Salt Marsh Restoration

Scott Miner
Ecosystem Restoration Specialist
Sacramento District

Salt Marsh Restoration

- Where salt marshes come from
- How the Corps accidentally saved the coast
  A brief history of San Francisco Bay marshes
- How the Corps turned a political quagmire into a marsh
  Politics, design, construction and monitoring of the Sonoma Baylands project
- How the Corps planned to make 4 billion lbs. of salt vanish
  The Napa Salt Marsh Restoration planning process

Where salt marshes come from

Salt marsh: a community of organisms dominated by plants that are tolerant of wet, saline soils, generally found in low-lying coastal habitats which are periodically wet and saline to hypersaline.

Salt marsh - a muddy seashore with plants on it.

China Camp State Park, Marin County, California

China Camp State Park, Marin County, California

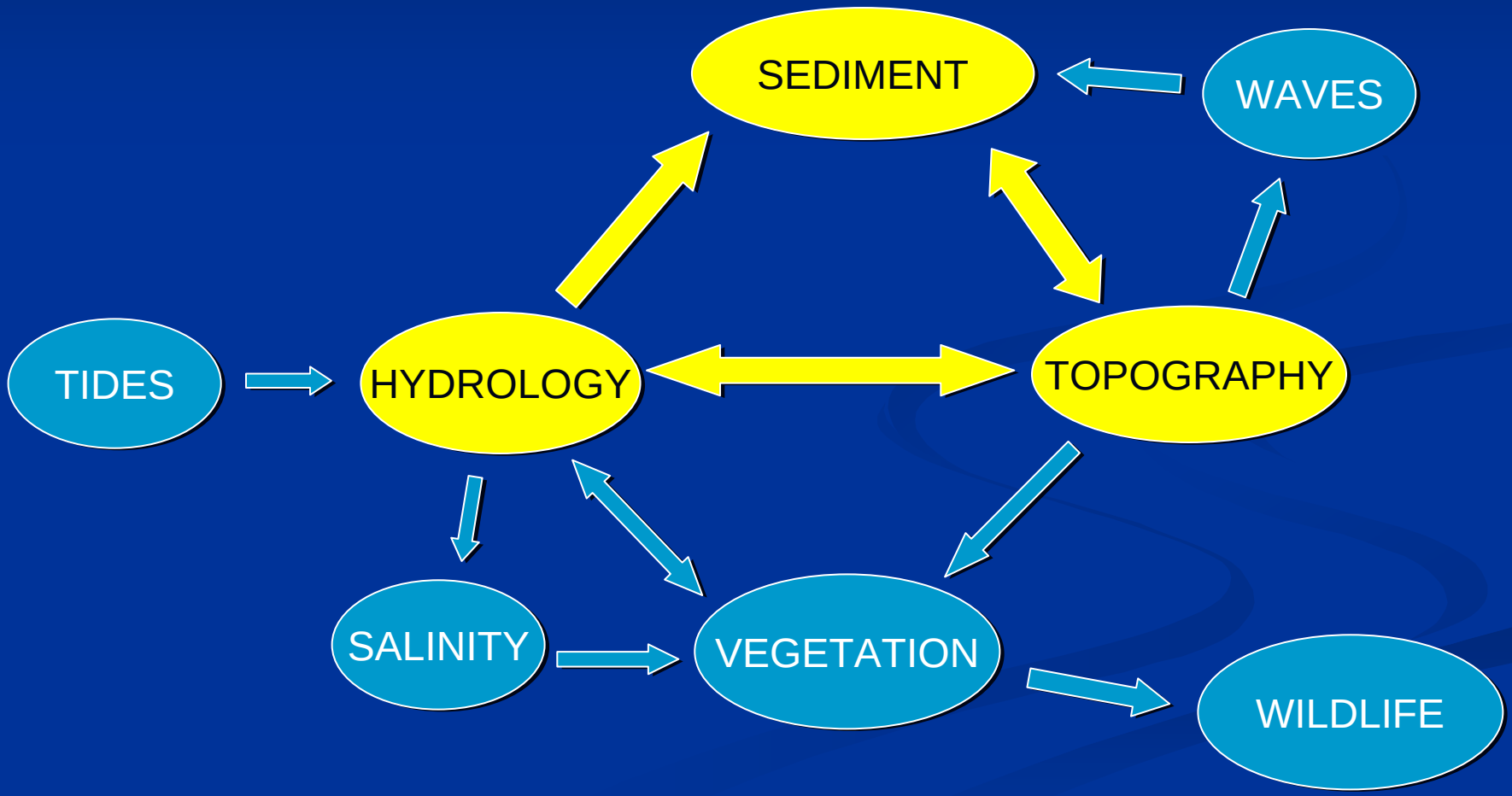
Tidal slough adjacent to baylands

Mangroves (Florida)

Pickleweed (*Salicornia* sp.)

Pacific cordgrass (*Spartina foliosa*)

Salt Marsh Equilibrium



Remnant tidal marsh channels in SF Bay salt pond

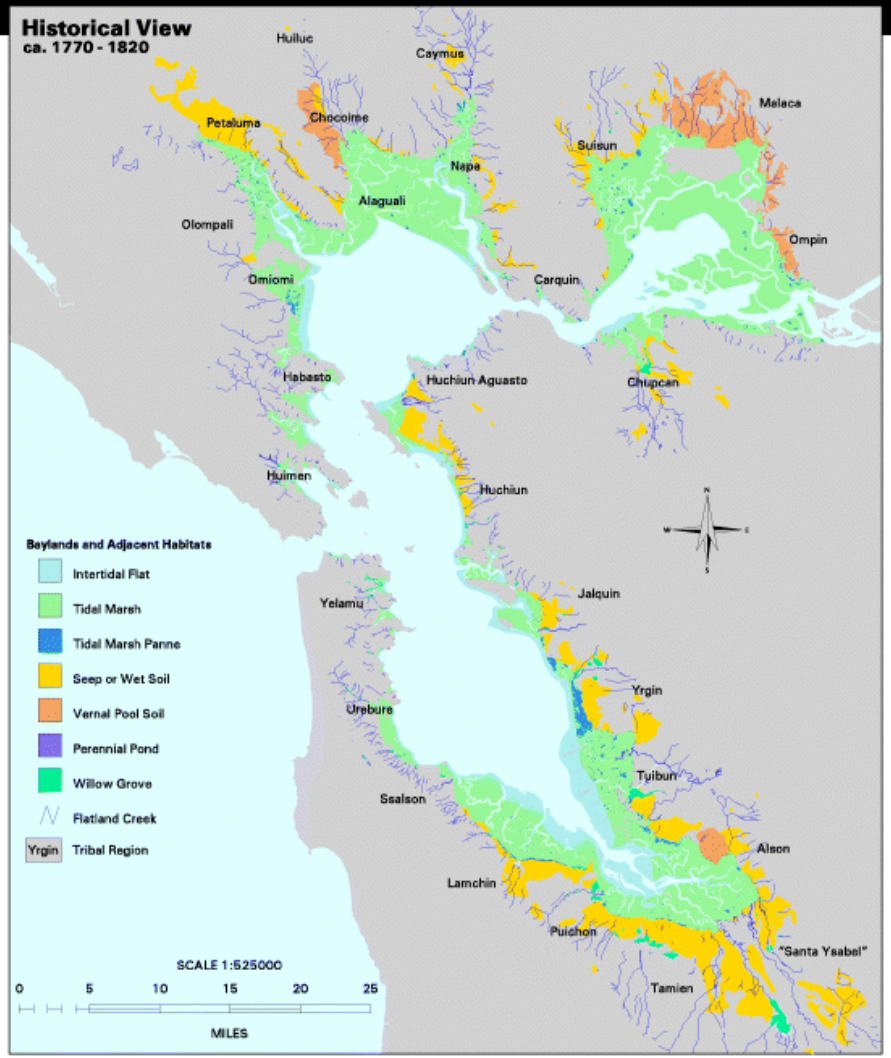
How the Corps accidentally saved the coast

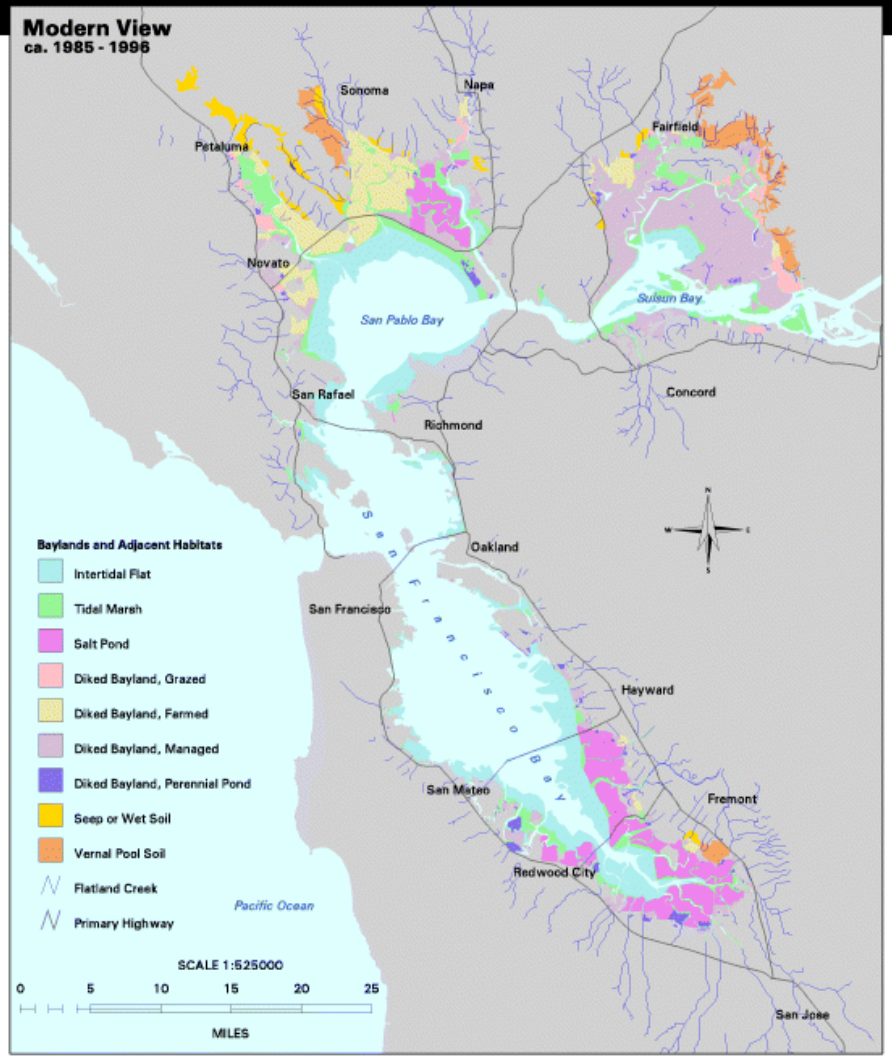
A brief history of San Francisco Bay marshes

San Francisco Bay

Bay Area EcoAtlas

Past and Present





Historical View Primary Sources:
US Coast Survey, US Geological Survey, US Department of Agriculture, Spanish diseños, explorers' journals, and local archives.
Tribal Regions courtesy of Randall Milliken.

Projection:
1927 North American Datum
Universal Transverse Mercator Projection
UTM Zone 10

Modern View Primary Sources:
CA State Lands Commission, US Geological Survey, US Fish and Wildlife Service, US National Aeronautical and Space Administration, and local experts.

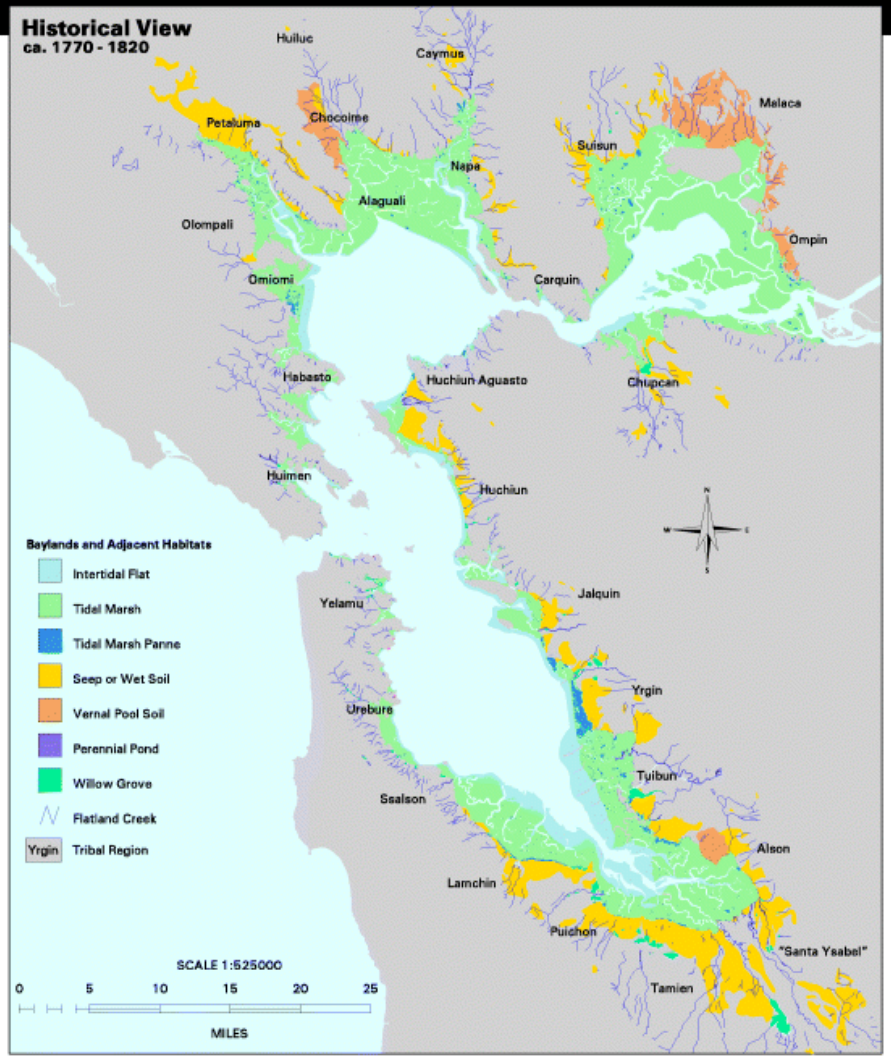
Production:
Science coordination, GIS and Map Design by the San Francisco Estuary Institute
Richmond, California http://www.sfei.org
EcoAtlas 1.0 ©1997 SFEI

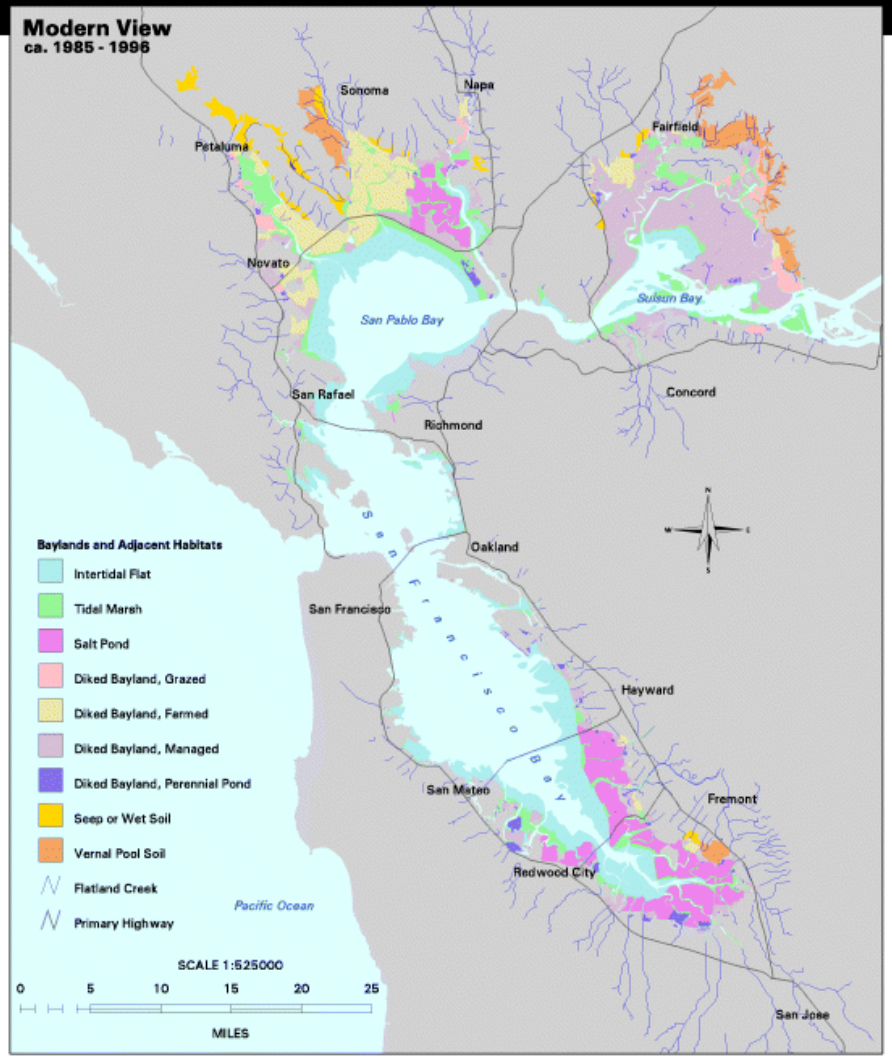
Crystallizer ponds, South SF Bay

San Francisco Bay

Bay Area EcoAtlas

Past and Present





Historical View Primary Sources:
US Coast Survey, US Geological Survey, US Department of Agriculture, Spanish diseños, explorers' journals, and local archives.
Tribal Regions courtesy of Randall Milliken.

Projection:
1927 North American Datum
Universal Transverse Mercator Projection
UTM Zone 10

Modern View Primary Sources:
CA State Lands Commission, US Geological Survey, US Fish and Wildlife Service, US National Aeronautical and Space Administration, and local experts.

Production:
Science coordination, GIS and Map Design by the San Francisco Estuary Institute
Richmond, California http://www.sfei.org
EcoAtlas 1.0 ©1997 SFEI

Diked baylands near Sonoma Baylands

California clapper rail (endangered)

Salt marsh harvest mouse (endangered)

Save San Francisco Bay Association (1961)

How the Corps turned a political quagmire into a marsh

Politics, design, construction and monitoring of the Sonoma Baylands project

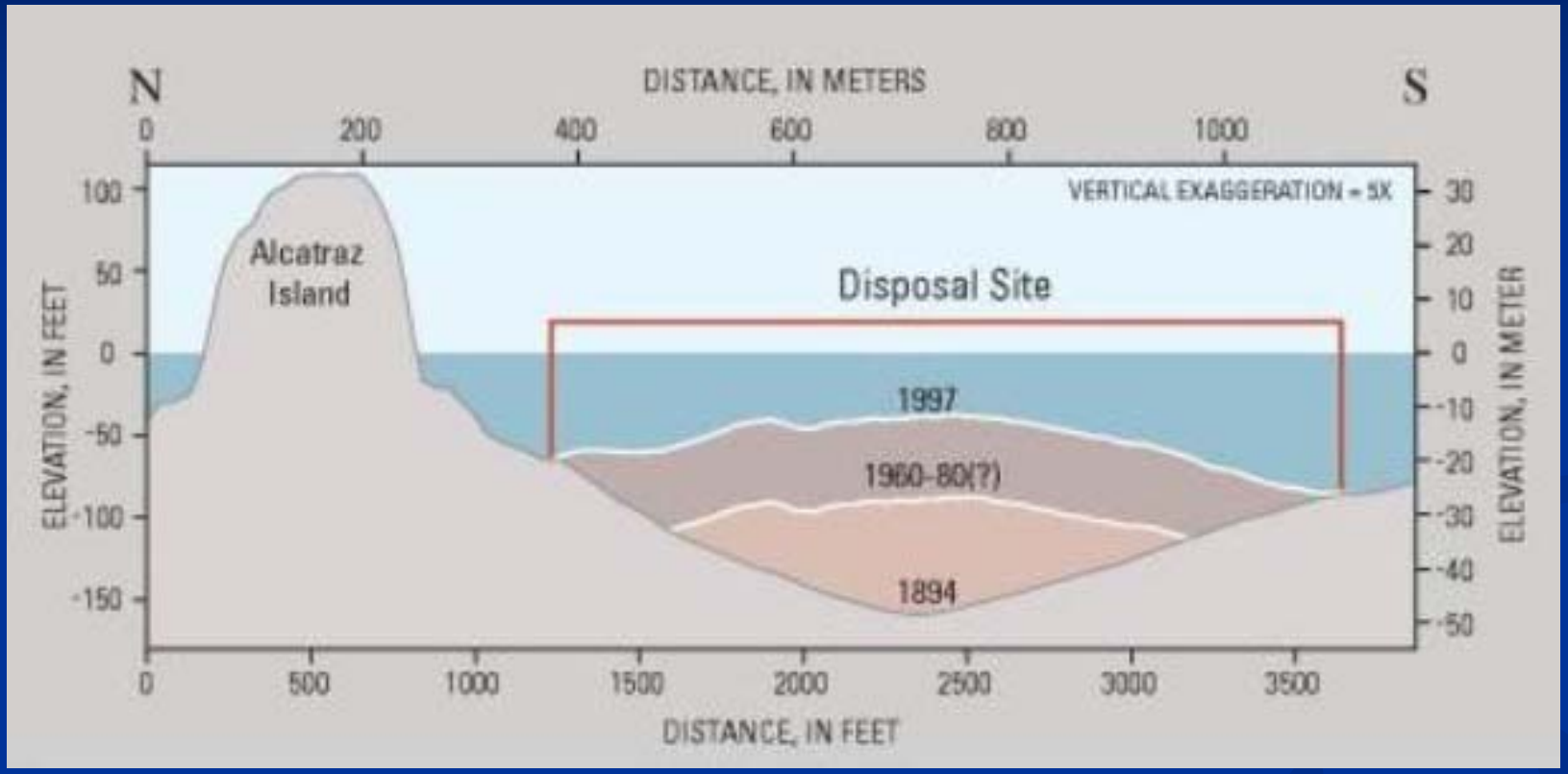
Sonoma Baylands

THE
SONOMA
BAYLANDS

A marriage made in mud

Sonoma Baylands Chronology

- 1980's – Increasing concerns about environmental and physical effects of open water disposal of dredged material in SF Bay

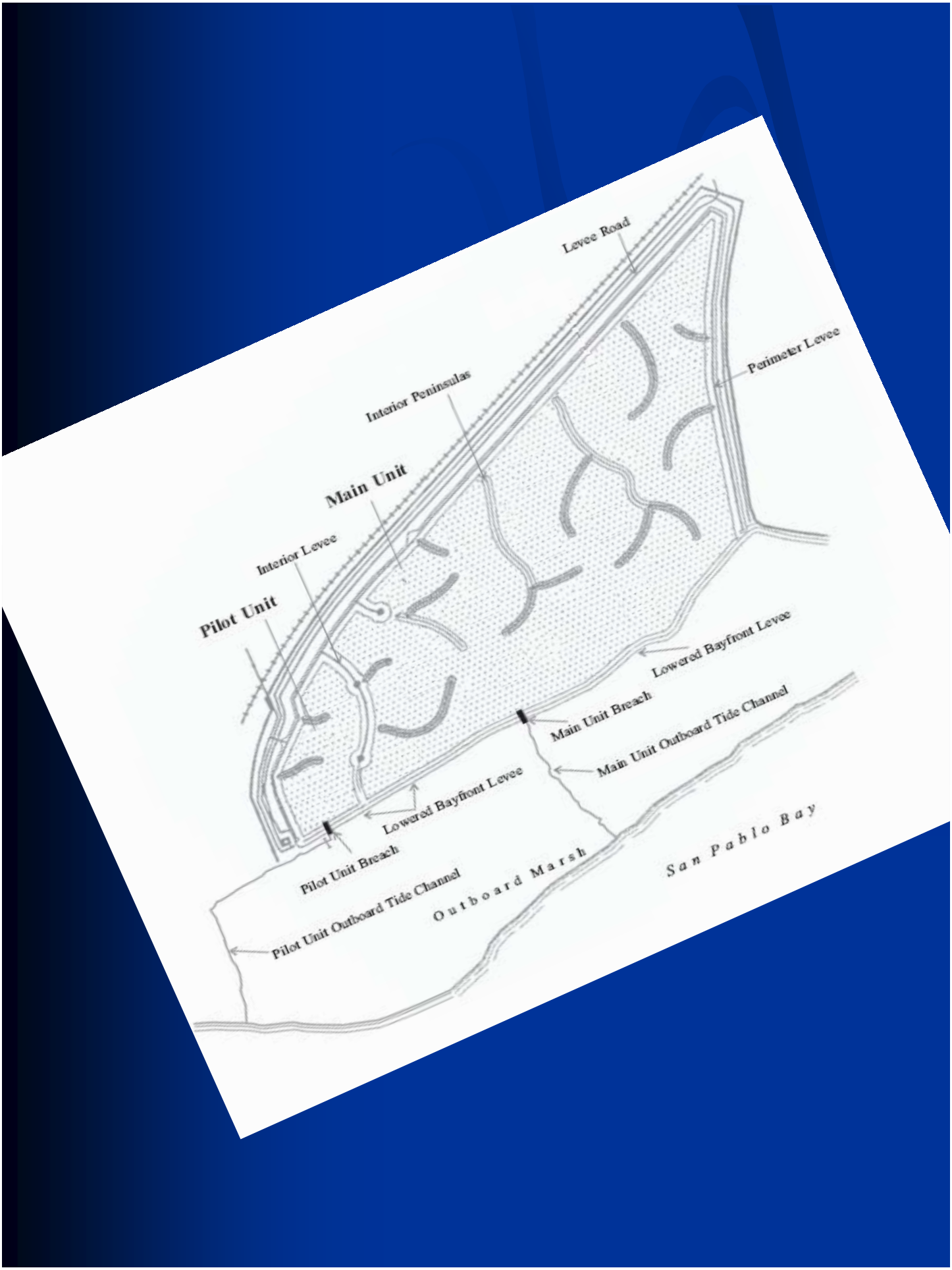

N
S
DISTANCE, IN METERS
0
200
400
600
800
1000
VERTICAL EXAGGERATION = 5X
Alcatraz Island
Disposal Site
1997
1960-80(?)
1894
ELEVATION, IN FEET
100
50
0
-50
-100
-150
ELEVATION, IN METER
30
20
10
0
-10
-20
-30
-40
-50
0
500
1000
1500
2000
2500
3000
3500
DISTANCE, IN FEET

Alcatraz Disposal Site Blockade (1989)

Sonoma Baylands Chronology

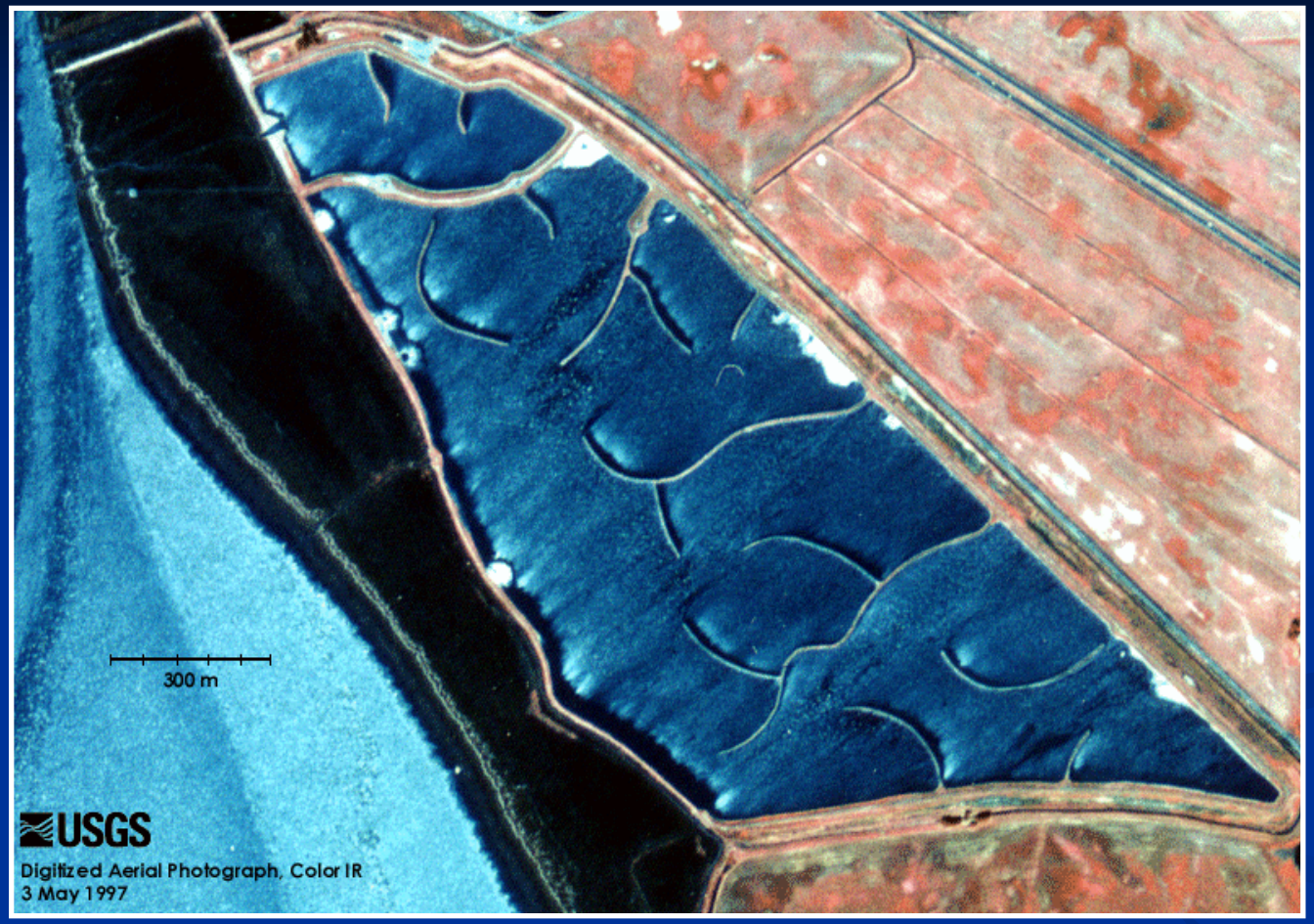
- 1980's – Increasing concerns about environmental and physical effects of open water disposal of dredged material in SF Bay
- circa 1990 – "Mudlock"
- 1991 – Sonoma Land Trust & California State Coastal Conservancy complete SB "Enhancement Plan"

  District initiates Sec 1135 pilot project under new Coastal America program
- 1992 – Congress directs Corps to construct SB (twice!)
- 1993 – District prepares Plan of Action for SB
- 1994 – District completes Oakland Harbor GDM/EIS and SB Demonstration Project Report/EA, initiates and completes SB site construction, and fills pilot unit with dredged material from Petaluma River


Levee Road
Perimeter Levee
Interior Peninsulas
Main Unit
Interior Levee
Pilot Unit
Lowered Bayfront Levee
Main Unit Breach
Main Unit Outboard Tide Channel
Lowered Bayfront Levee
Pilot Unit Breach
Pilot Unit Outboard Tide Channel
Outboard Marsh
San Pablo Bay

Sonoma Baylands

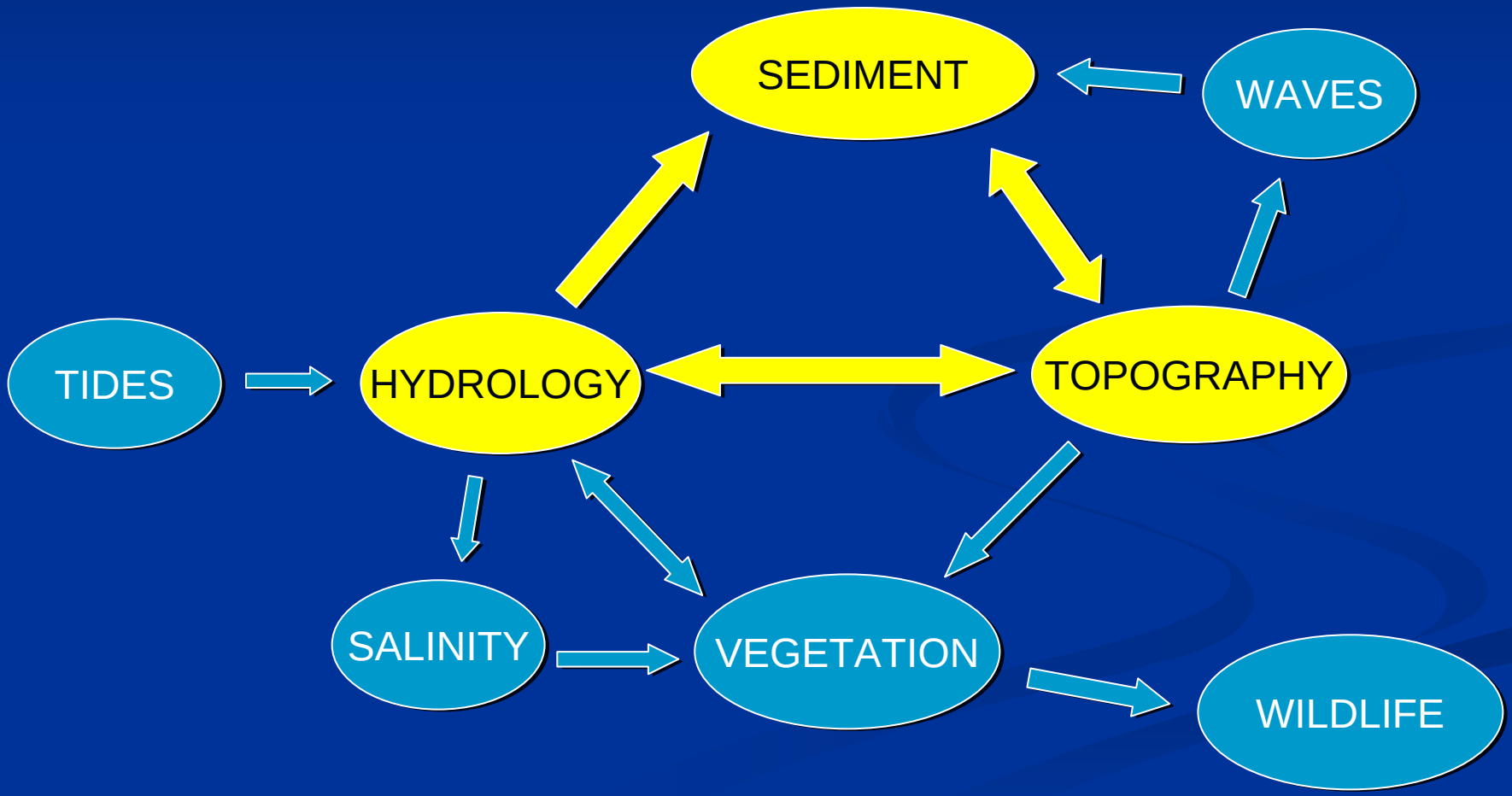
Sonoma Baylands



Sonoma Baylands

1996

Salt Marsh Equilibrium



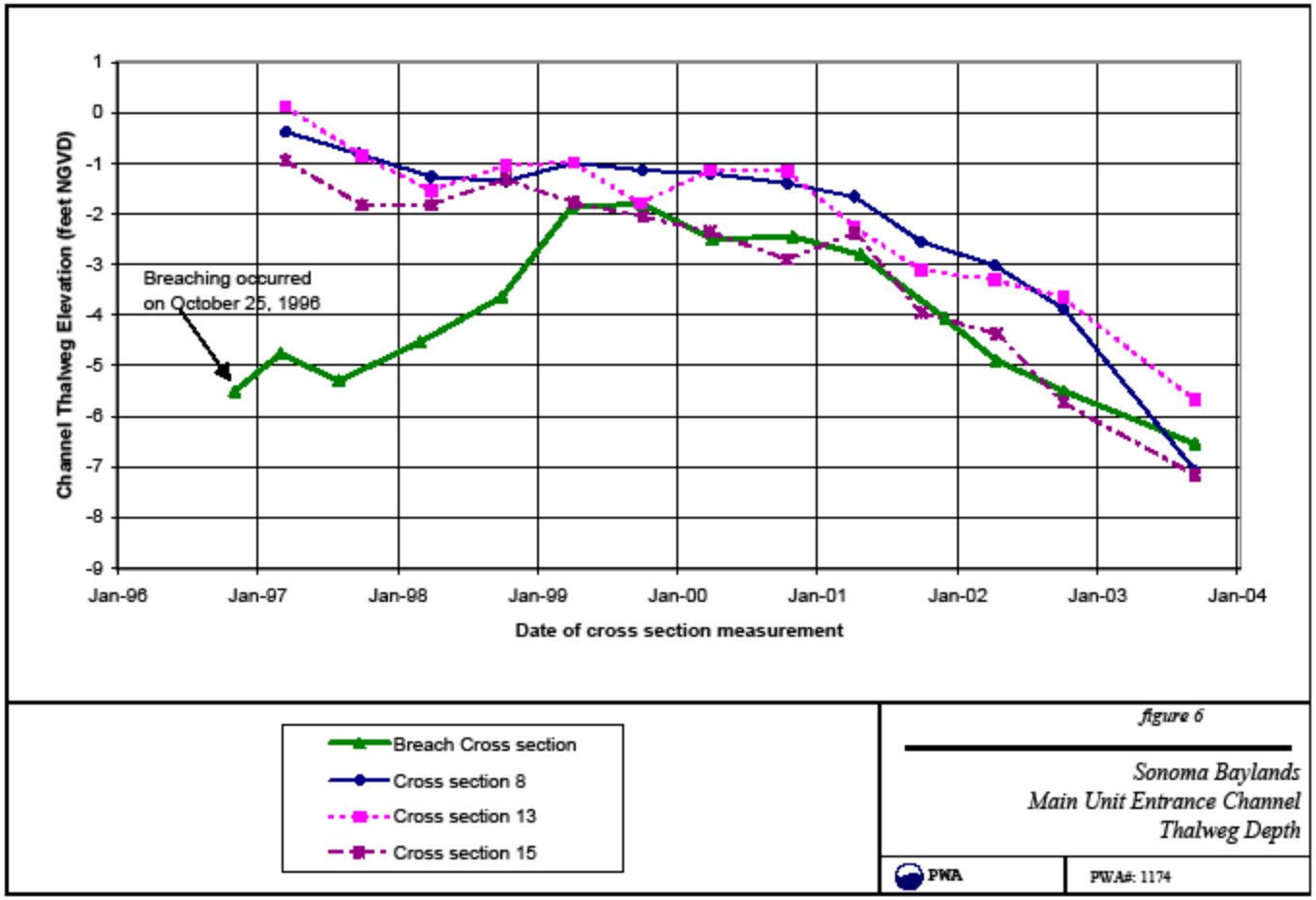


figure 6

Sonoma Baylands
Main Unit Entrance Channel
Thalweg Depth

PWA

PWA#: 1174

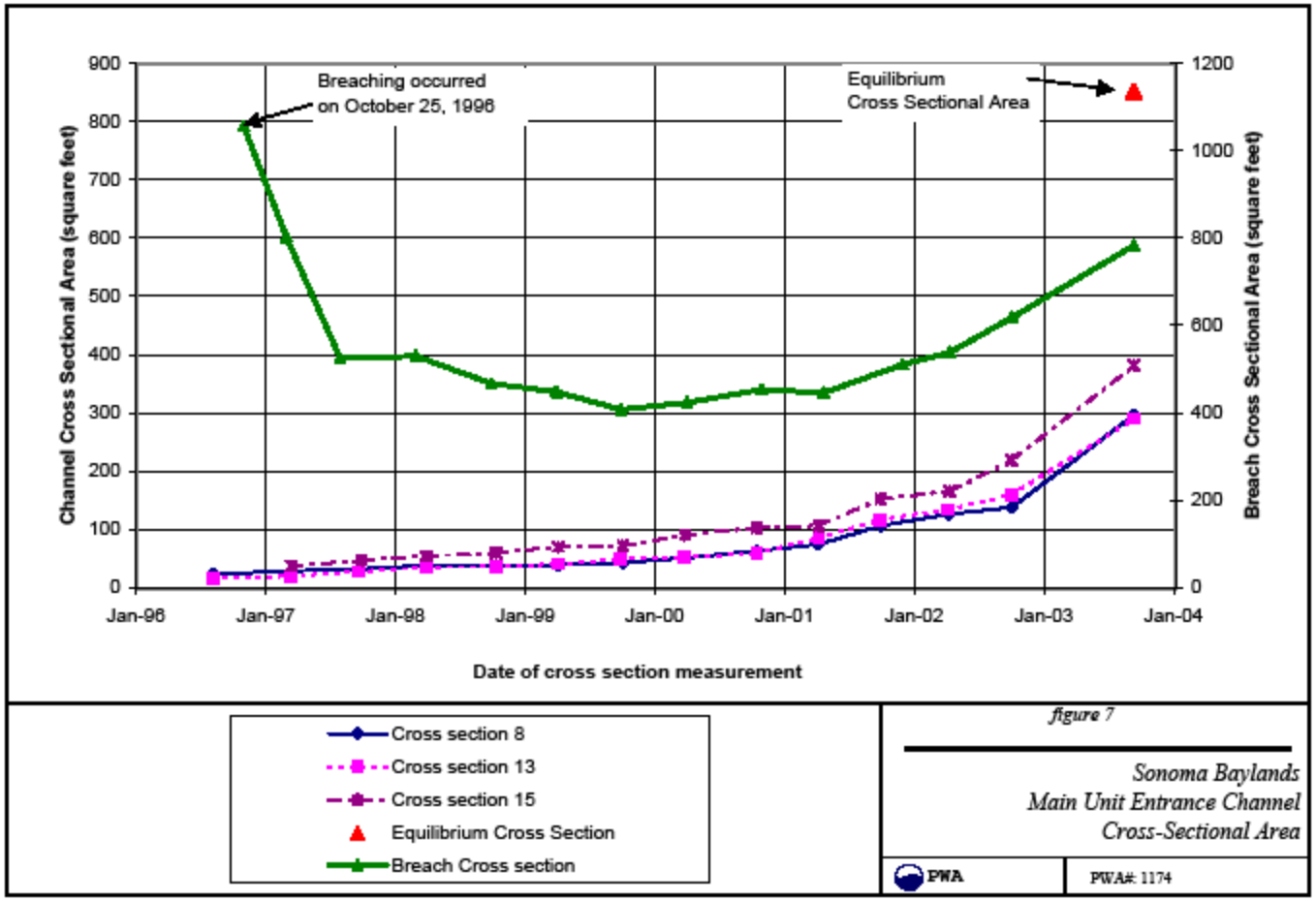


figure 7

Sonoma Baylands
Main Unit Entrance Channel
Cross-Sectional Area

PWA

PWA#: 1174

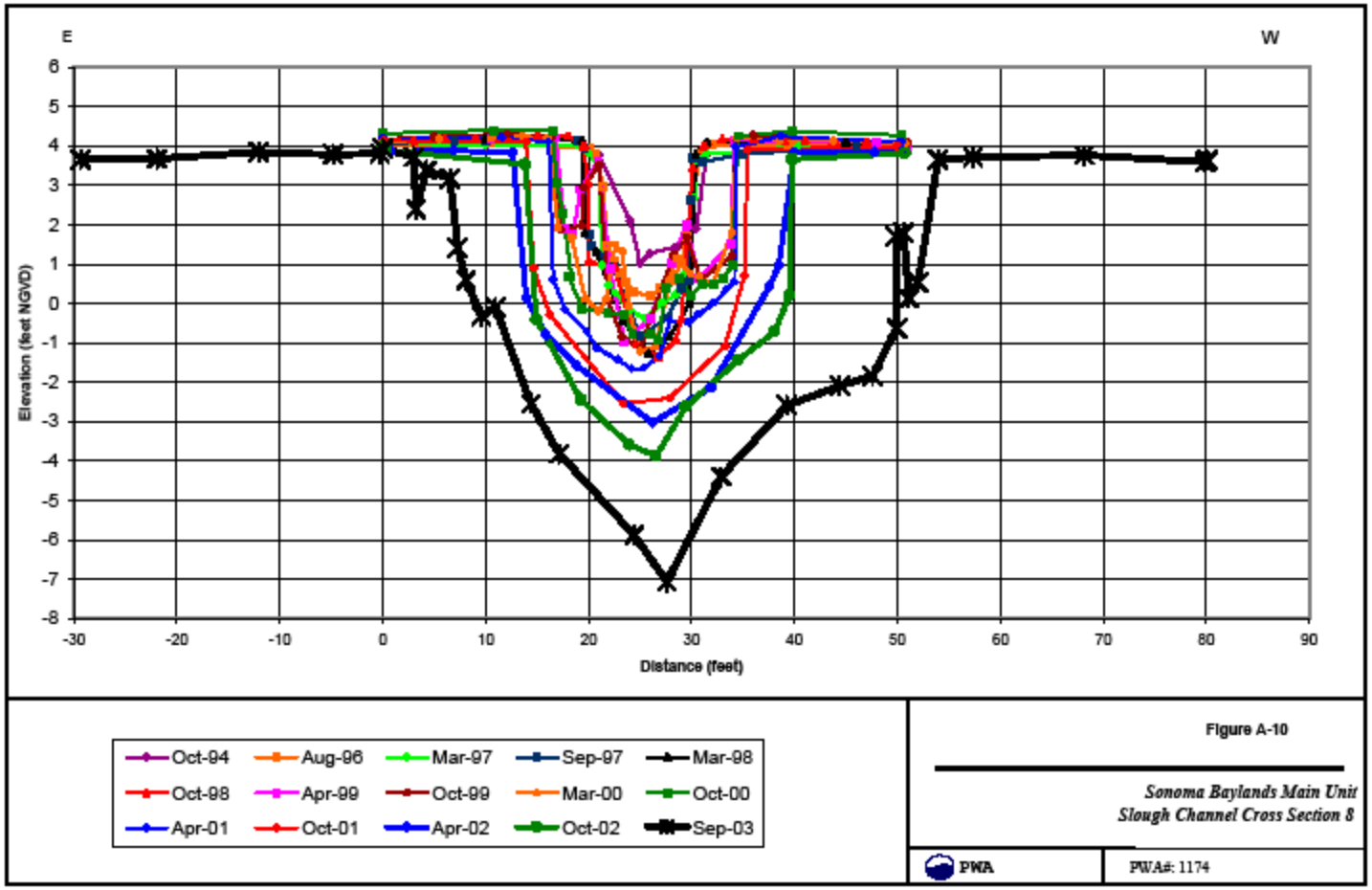


Figure A-10

Sonoma Baylands Main Unit
Slough Channel Cross Section 8

PWA

PWA#: 1174

Sonoma Baylands

Main Unit Outer Channel

1994

2003

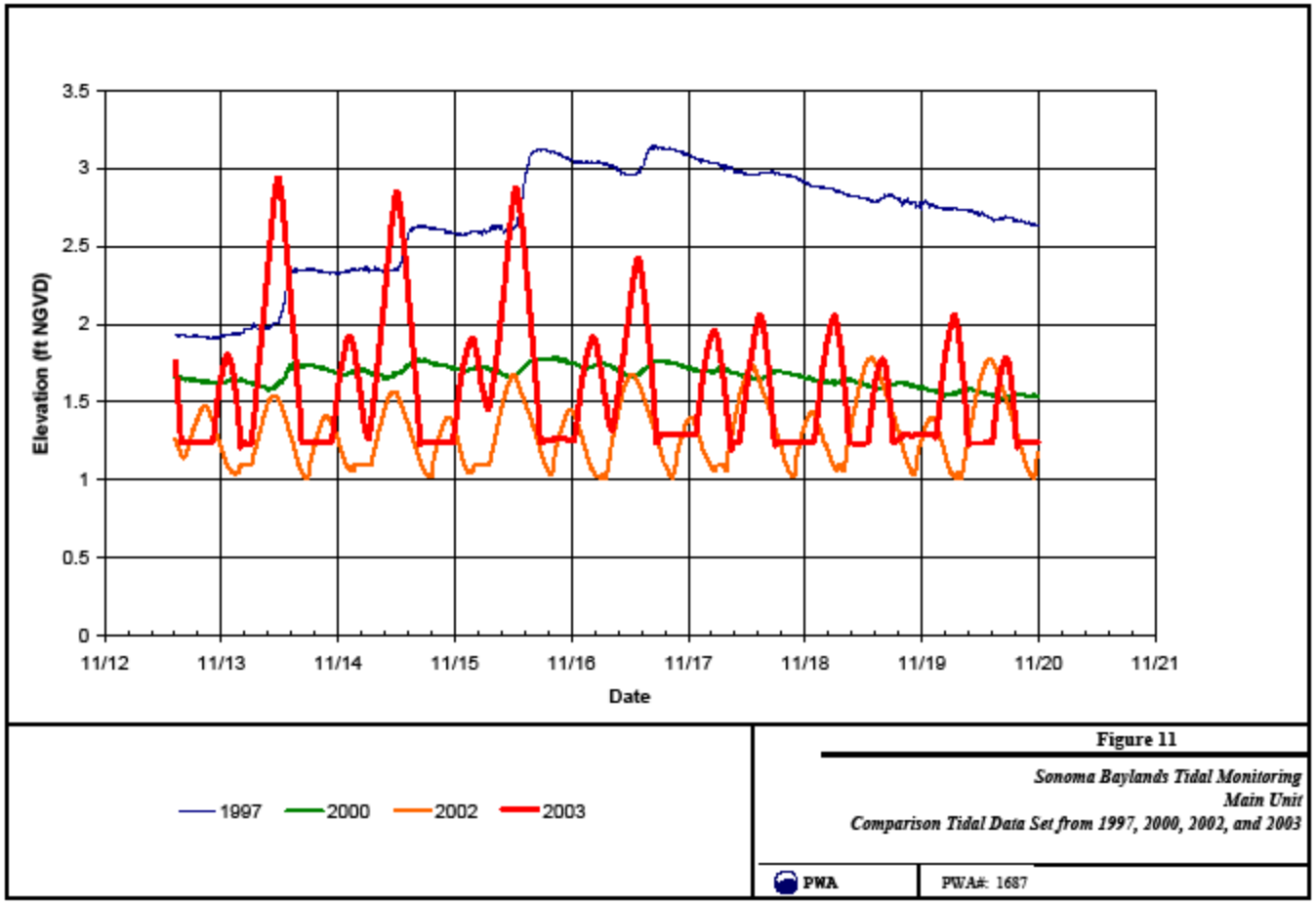


Figure 11

Sonoma Baylands Tidal Monitoring
Main Unit
Comparison Tidal Data Set from 1997, 2000, 2002, and 2003

PWA | PWA#: 1687

P:\Projects\son_bay_master\2004\Report\Figures

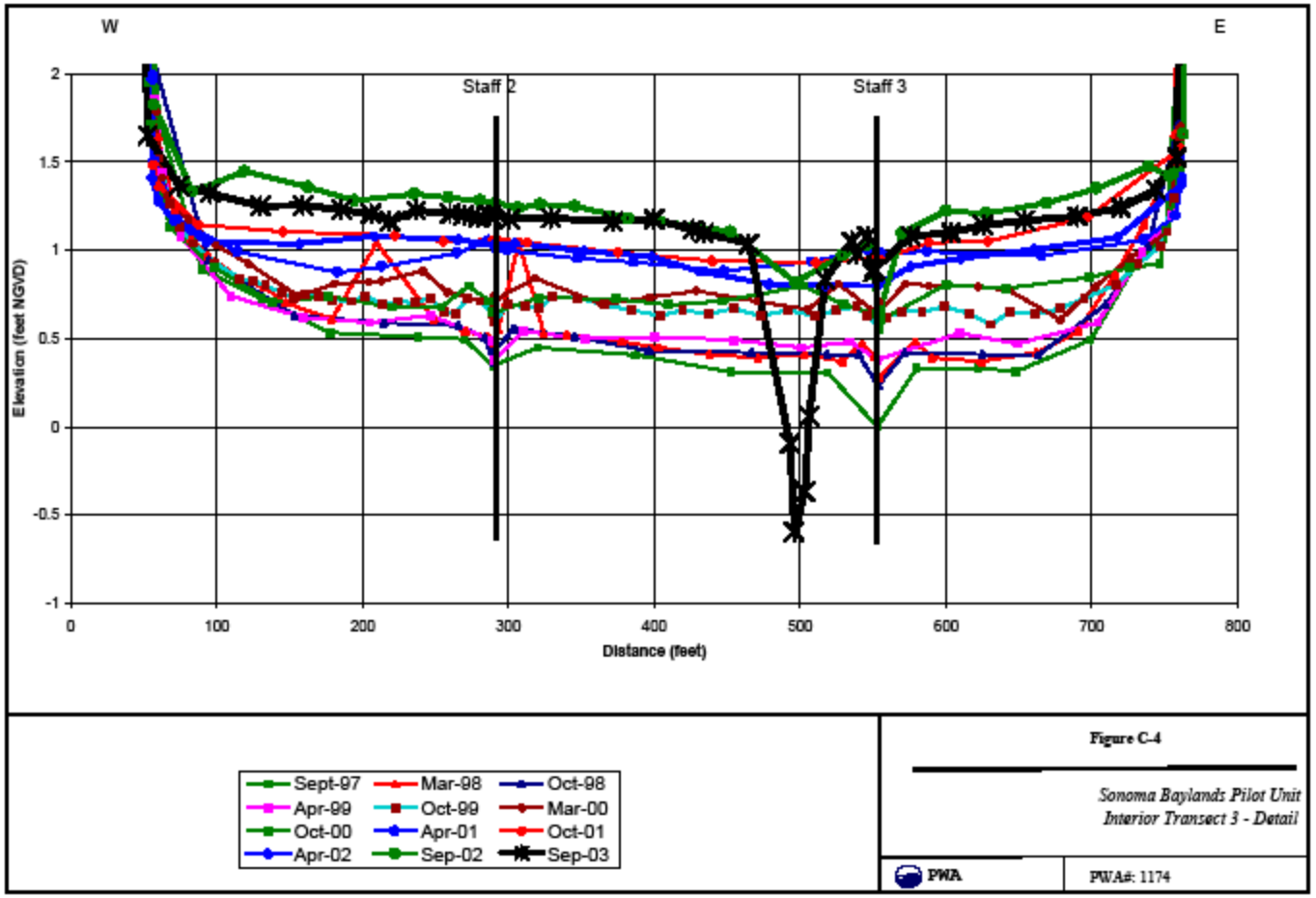


Figure C-4

Sonoma Baylands Pilot Unit
Interior Transect 3 - Detail

PWA

PWA#: 1174

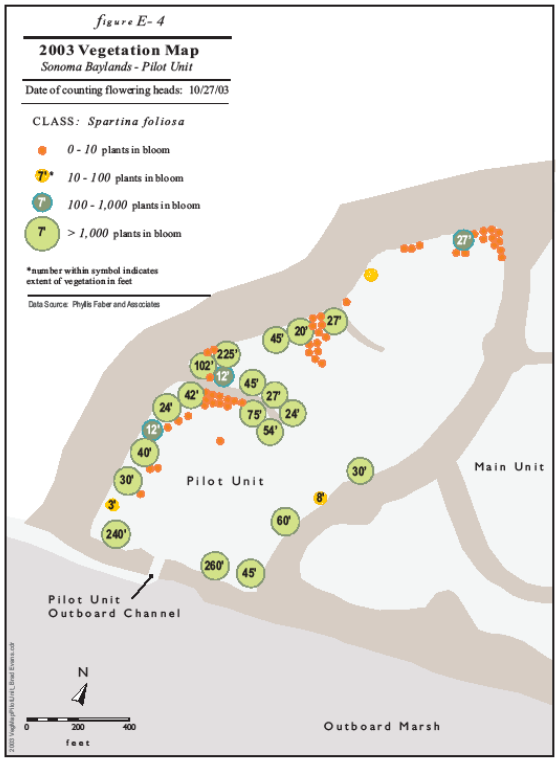
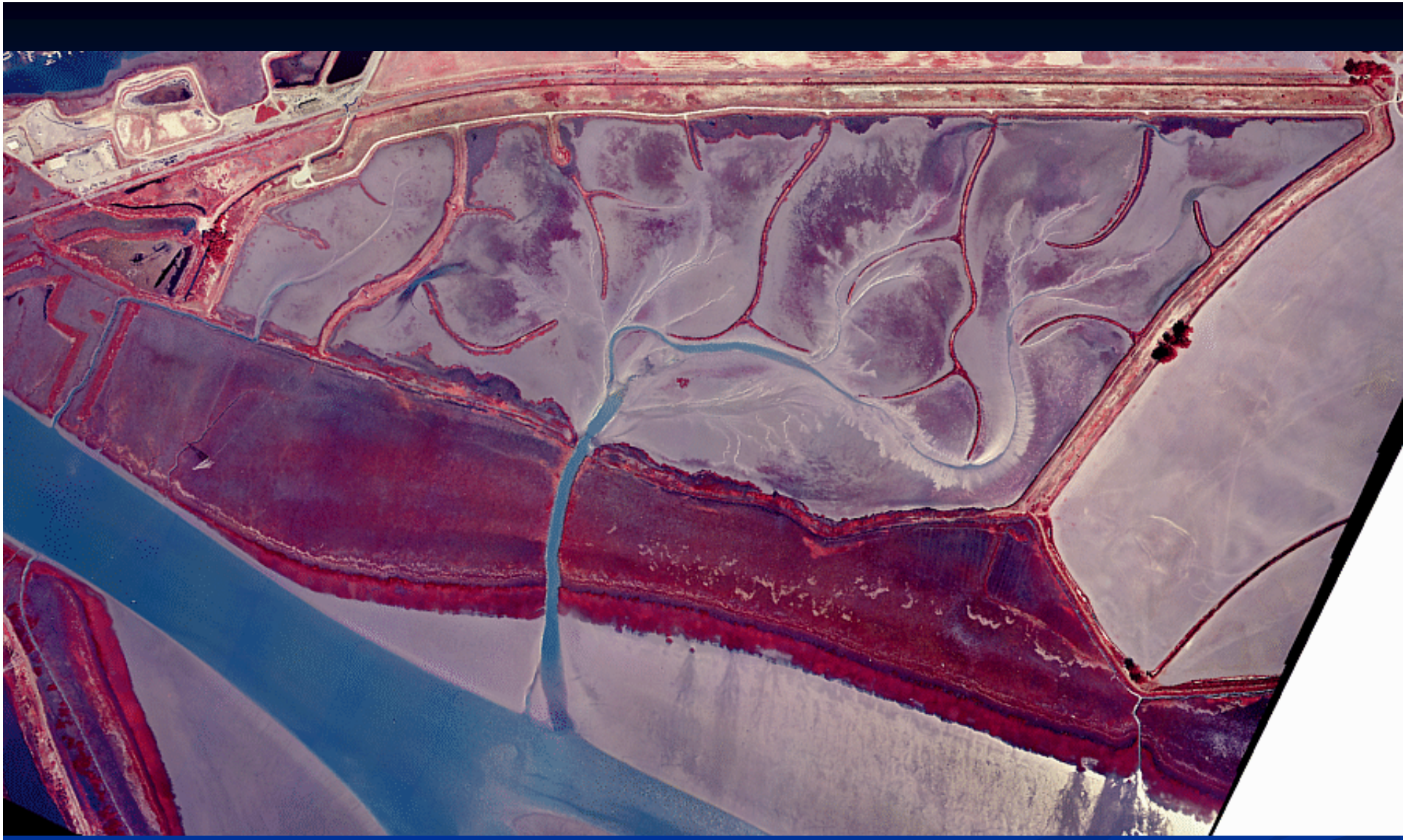
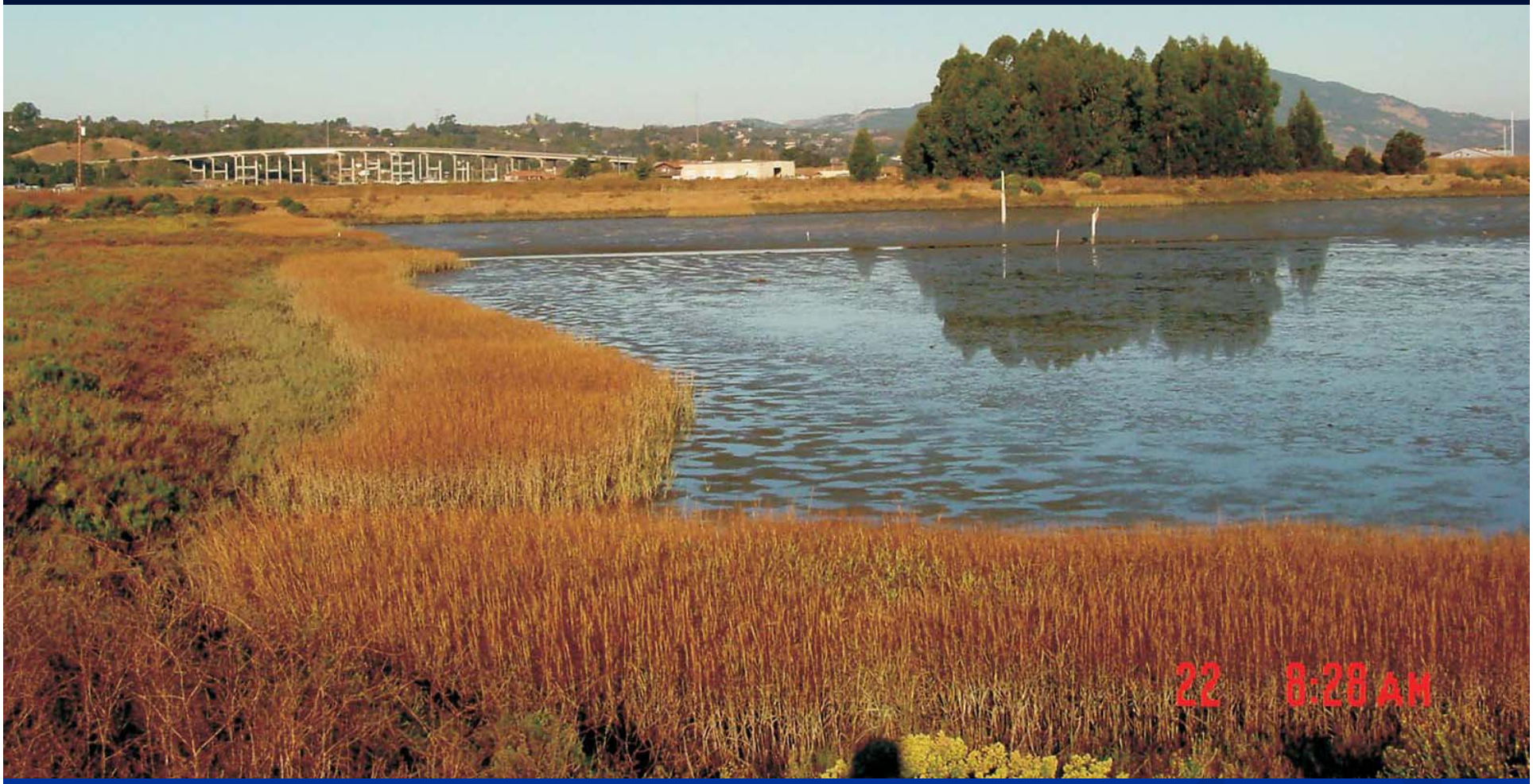


figure E-4
2003 Vegetation Map
Sonoma Baylands - Pilot Unit
Date of counting flowering heads: 10/27/03
CLASS: Spartina foliosa
0 - 10 plants in bloom
10 - 100 plants in bloom
100 - 1,000 plants in bloom
> 1,000 plants in bloom
*number within symbol indicates extent of vegetation in feet
Data Source: Phyllis Faber and Associates
Pilot Unit
Main Unit
Pilot Unit Outboard Channel
Outboard Marsh
N
0
200
400
feet


figure E-8
2003 Vegetation Map
Sonoma Baylands - Main Unit
Date of counting flowering heads: 10/27/03
CLASS: Spartina foliosa
0 - 10 plants in bloom
10 - 100 plants in bloom
100 - 1,000 plants in bloom
> 1,000 plants in bloom
*number within symbol indicates extent of vegetation in feet
Data Source: Phyllis Faber and Associates
Main Unit
Outboard Marsh
Main Unit Outboard Channel
San Pablo Bay
2003 VegMap Brad Evens.cdr
PWA
N
0
250
500
feet



Sonoma Baylands (2003)



Sonoma Baylands Pilot Unit (2003)

Sonoma Baylands Main Unit (2003)

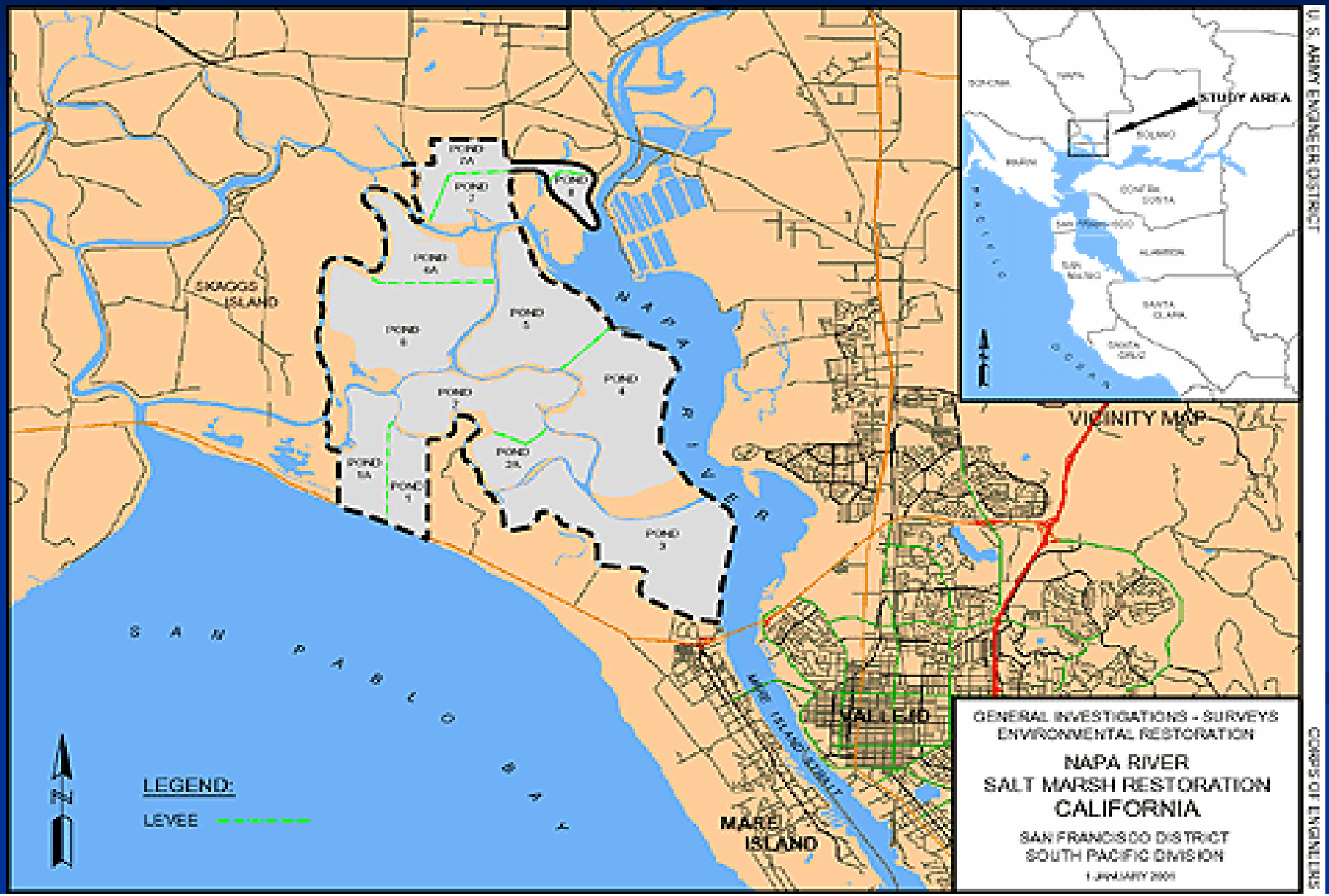
Sonoma Baylands Pilot Unit (2007)


Napa Marsh
Sonoma Baylands
Hamilton Airfield & Bel Marin Keys
South Bay Salt Pond Restoration Project
Sonoma
Napa
Solano
Contra Costa
Marin
San Francisco
Alameda
San Mateo
Santa Clara
N

How the Corps planned to make 4 billion lbs. of salt vanish

The Napa Salt Marsh Restoration planning process

Napa Salt Marsh Restoration



Napa Salt Ponds

Napa Marsh
Problems & Opportunities

Problems

- **Loss of Wetlands and Development in Wetlands**
- **Potential for Future High-Salinity Release**

Opportunities

- **Ecosystem Restoration and Incidental Economic Benefits**
- **Deepening of Mare Island Ship Channel**
- **Beneficial Use of Recycled Water**
- **Recreation**

Napa Marsh Objectives

- To create a mix of tidal habitat and managed pond habitat to serve a broad range of wildlife, including endangered and threatened species, fish and other aquatic species, and migratory shorebirds and waterfowl.
- To restore large areas of tidal habitats in a band along the Napa River to maximize benefits to fish and other aquatic animals, and ensure connections between the patches of tidal marsh (within the project site and with adjacent sites) to enable the movement of small mammals, marsh-dependent birds, and fish and aquatic species.
- To improve the ability to manage water depths and salinity levels in the managed ponds to maximize feeding and resting habitat for migratory and resident waterfowl and shorebirds.

Napa Marsh Planning Constraints

Regulatory and Policy Constraints

- Ecosystem restoration must be consistent with Corps' policy as established under EC 1105-2-210, Ecosystem Restoration in the Civil Works Program.
- Implementation of ecosystem restoration must not adversely affect operation of the existing Napa River navigation channel.
- Implementation of ecosystem restoration must not have a significant adverse impact on the water quality of the Napa River or San Pablo Bay.

Biological Constraints

- Implementation of ecosystem restoration must minimize impacts to the existing habitat and sensitive species in the area.

Utilities

- Potential erosion of electrical transmission tower footings would have to be addressed as part of the project design.

Napa Marsh
Planning Considerations

- Regional Habitat Goals
- Physical and Hydrological Considerations
- Chemical Considerations
- Pond Access by Construction Equipment
- Nearby Projects
- Other Design Considerations

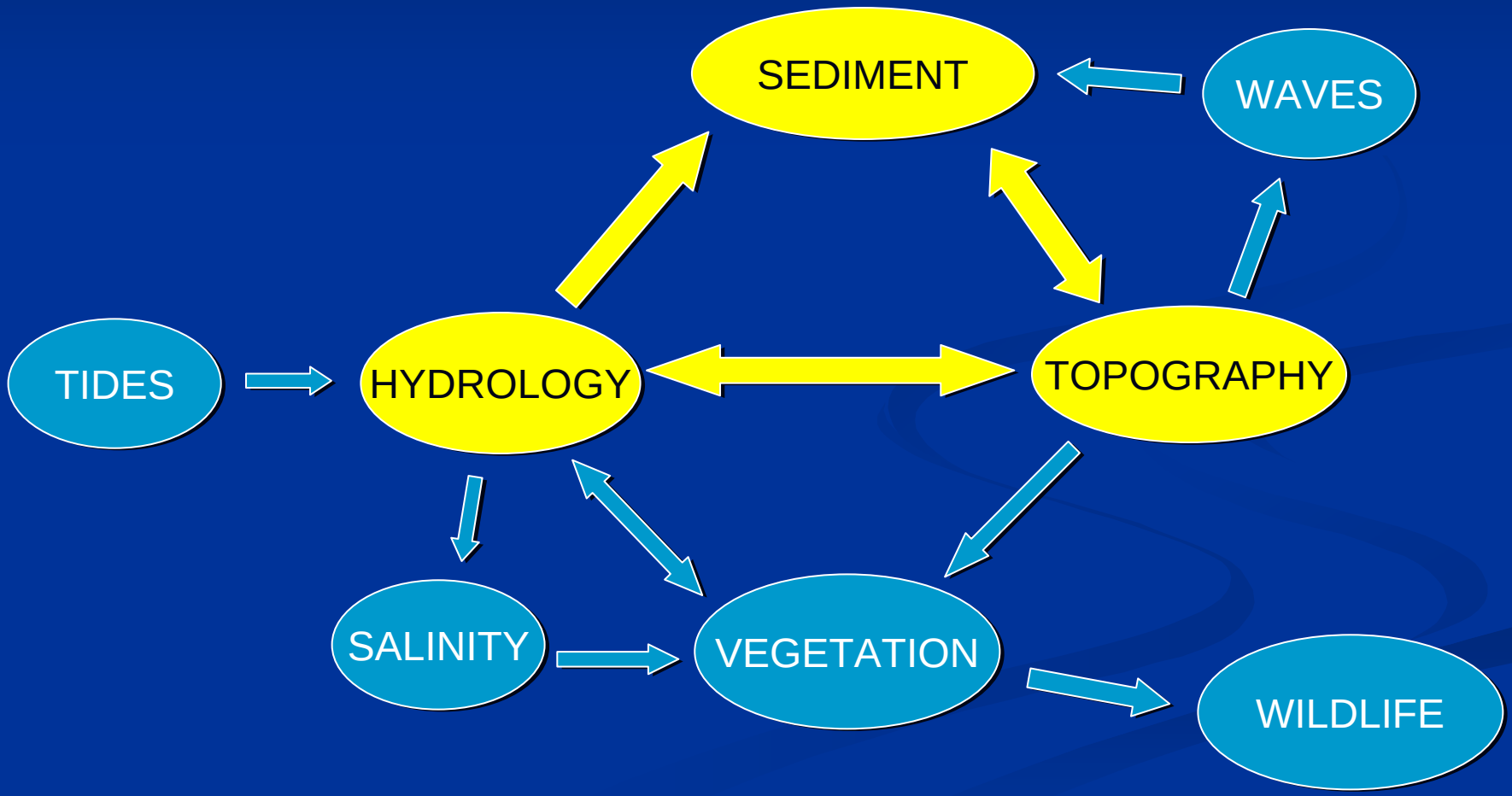
Napa Marsh Measures

- Levee reinforcement/repairs (All Ponds)
- Salinity reduction (Ponds 3-6A)
  - Levee breaches
  - Water control structures
  - Natural flood events
- Salinity reduction (Ponds 7-8)
  - Dilute with slough water
  - Recycled water pipeline
  - Water control structures/fish screens
- Addition of Lime (Pond 8)

Napa Marsh Measures

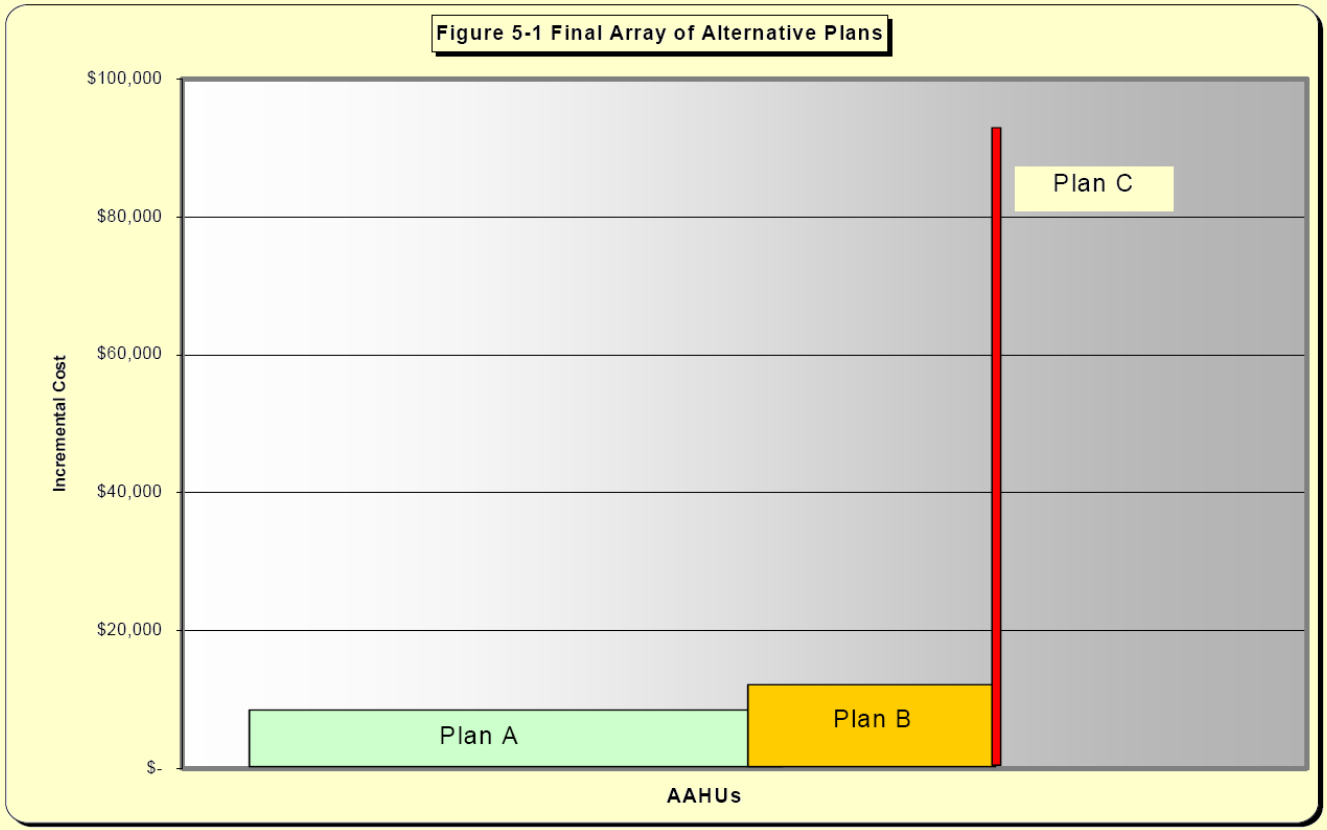
- Managed ponds
  - Water control structures
- Restore tidal action
  - Levee breaches (excavation/explosives)
  - Starter channels
  - Berms
  - Ditch blocks
  - Lower levees
- Fill 100 acres for mid-elevation marsh
- Recreation (access + fishing platforms)

Salt Marsh Equilibrium



Napa Marsh
Final Array of Alternatives

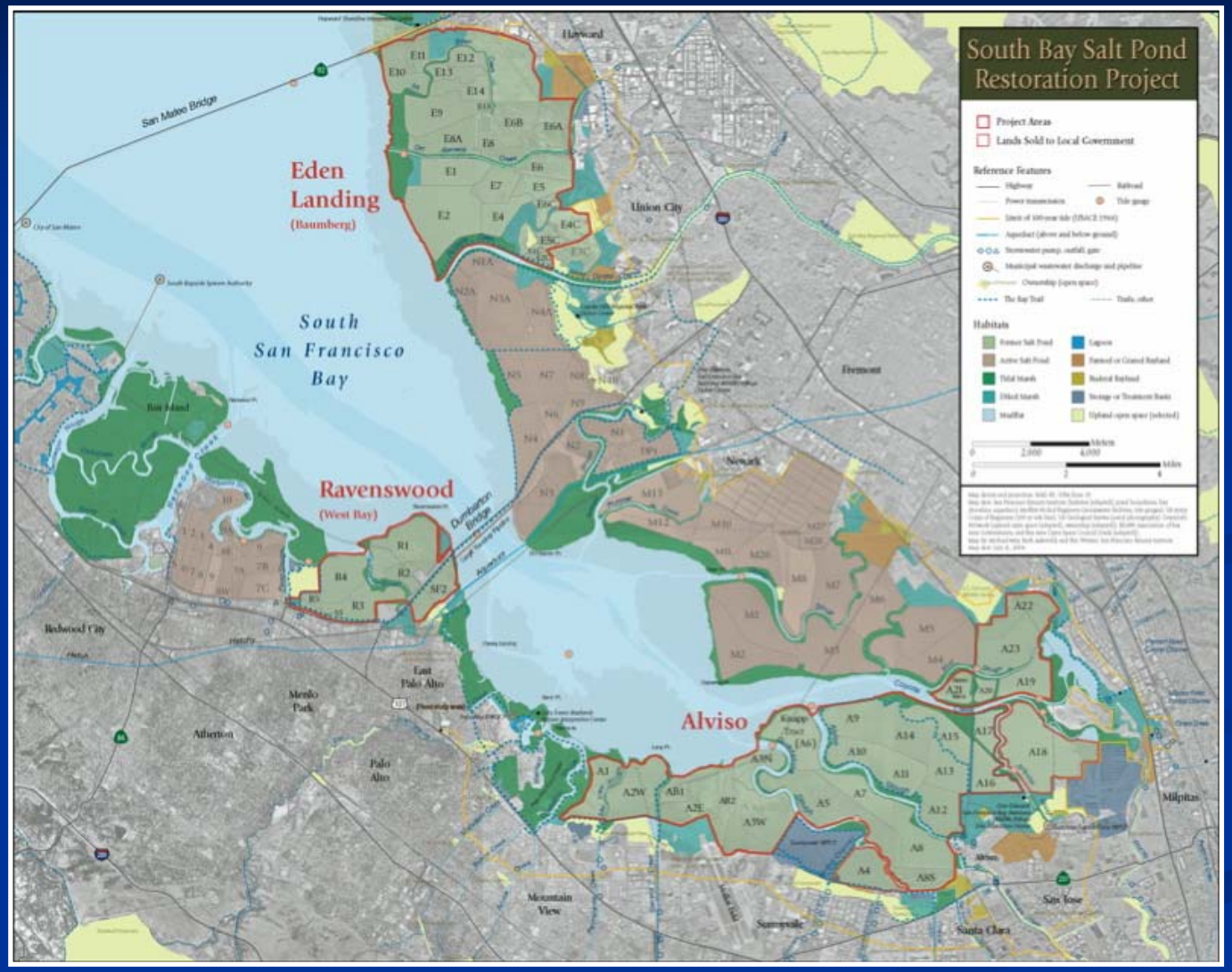
- No Action
- Plan A: Tidal Marsh – Ponds 4/5
  Managed Ponds – Ponds 6/6A
- Plan B: Plan A +
  Managed Ponds – 7/7A/8 (Neighboring Waters)
- Plan C: Plan A +
  Managed Ponds – 7/7A/8 (Recycled Water Pipeline)



Plan	Average Annual Cost $	Incremental Cost $	Output (AAHU)	Incremental Output (AAHU)	Incremental Cost Per Unit ($/AAHU)
No Action	$0	$0	0	0	0
PLAN A: [Ponds 4, 5, 6, 6A]	$1,863,843	$1,863,843	1403	1403	$1,328
PLAN B: [Ponds 4, 5, 6, 6A] and [Ponds 7, 7A, 8 -- Neighboring Waters]	$3,887,122	$2,023,279	2000.2	597.2	$3,388
PLAN C: [Ponds 4, 5, 6, 6A] and [Ponds 7, 7A, 8 -- Recycled Water Pipeline]	$4,672,881	$785,759	2008.1	7.9	$99,463


Napa Marsh
Sonoma Baylands
Hamilton Airfield & Bel Marin Keys
South Bay Salt Pond Restoration Project
Sonoma
Napa
Solano
Contra Costa
Marin
San Francisco
Alameda
San Mateo
Santa Clara
N

South San Francisco Bay Shoreline Study



Discussion