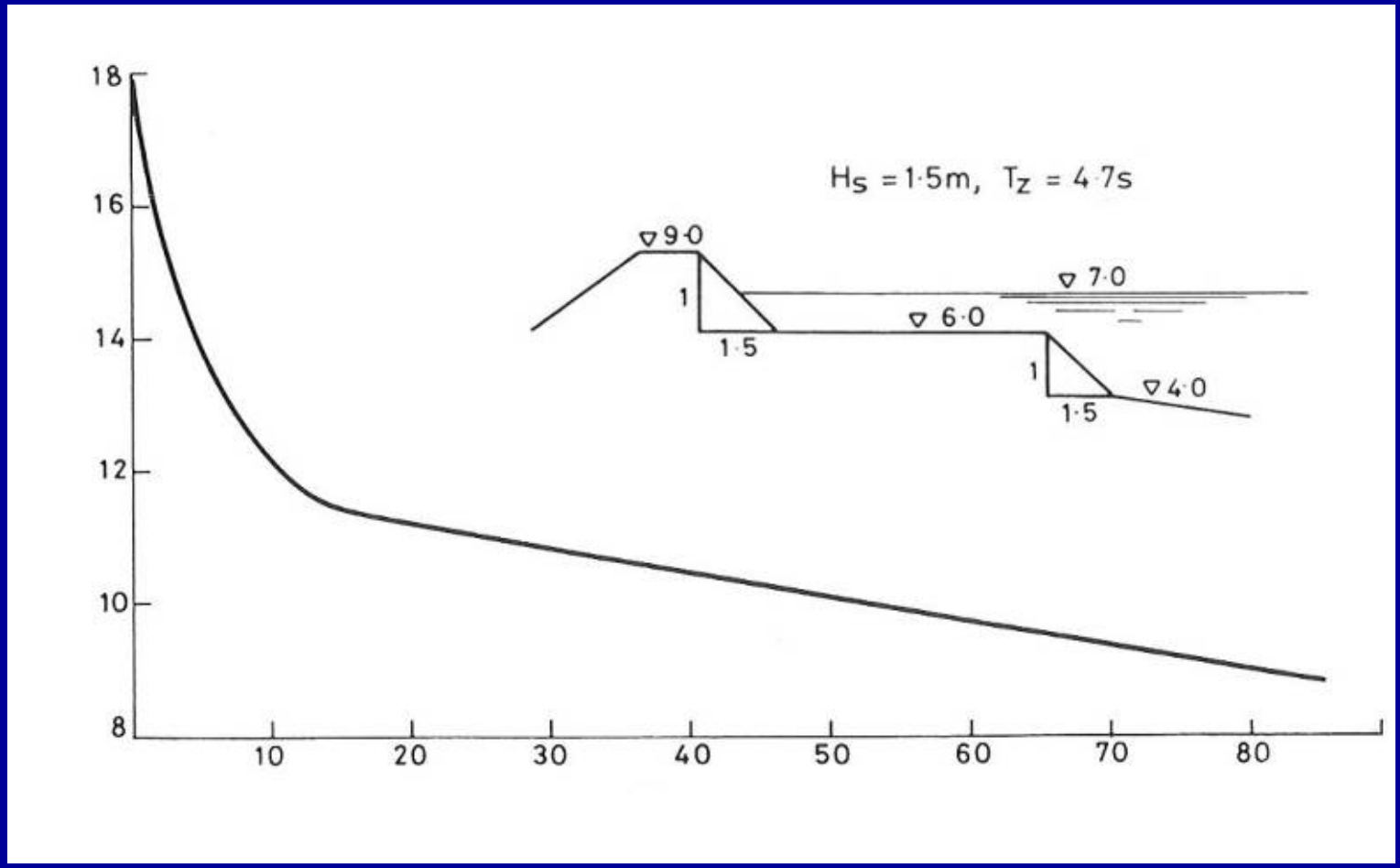


Coastal Flood Protection



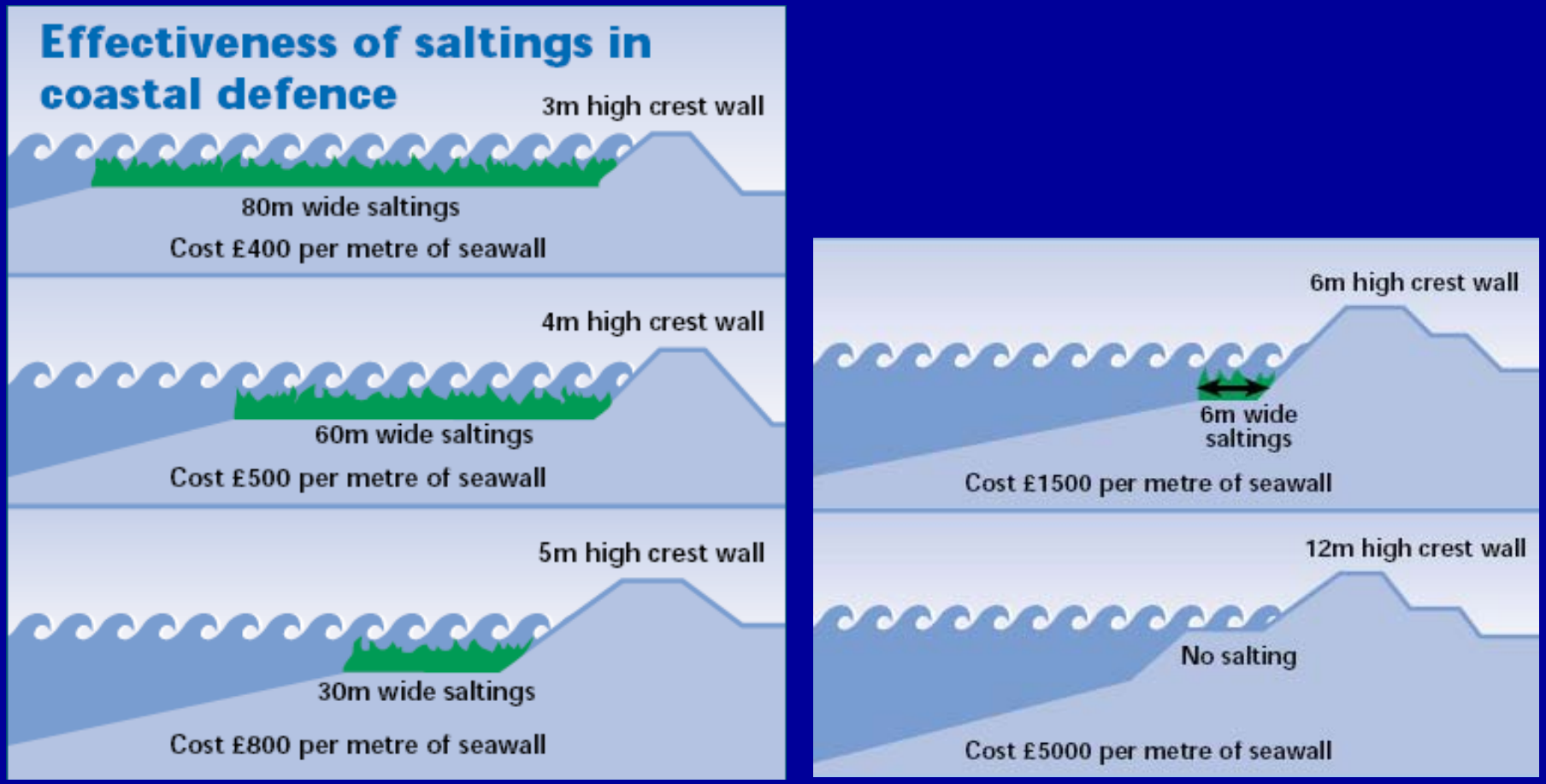


Flood Protection Benefits of Tidal Marsh



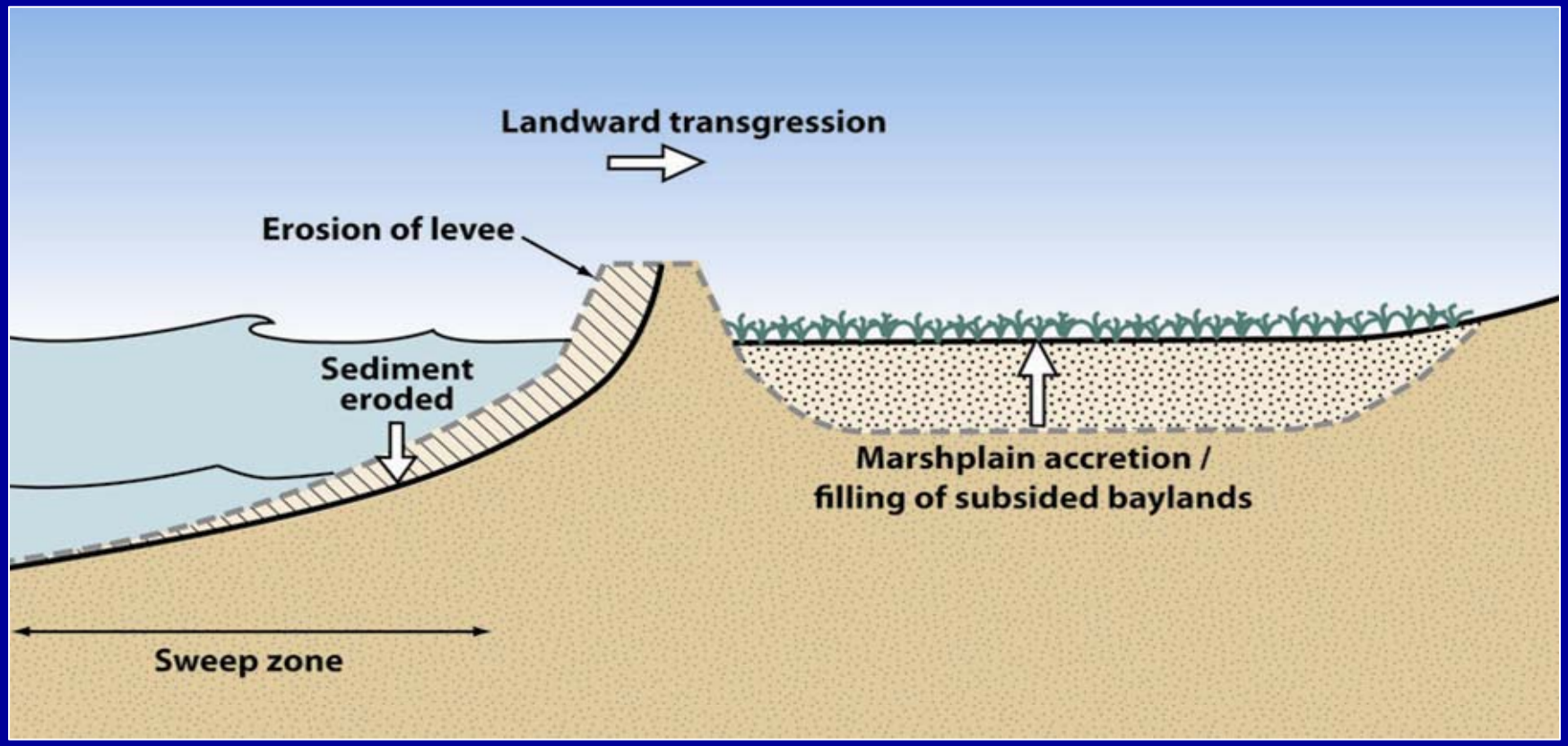
Source: Owen 1984

Wetlands creation can greatly reduce flood protection costs

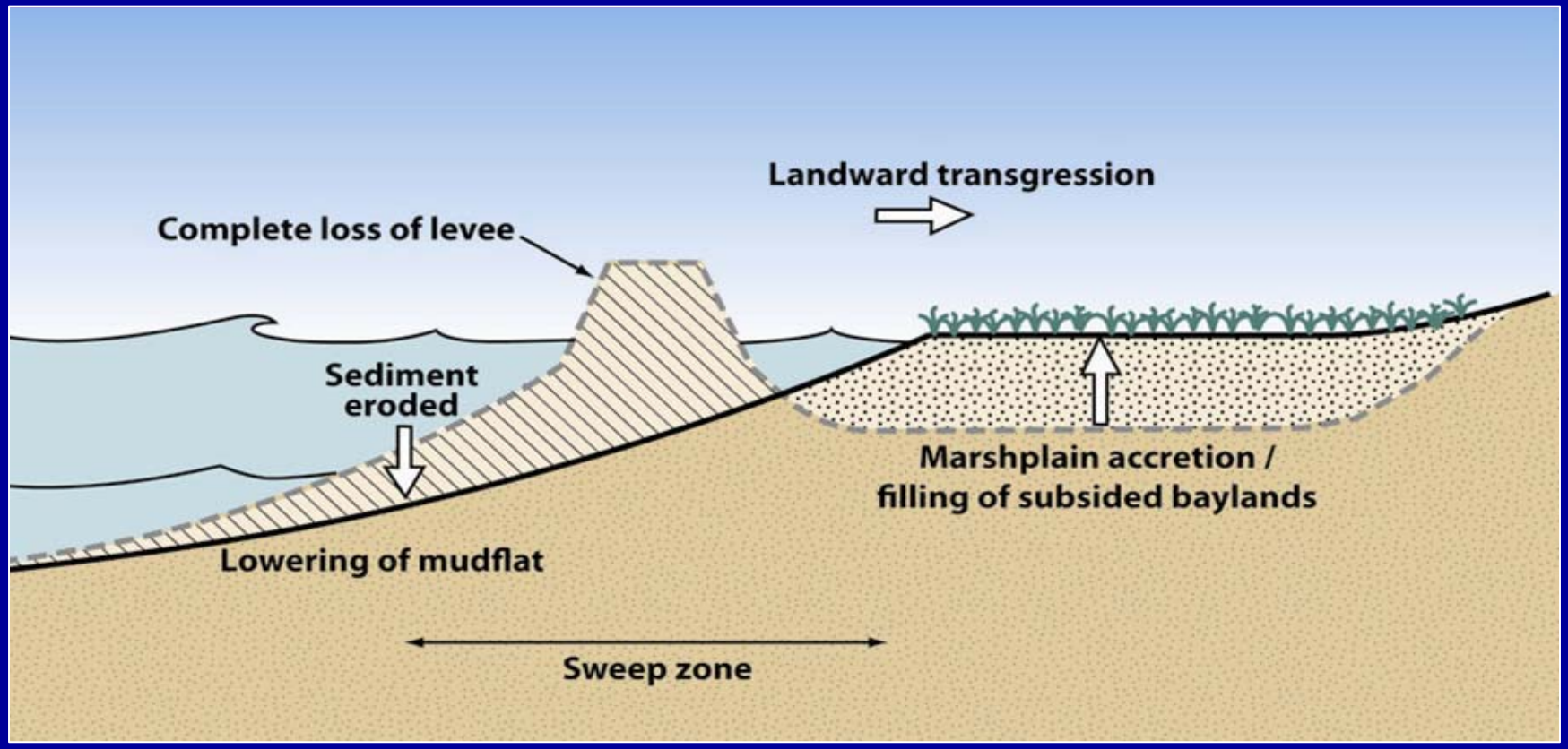


Original Source Brampton 1992

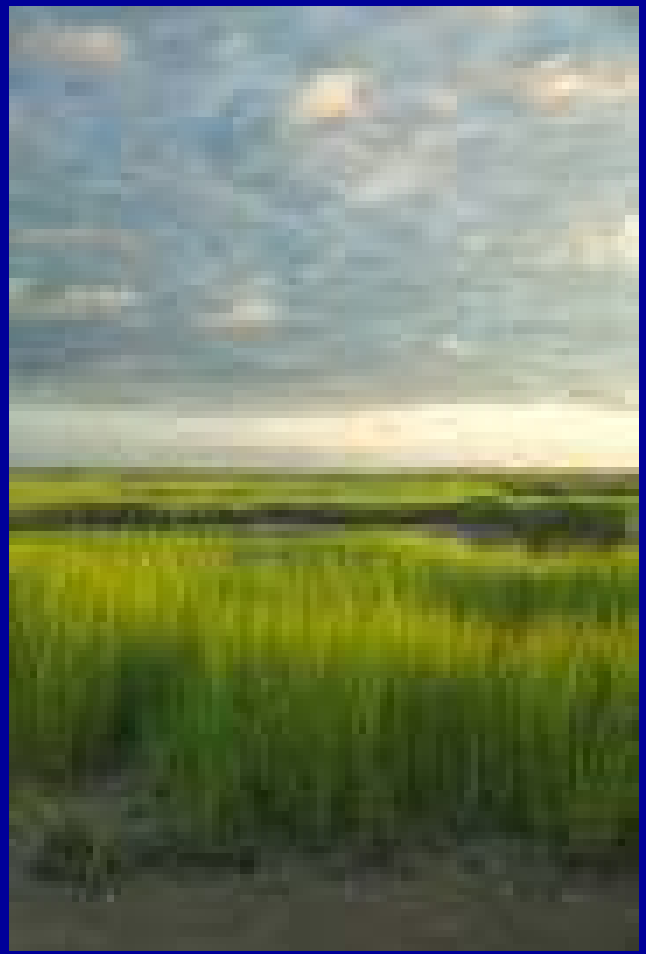
Restoration with levee in place



Levee failure after restoration



Carbon sequestration

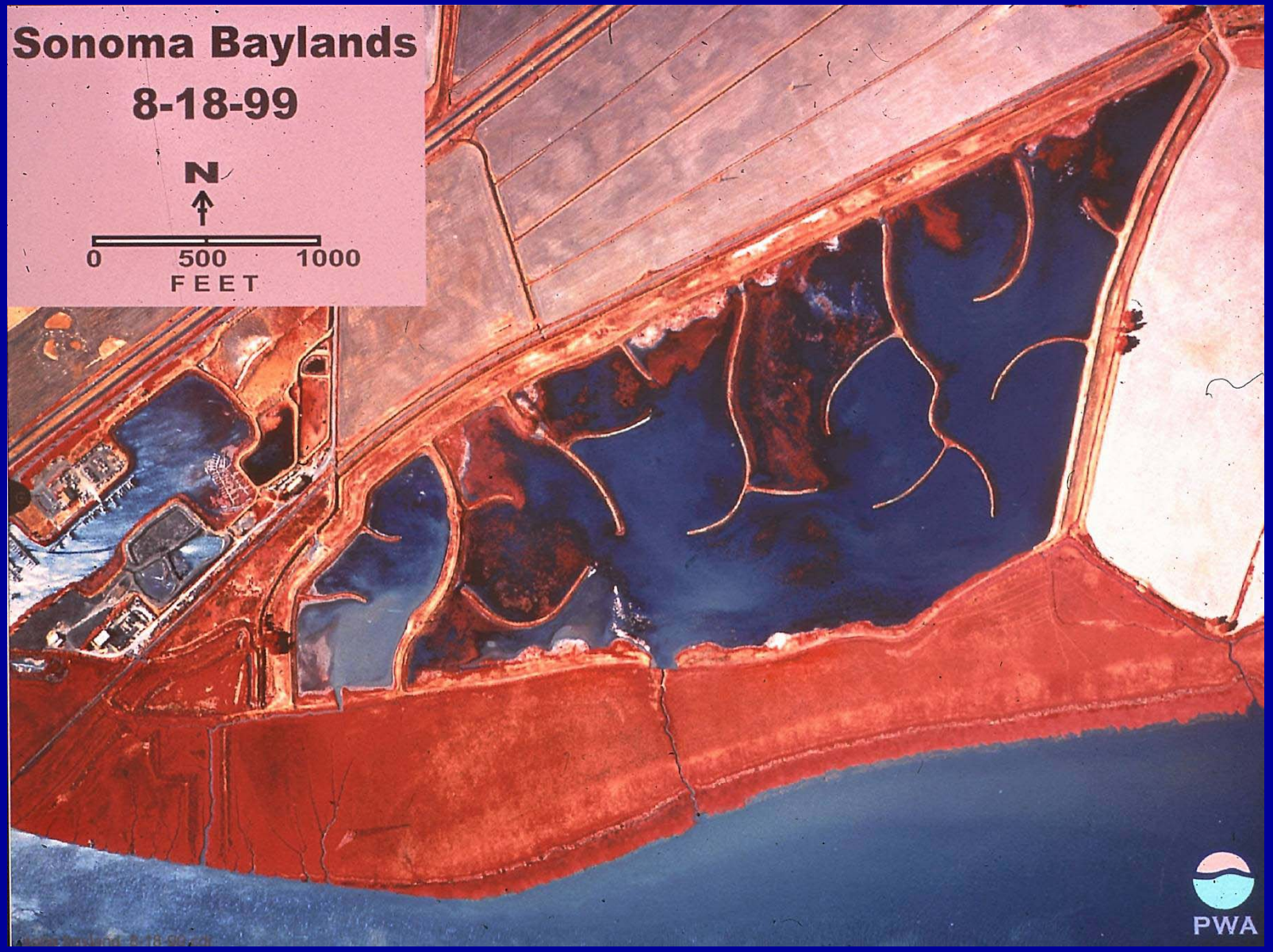


San Francisco Bay:

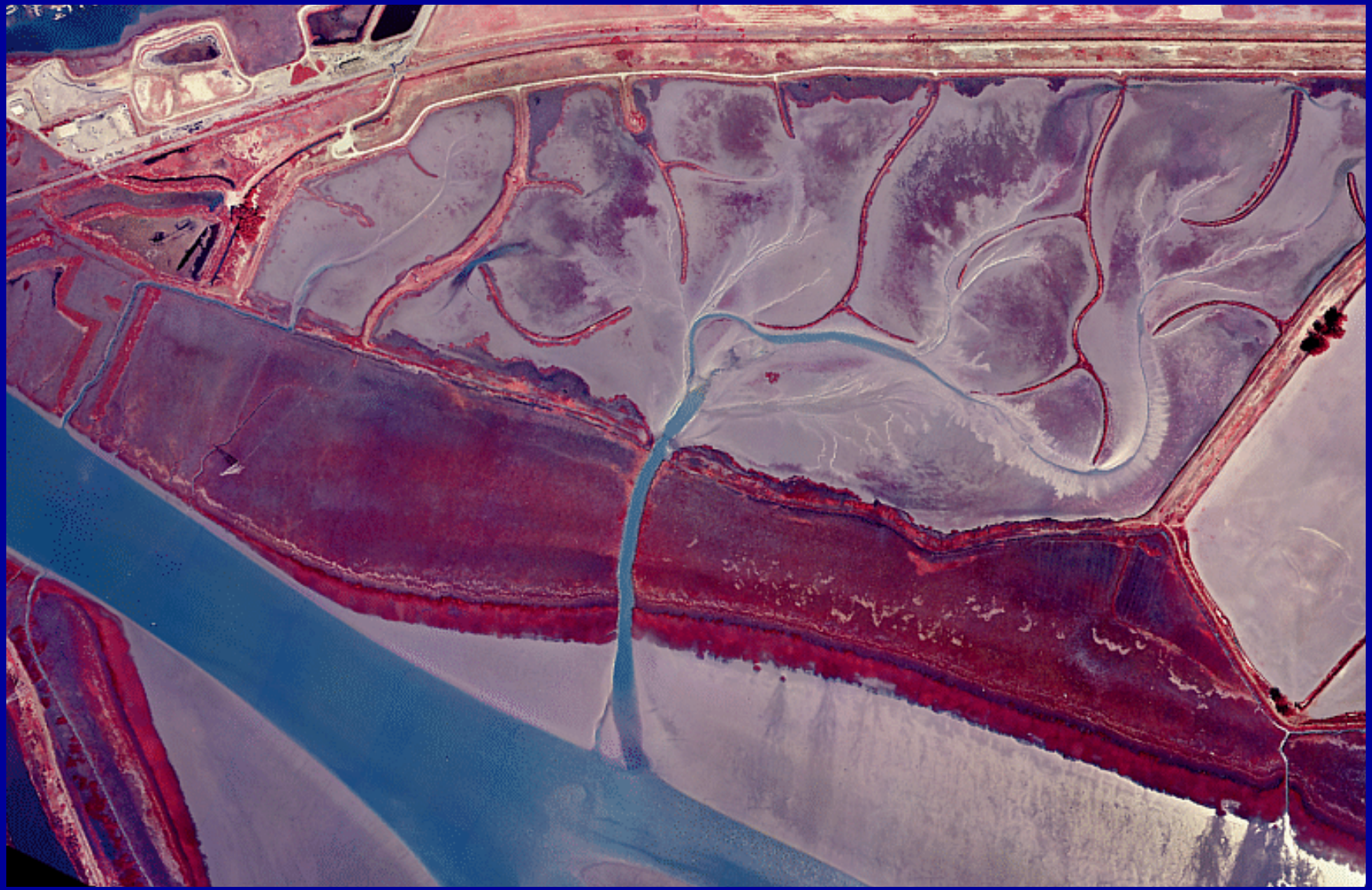
A dynamic, muddy estuary

Muzzi Marsh: Fill location breached naturally in 1976

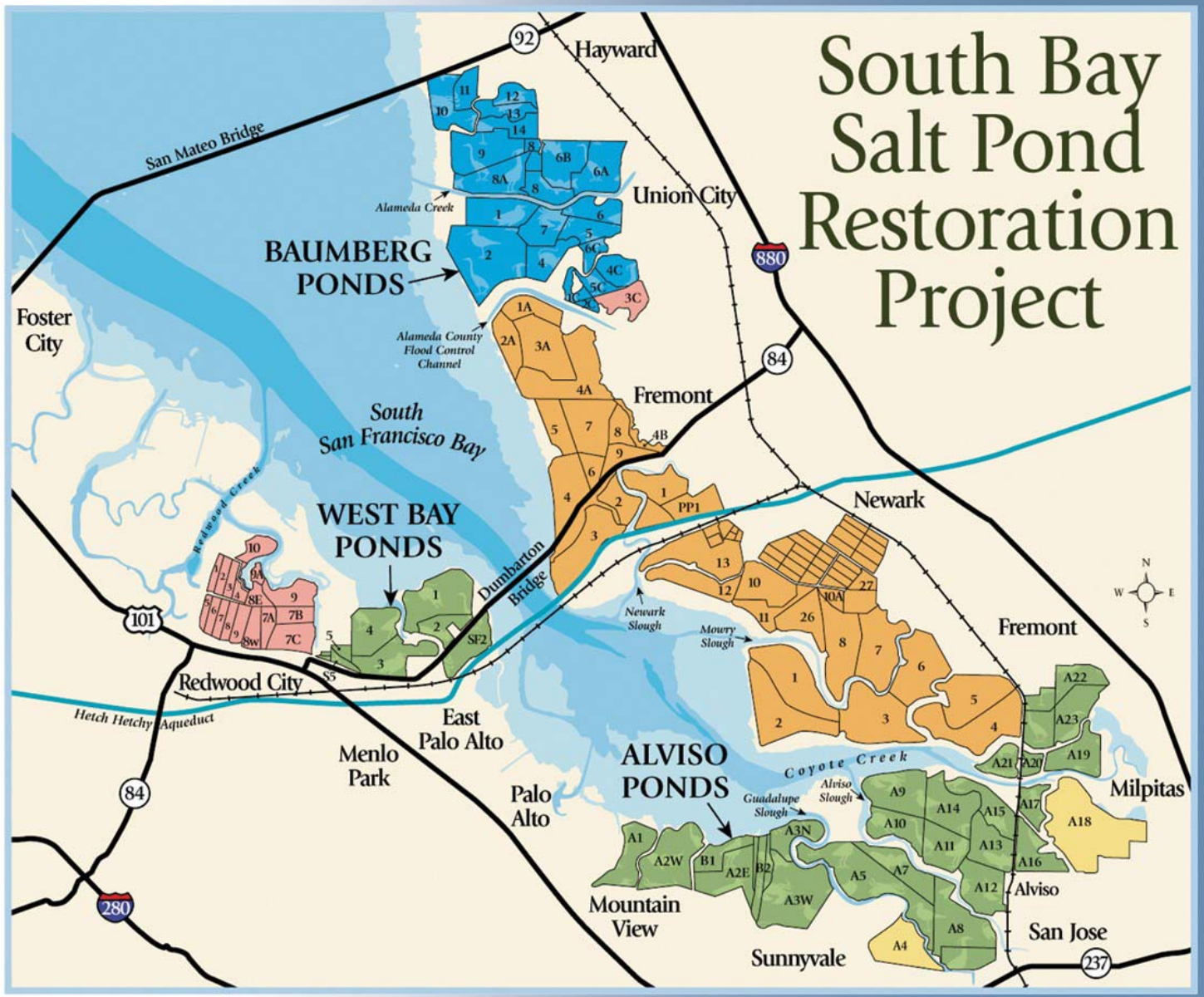
Sonoma Baylands 1999

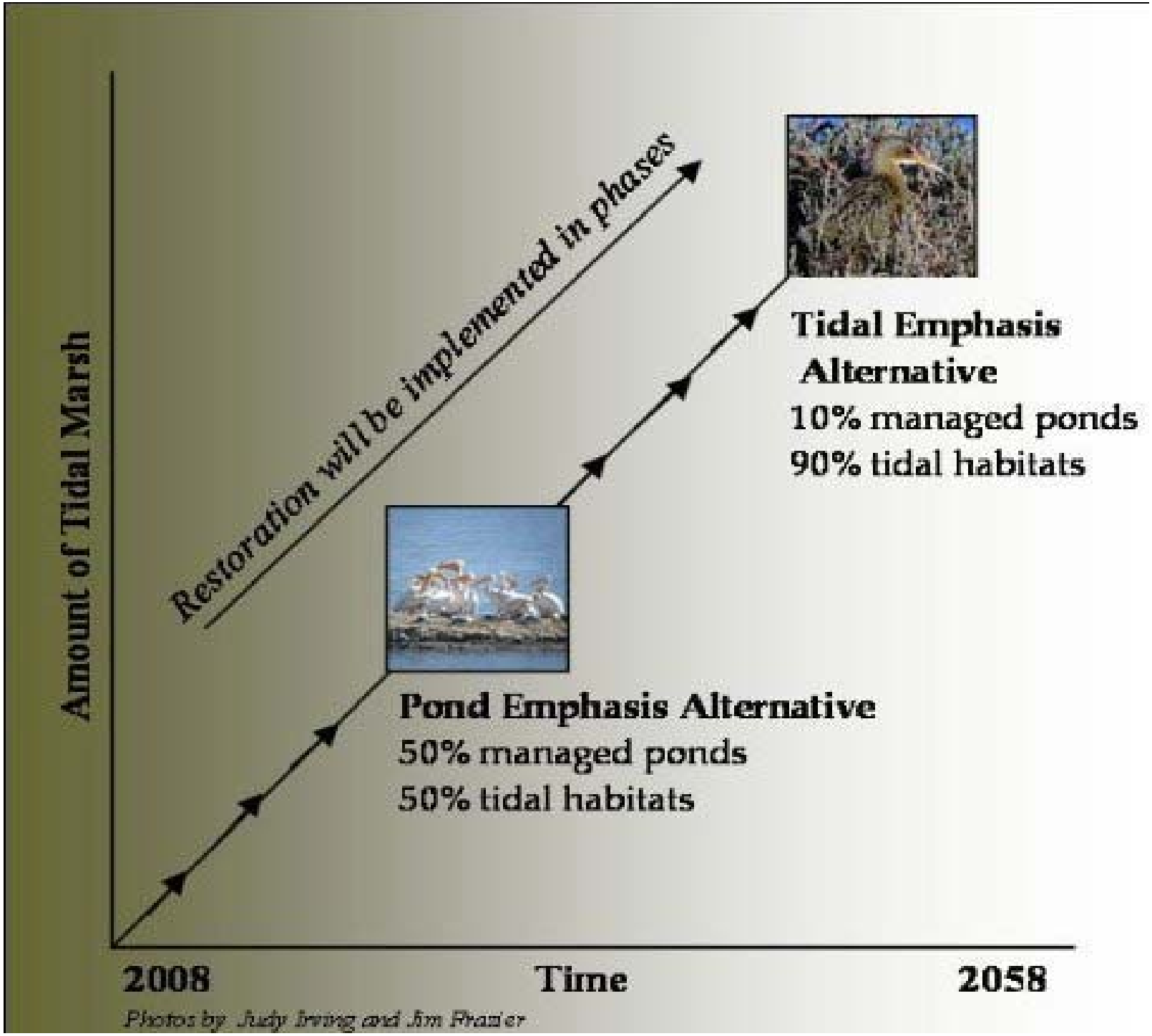


Sonoma Baylands 2006



Hamilton Army Airbase Restoration


South Bay Salt Pond Restoration Project
San Mateo Bridge
Hayward
Union City
Alameda Creek
BAUMBERG PONDS
Foster City
Alameda County Flood Control Channel
Fremont
South San Francisco Bay
Redwood Creek
WEST BAY PONDS
Dumbarton Bridge
Newark
Newark Slough
Moury Slough
Fremont
Redwood City
Hetch Hetchy Aqueduct
East Palo Alto
Menlo Park
Palo Alto
ALVISO PONDS
Coyote Creek
Alviso Slough
Guadalupe Slough
Milpitas
Mountain View
Sunnyvale
Alviso
San Jose
92
880
84
101
280
237


Amount of Tidal Marsh
Restoration will be implemented in phases
Tidal Emphasis Alternative
10% managed ponds
90% tidal habitats
Pond Emphasis Alternative
50% managed ponds
50% tidal habitats
2008
Time
2058
Photos by Judy Irving and Jim Frazier

Monitoring and Research

- We need to manage both the marsh and mudflat.
- What is happening to mudflat elevations and saltmarsh edge around the wetland?
- What are the long term trends in sediment budget?
- How do we manage sweep zones as active reservoirs of sediment?
- How will these physical changes impact the future distribution of habitats?

What we know for sure

- We need to restore sooner, rather than later
- We need coordinated regional efforts
- We need a web-based clearinghouse for information about managing the effects of climate change on wetland restoration.