# FLOOD CONTROL 2.0 REGIONAL FORUM

## Novato Creek Flood Protection Project

## November 13, 2013 • 8:30 am - 4:30 pm

# Agenda

| | | |
|---|---|---|
| **Welcome** | **8:30** | Tracy Clay (Marin County) |
| **Introductions/Overview of Meeting Goals**<br>• *To help advance conceptual design of the Novato Flood Control Project as a multi-benefit project providing flood protection, sediment transport, habitat restoration, and sea level rise resilience to lower Novato Creek and the adjacent baylands.* | **8:35** | Meredith Williams (SFEI) |
| **Flood Control 2.0 Project and Concepts**<br>• *Overview of project goals and concepts, and the role of this forum in linking regional and local expertise.* | **8:40** | Caitlin Sweeney (SFEP) and<br>Robin Grossinger (SFEI) |
| **Novato Creek Baylands Historical Landscape**<br>• *Provide background information on historical ecological and hydrological characteristics.* | **9:00** | Micha Salomon (SFEI) |
| **Change Analysis**<br>• *Describe landscape change since 1850, using spatial metrics representing important ecological functions.* | **9:20** | Robin Grossinger (SFEI) |
| **Geomorphic Conceptual Model**<br>• *Present initial conceptual model of drivers controlling local landscape form and function.* | **9:40** | Scott Dusterhoff (SFEI) |

# Agenda

| | | |
|---|---|---|
| **Break** | **10:00** | |
| **Novato Flood Control Project**<br>• *Provide summary of goals, constraints, status, design concepts* | **10:15** | Roger Leventhal (Marin County) |
| **Discussion**<br>• *Priority project questions (separate handout)* | **11:15** | All; Meredith Williams, facilitator |
| **Lunch** | **12:00** | |
| **Discussion**<br>• *Continue discussion with design team* | **12:30** | All; Meredith Williams, facilitator |
| **Field Trip**<br>• *Visit two potential areas for project implementation* | **3:00** | Roger Leventhal |
| **Adjourn** | **4:30** | |

# Regional Science Advisory Team Members

- Peter Baye, coastal ecologist, botanist
- Letitia Grenier, wildlife ecologist, conservation biologist
- Jeff Haltiner, ESA-PWA, engineer
- Robert Leidy, EPA, fisheries and stream ecologist (not present)
- Jeremy Lowe, ESA-PWA, coastal geomorphologist

# Flood Control 2.0:

## Rebuilding Habitat and Shoreline Resilience through a New Generation of Flood Control Channel Design and Management

United States Environmental Protection Agency
San Francisco Estuary Partnership
SFEI
bcdc
San Francisco Bay Joint Venture
County of Marin
Contra Costa County Public Works Department
San Francisquito Creek Joint Powers Authority

# Flood Control “2.0”

- Sea Level Rise – Meeting Increasing Challenges for Flood Protection

- Sediment – Moving from Problems to Solutions

- Aging Infrastructure – Taking Advantage of Window of Opportunity

**Increase Resilience**
**Support Multiple Benefits**

# Project Partners

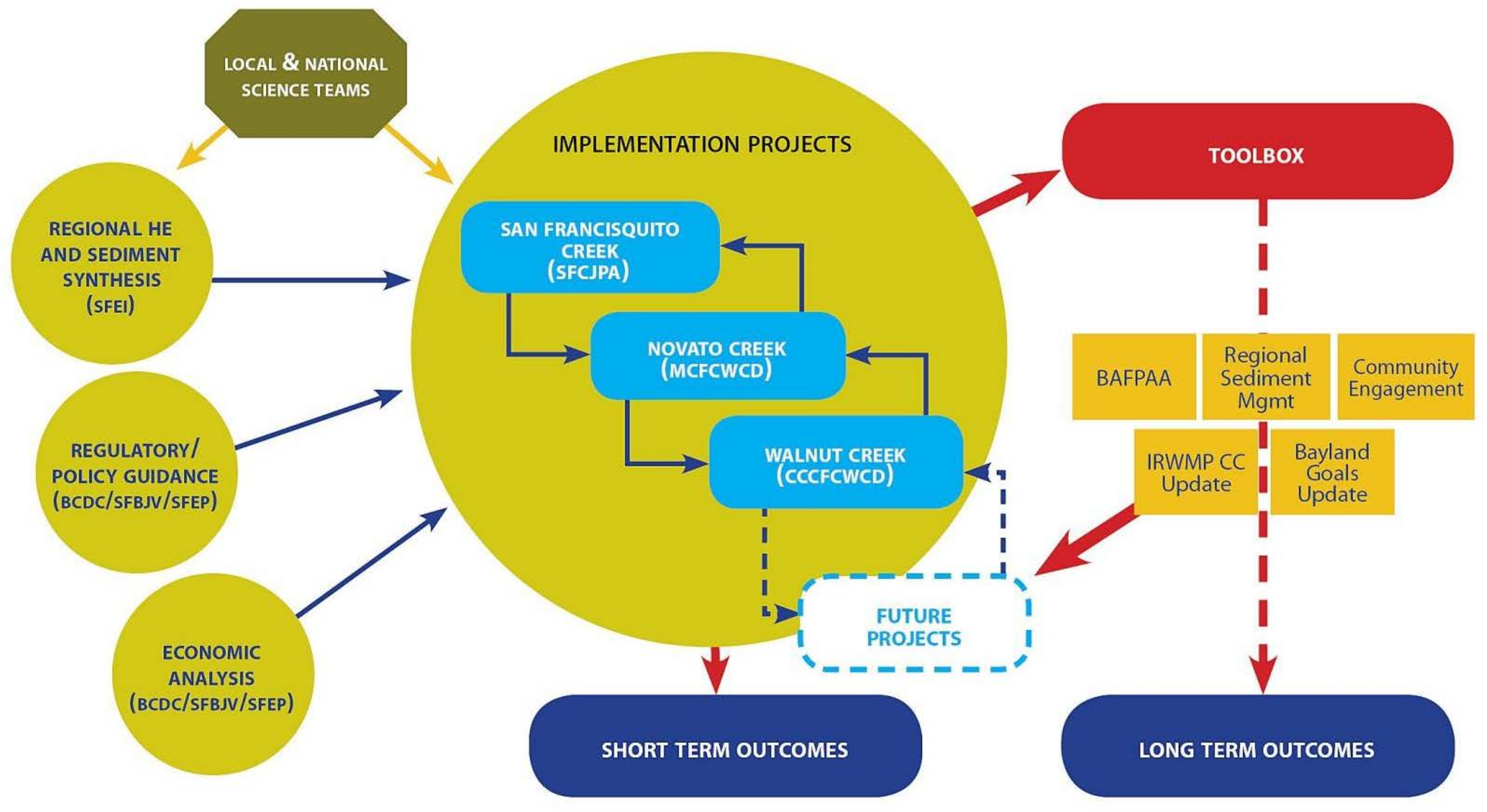
- Funder - EPA SF Bay Water Quality Improvement Fund
- Project Team:
  - SFEP (grant recipient, project manager)
  - SFEI
  - BCDC
  - SFBJV
  - SFCJPA
  - MCFCWCD
  - CCCFCWCD
- Regional Partner – BAFPAA
- Project Oversight – Regional and National Science Forums
- Regulatory Partners – RWQCB, USACE, NMFS, CDFW, Etc.

# Project Components

- Conceptual Models
  - Regional Historical Ecology Synthesis
  - Regional Coarse Sediment Supply Synthesis
- Regulatory and Economic Guidance
- Implementation Projects
- Public Outreach and Education
- Regional Implementation Toolbox

# Project Overview

- 4 year project, $3 million (½ grant, ½ match)



# Regional Science Advisory Team

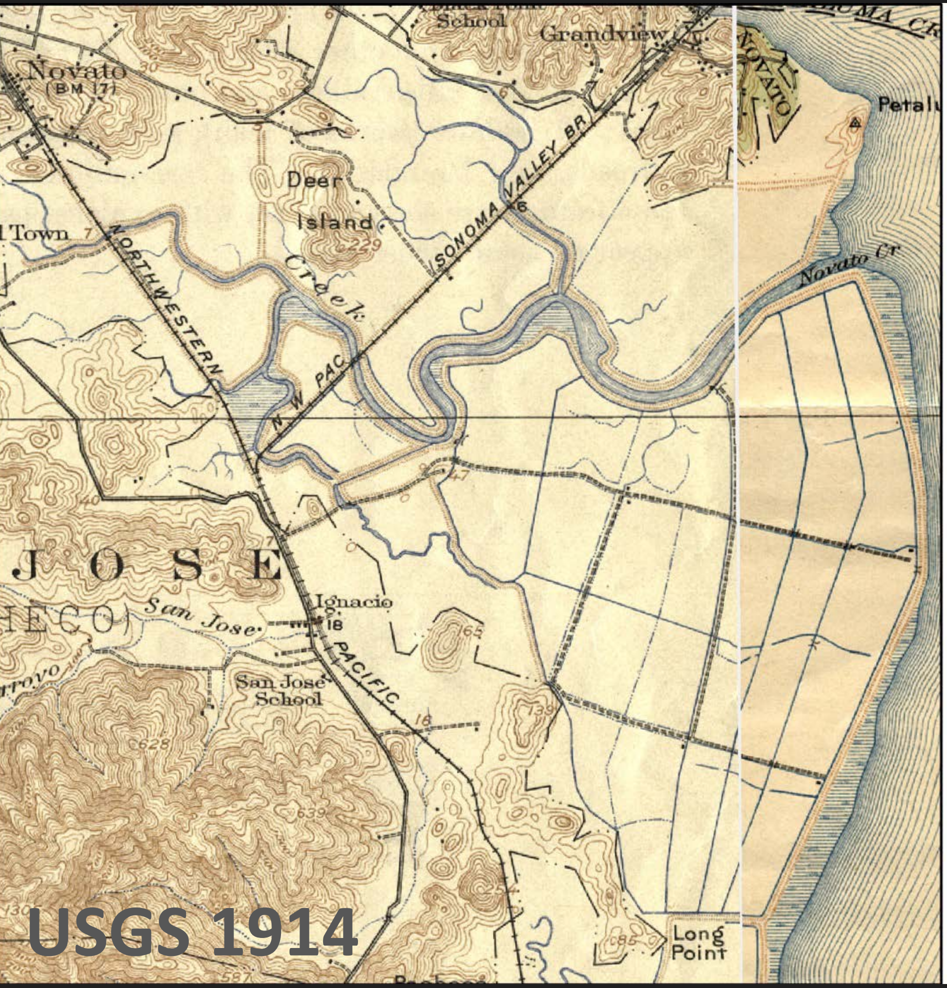
- sponsored by SFBJV Design Review Program and FC2.0, coordinated by SFEI
- multidisciplinary background
- provide expert advice/review to help achieve resilient, multi-benefit, landscape-scale restoration projects
- synthesize existing knowledge and experience to identify opportunities and constraints
- not expected to develop project restoration/engineering designs
- work collaboratively with project proponents to shape broadly-supported, landscape-scale conceptual designs
- Potential team products: conceptual landscape designs/visions, ecological or geomorphic targets, narrative principles, and/or recommended research priorities.

# Workshop Goal

***To help advance conceptual design of the Novato Flood Control Project as a multi-benefit project providing flood protection, sediment transport, habitat restoration, and sea level rise resilience to lower Novato Creek and the adjacent baylands.***

- Not a goal of perfection – not necessarily a perfect option out there
- Learning how to do this together – exploring what's possible, identifying opportunities and challenges, both short-term and long-term
- Trying to actually do multi-benefit planning: not flood control versus ecosystem--all on the same team here
- Learning from the region and drawing regional resources to local challenges
- Will likely be a complex and challenging process – but expect benefits from more integrated and inclusive process
  -- local and regional support
  -- funding avenues
  -- permitting process

# Circa 1900 Design Principle:
## *Minimize tidal and fluvial hydrologic footprint to maximize dry land.*




→ Now recognize limitations and unintended consequences.

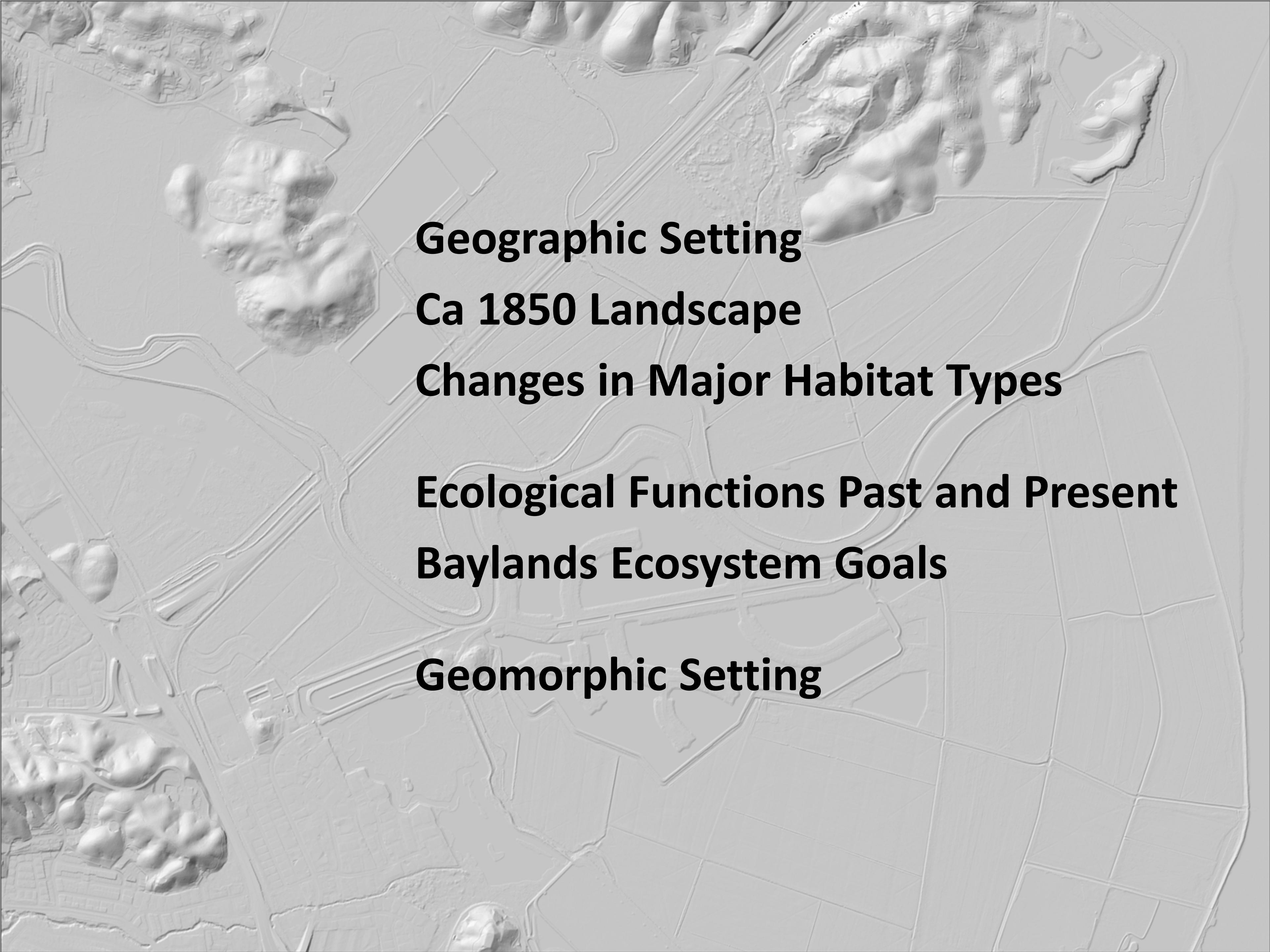
→ And changing drivers: subsidence, climate change, environmental values, economics.

**Potential new design principles?**

*Maximize tidal prism for sediment transport to the Bay*

*Support marsh-building processes to maintain wave energy buffers*

*Create larger, well-connected populations of native species to support ecosystem functions and reduce regulatory conflicts.*



Geographic Setting

Ca 1850 Landscape

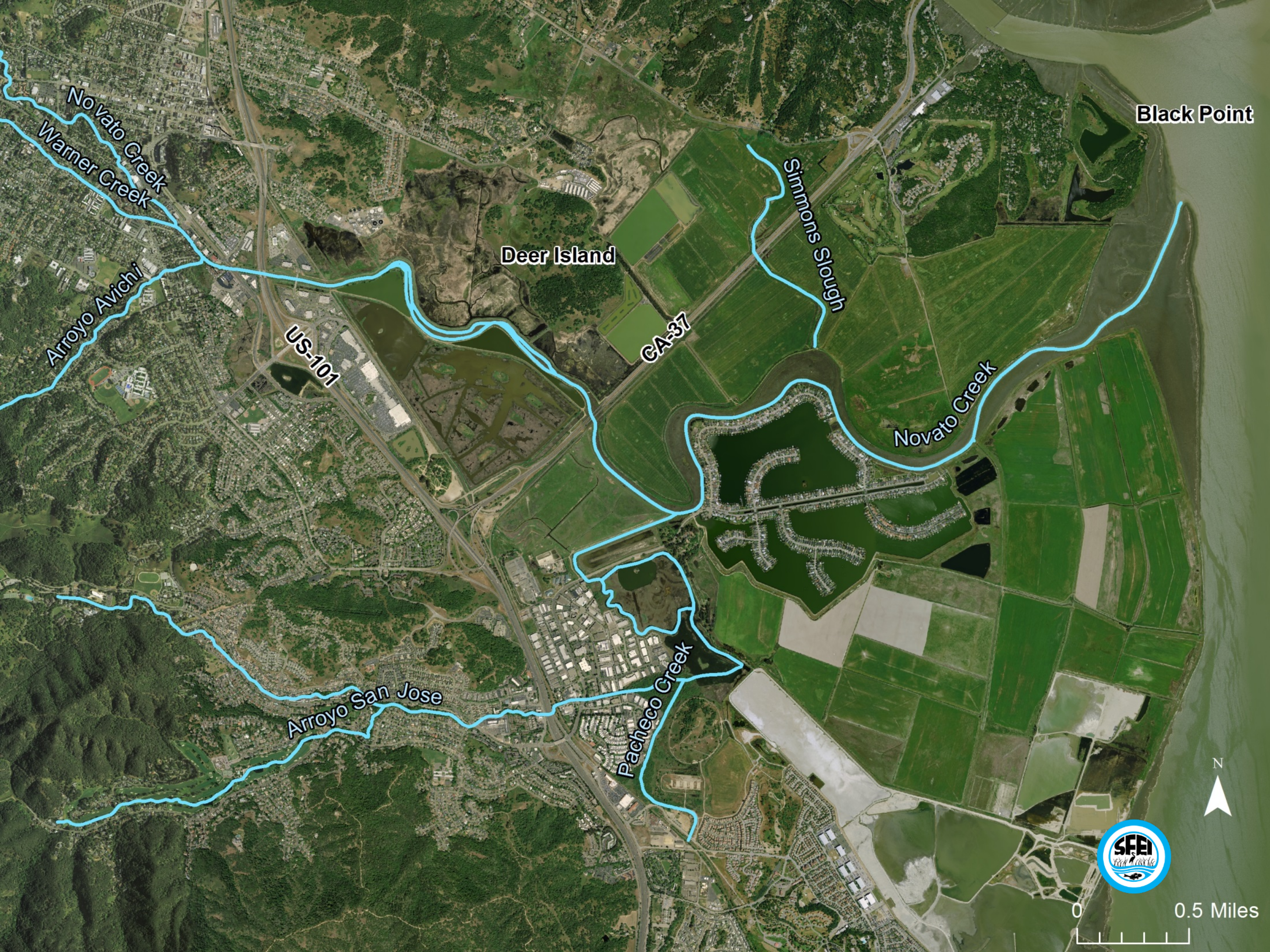
Changes in Major Habitat Types

Ecological Functions Past and Present

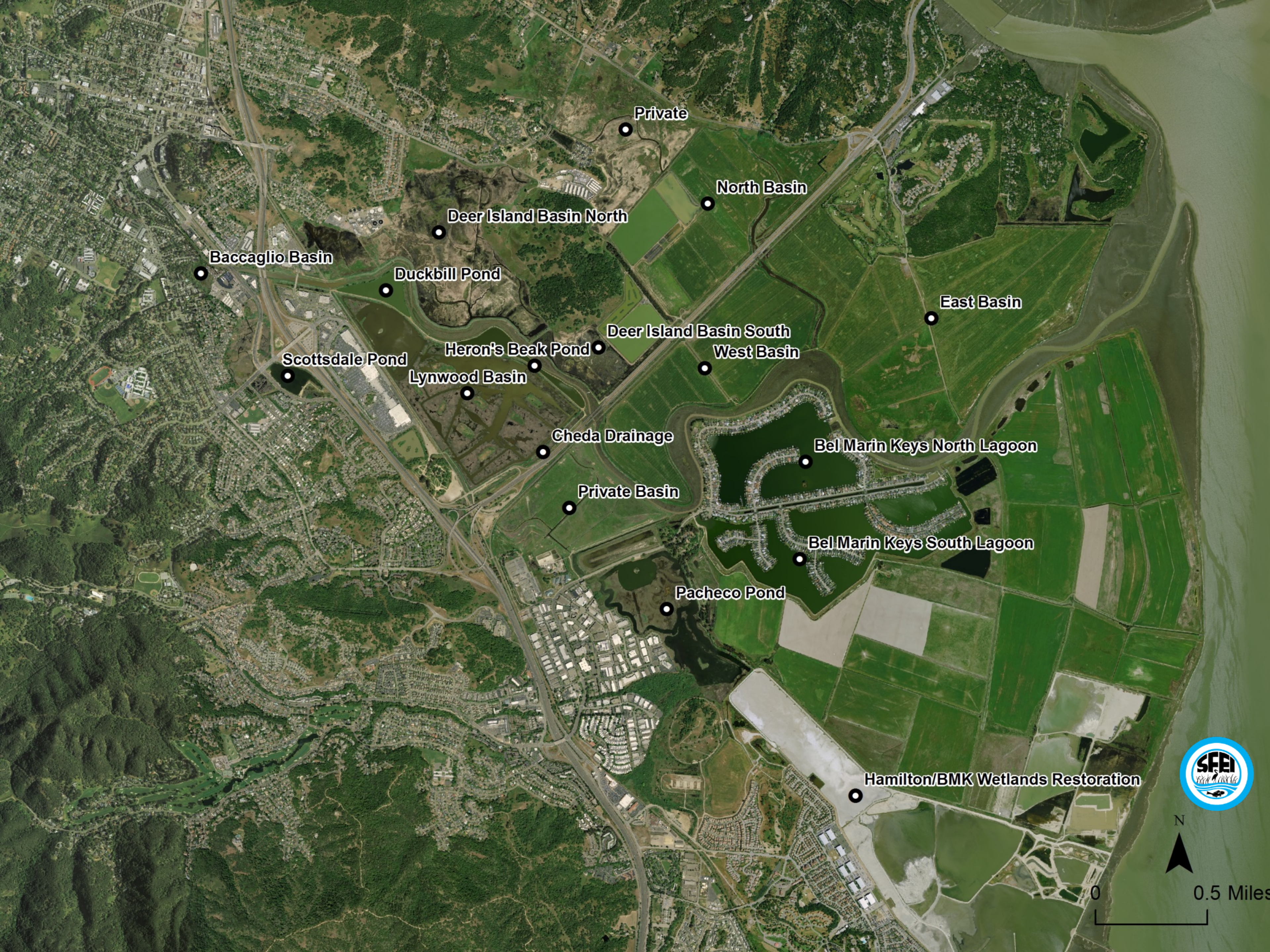
Baylands Ecosystem Goals

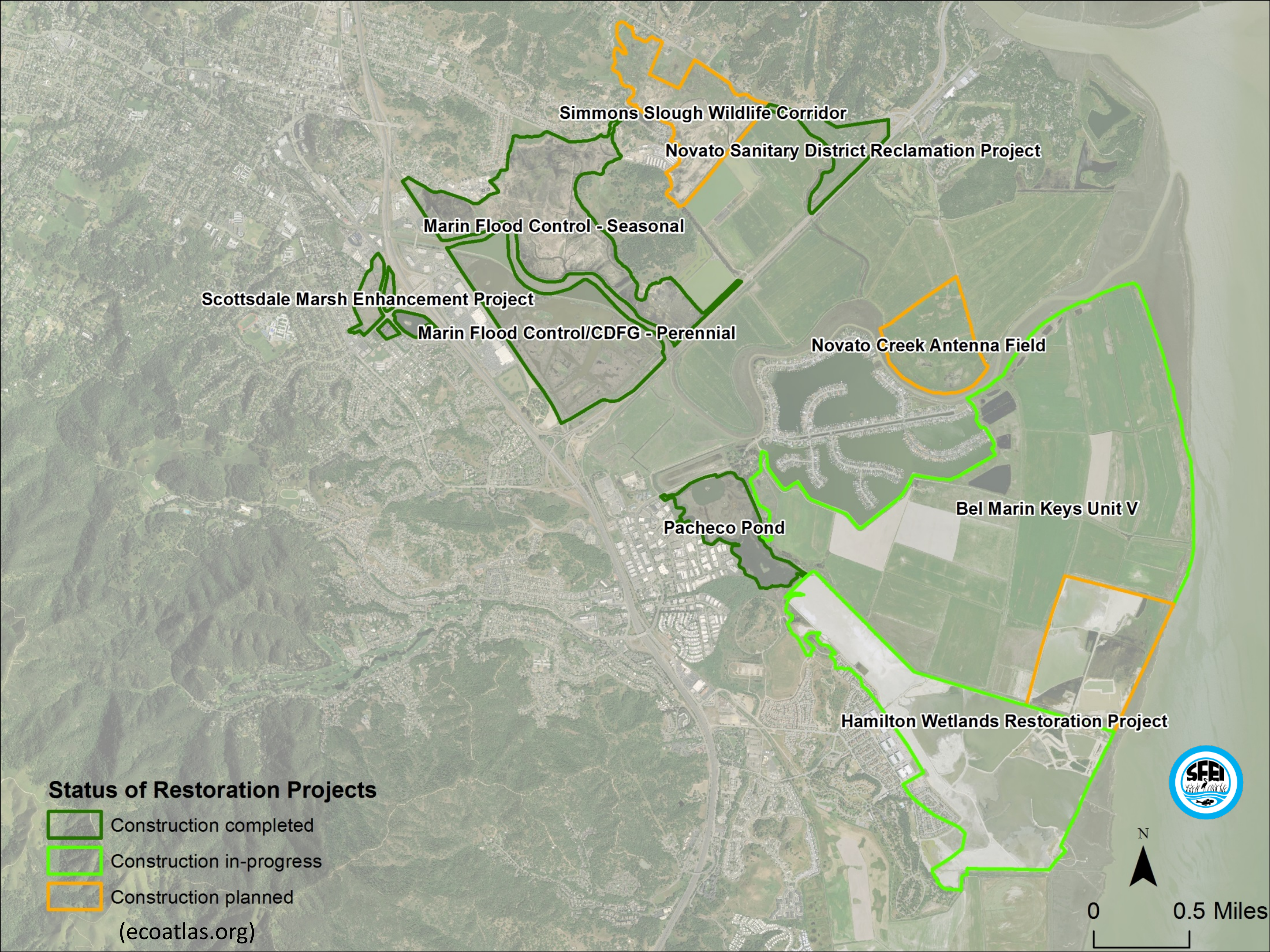
Geomorphic Setting

# Geographic Setting



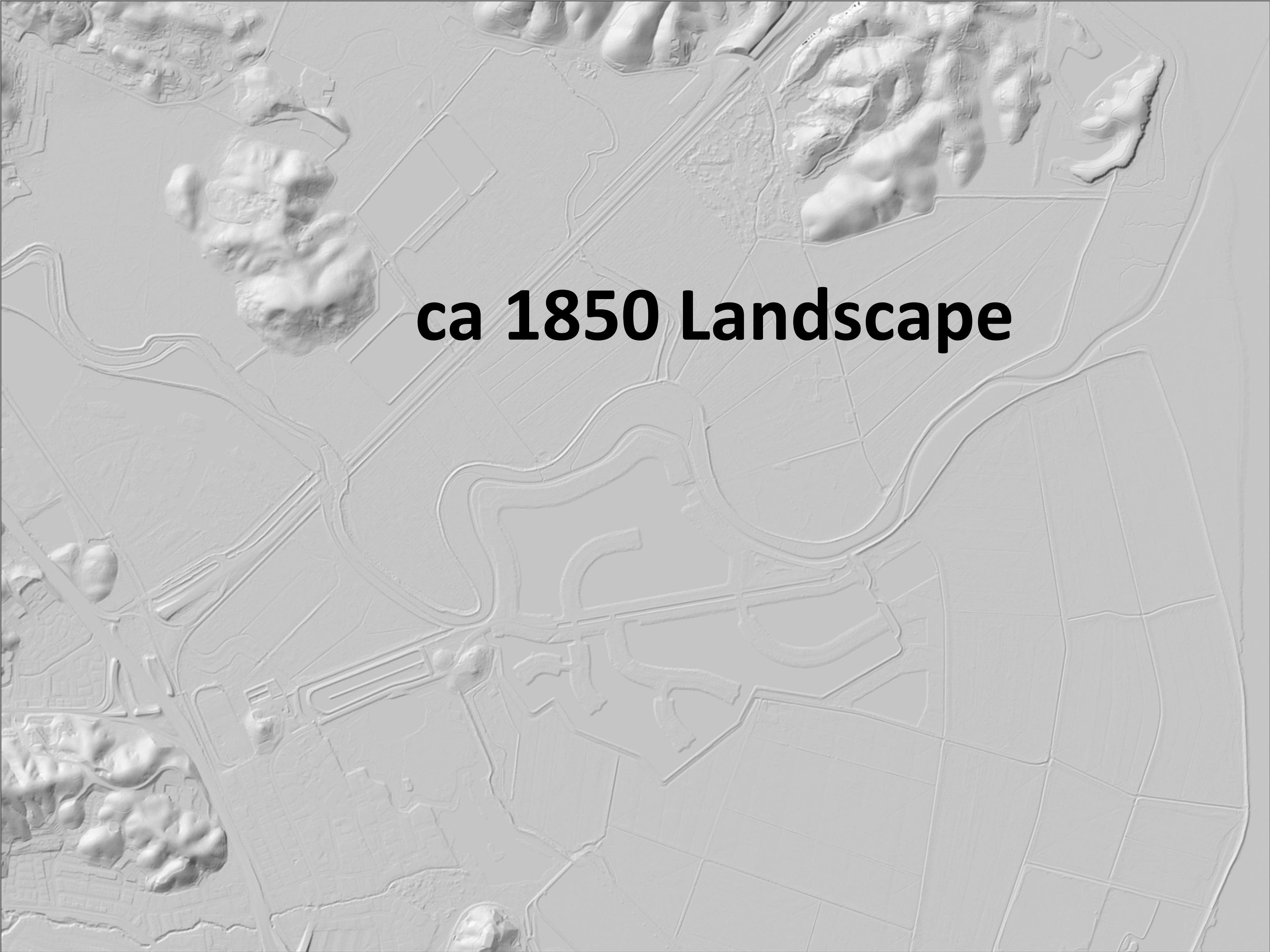
Black Point
Novato Creek
Warner Creek
Simmons Slough
Deer Island
Arroyo Avichi
US-101
CA-37
Novato Creek
Arroyo San Jose
Pacheco Creek
N
0
0.5 Miles
SFEI


Private
North Basin
Deer Island Basin North
Baccaglio Basin
Duckbill Pond
East Basin
Deer Island Basin South
Heron's Beak Pond
West Basin
Scottsdale Pond
Lynwood Basin
Cheda Drainage
Bel Marin Keys North Lagoon
Private Basin
Bel Marin Keys South Lagoon
Pacheco Pond
Hamilton/BMK Wetlands Restoration
SFEI
N
0
0.5 Miles


Simmons Slough Wildlife Corridor
Novato Sanitary District Reclamation Project
Marin Flood Control - Seasonal
Scottsdale Marsh Enhancement Project
Marin Flood Control/CDFG - Perennial
Novato Creek Antenna Field
Bel Marin Keys Unit V
Pacheco Pond
Hamilton Wetlands Restoration Project
SFEI
Status of Restoration Projects
Construction completed
Construction in-progress
Construction planned
(ecoatlas.org)
N
0
0.5 Miles

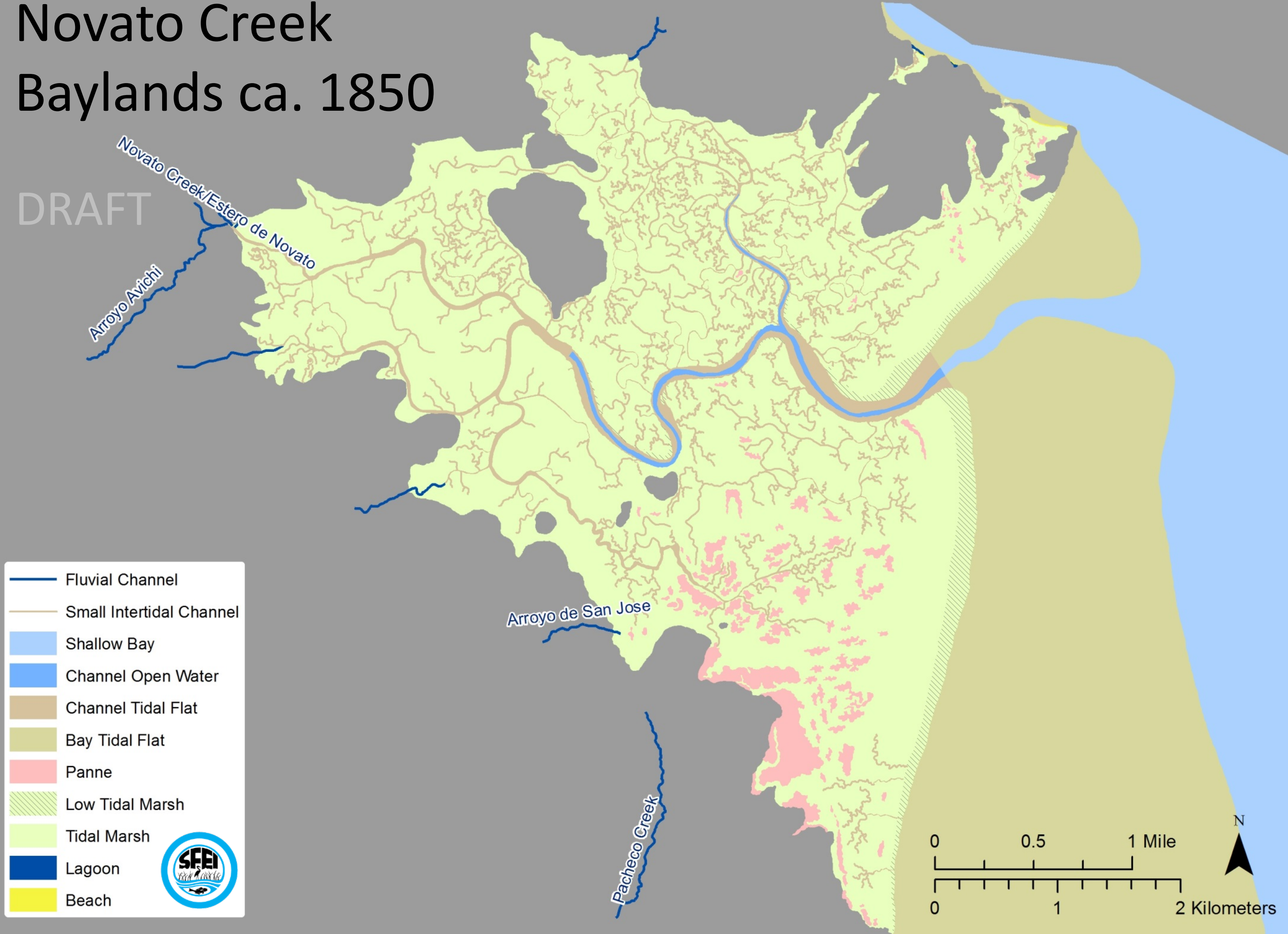
# Tidal marshes of northeast Marin
(BAARI 2011)

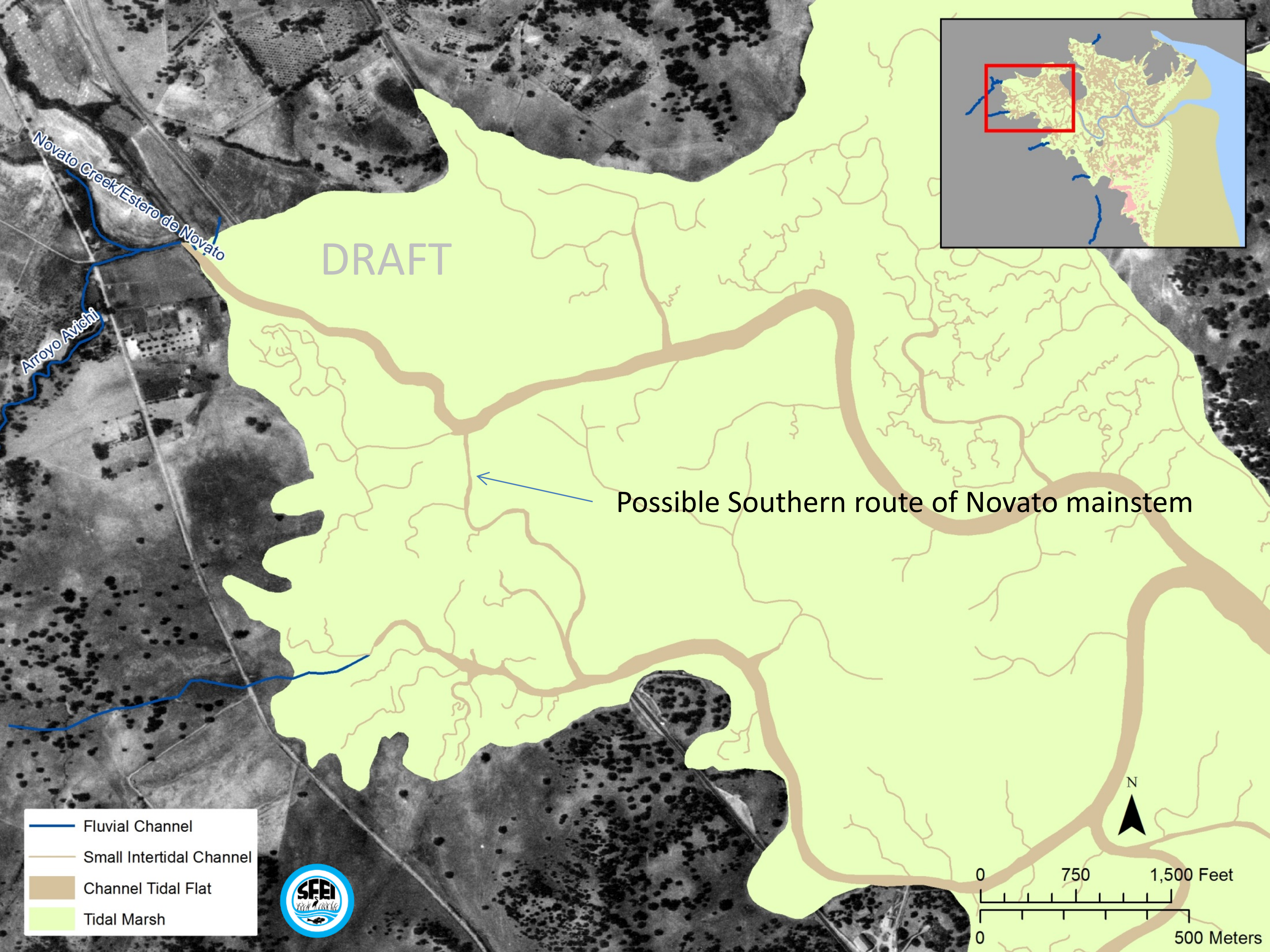
# ca 1850 Landscape



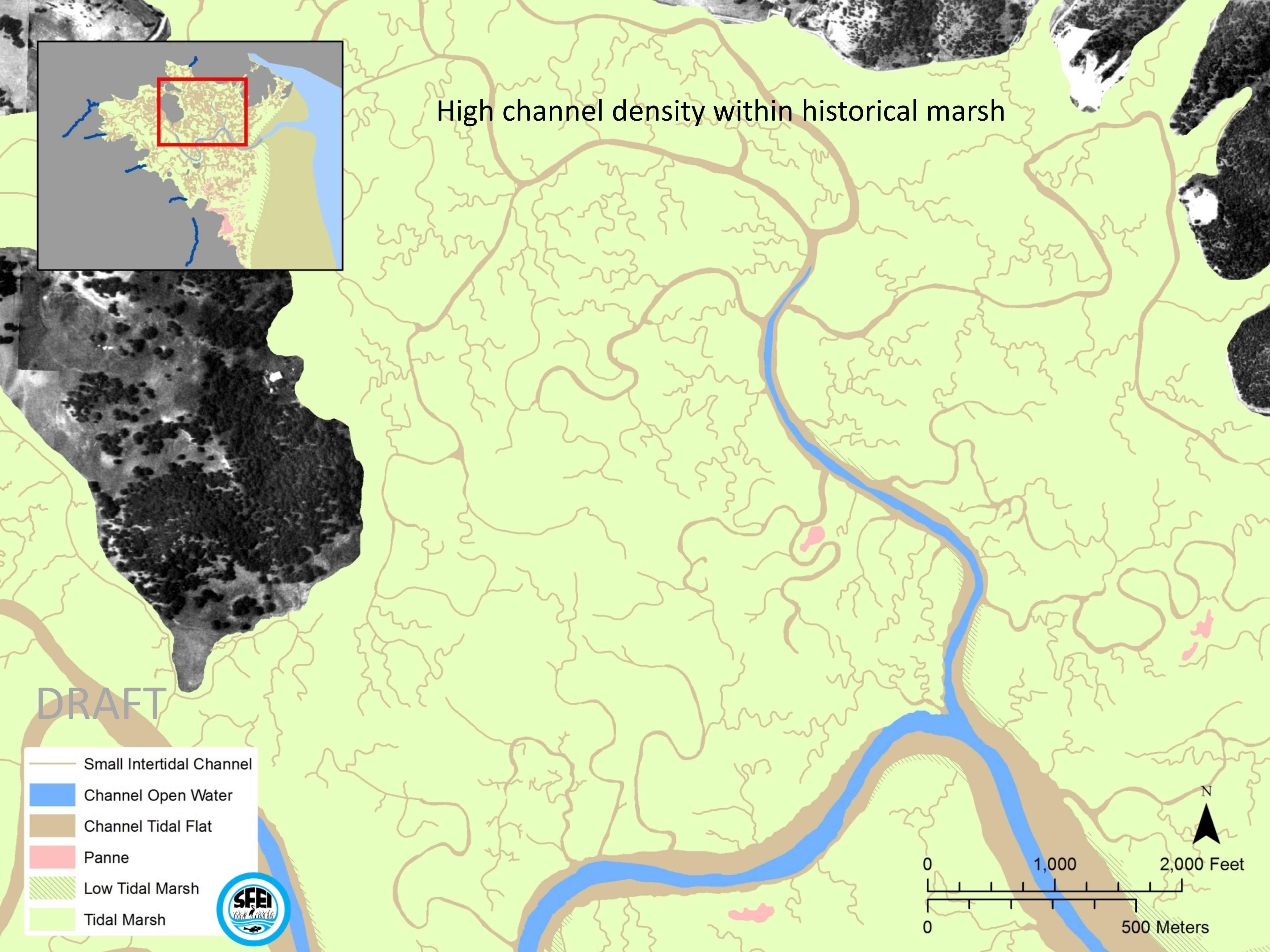
# Novato Creek Baylands ca. 1850

DRAFT



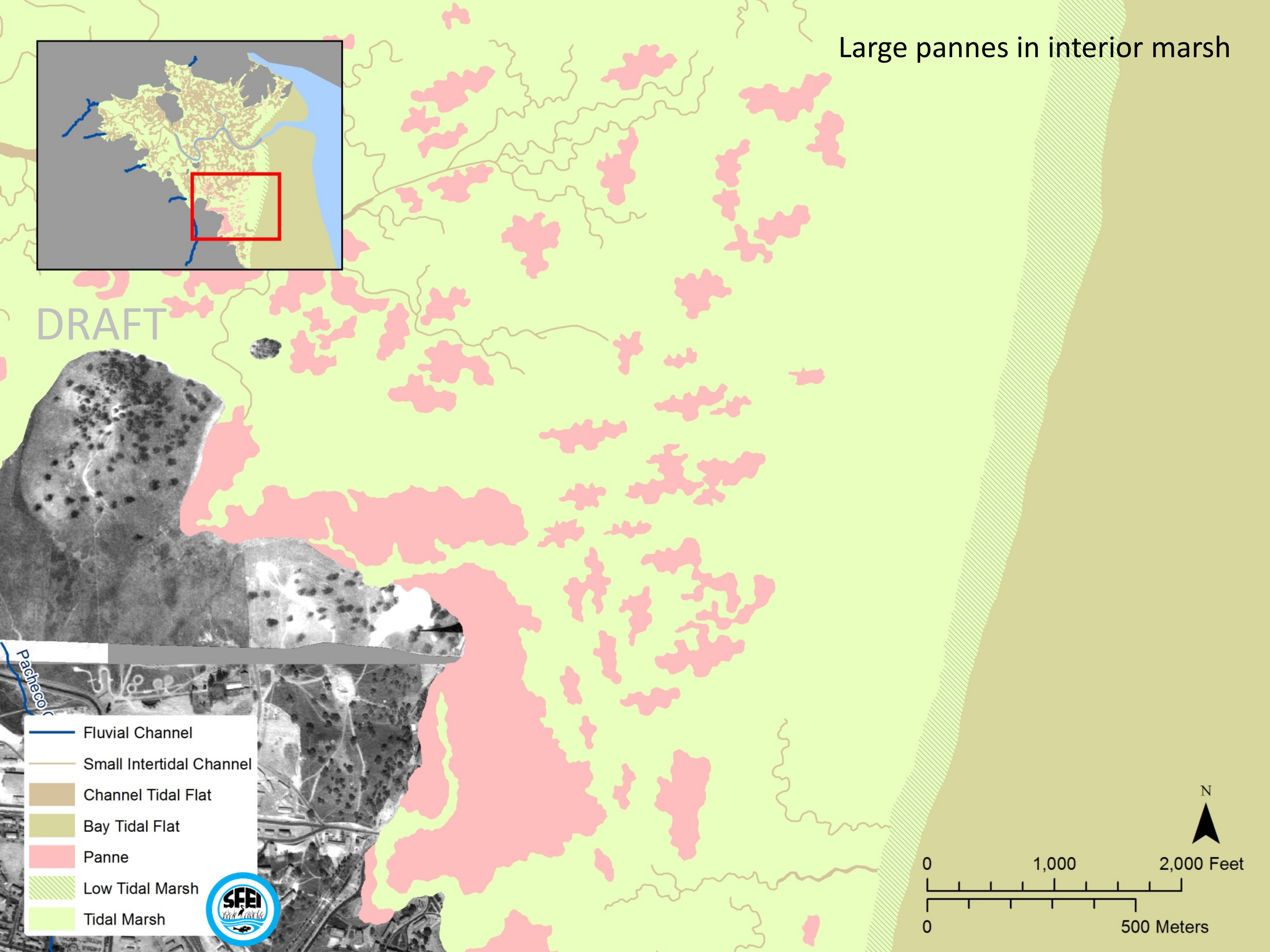


Novato Creek/Estero de Novato
Arroyo Avichi
DRAFT
Possible Southern route of Novato mainstem
Fluvial Channel
Small Intertidal Channel
Channel Tidal Flat
Tidal Marsh
SFEI
N
0
750
1,500 Feet
0
500 Meters

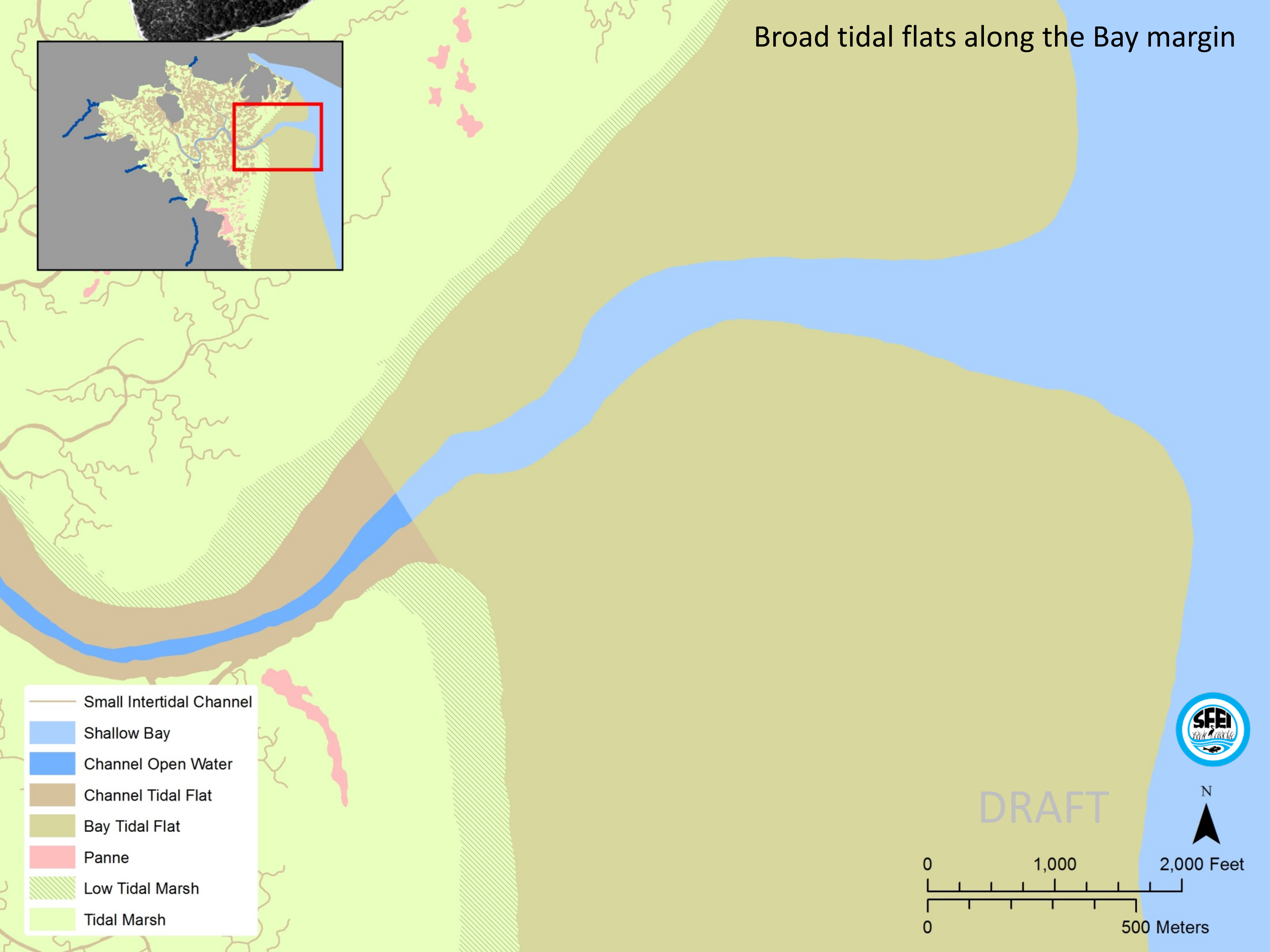


High channel density within historical marsh
DRAFT
Small Intertidal Channel
Channel Open Water
Channel Tidal Flat
Panne
Low Tidal Marsh
Tidal Marsh
SFEI
N
0
1,000
2,000 Feet
0
500 Meters

Large pannes in interior marsh

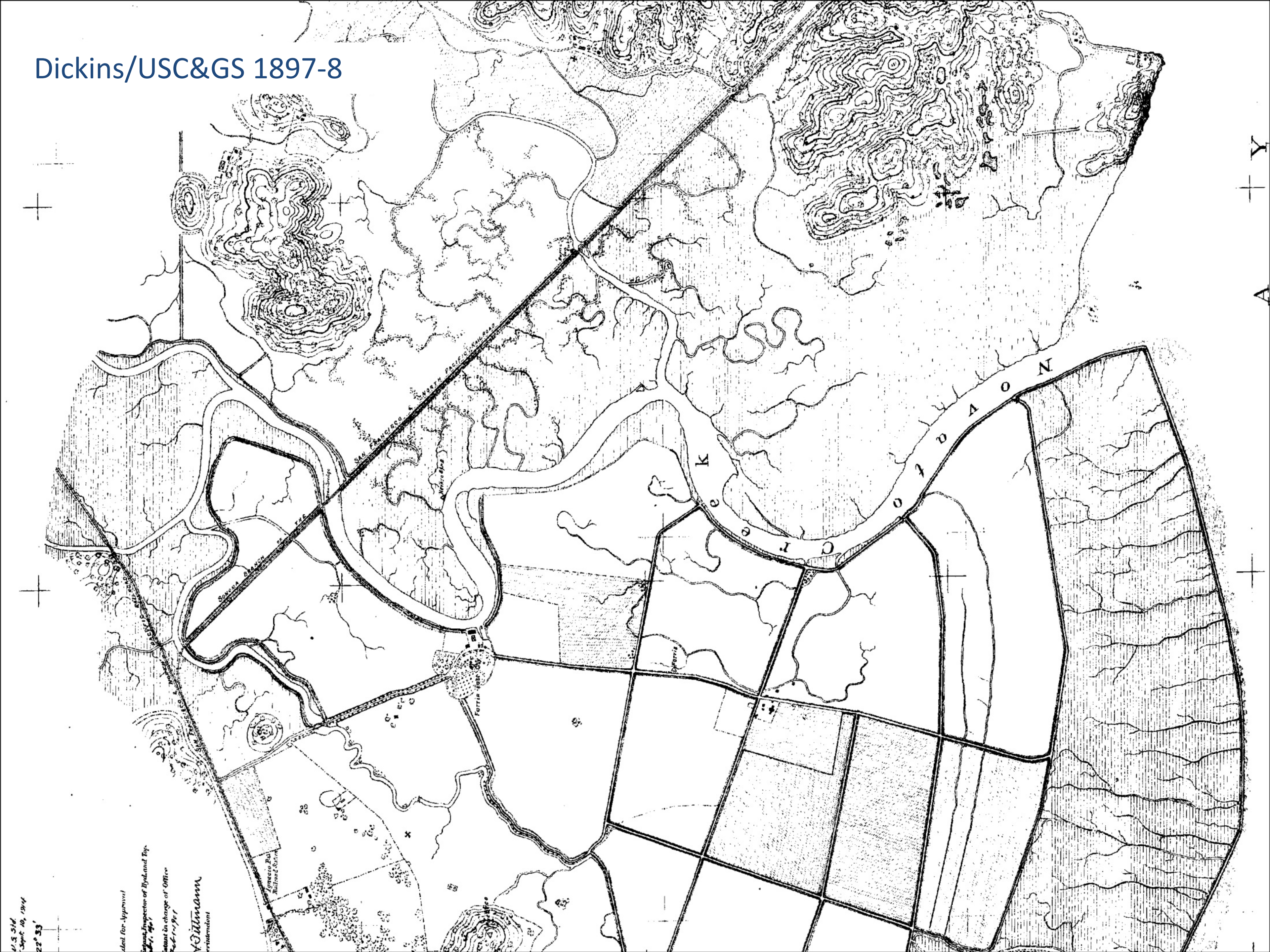


# Broad tidal flats along the Bay margin

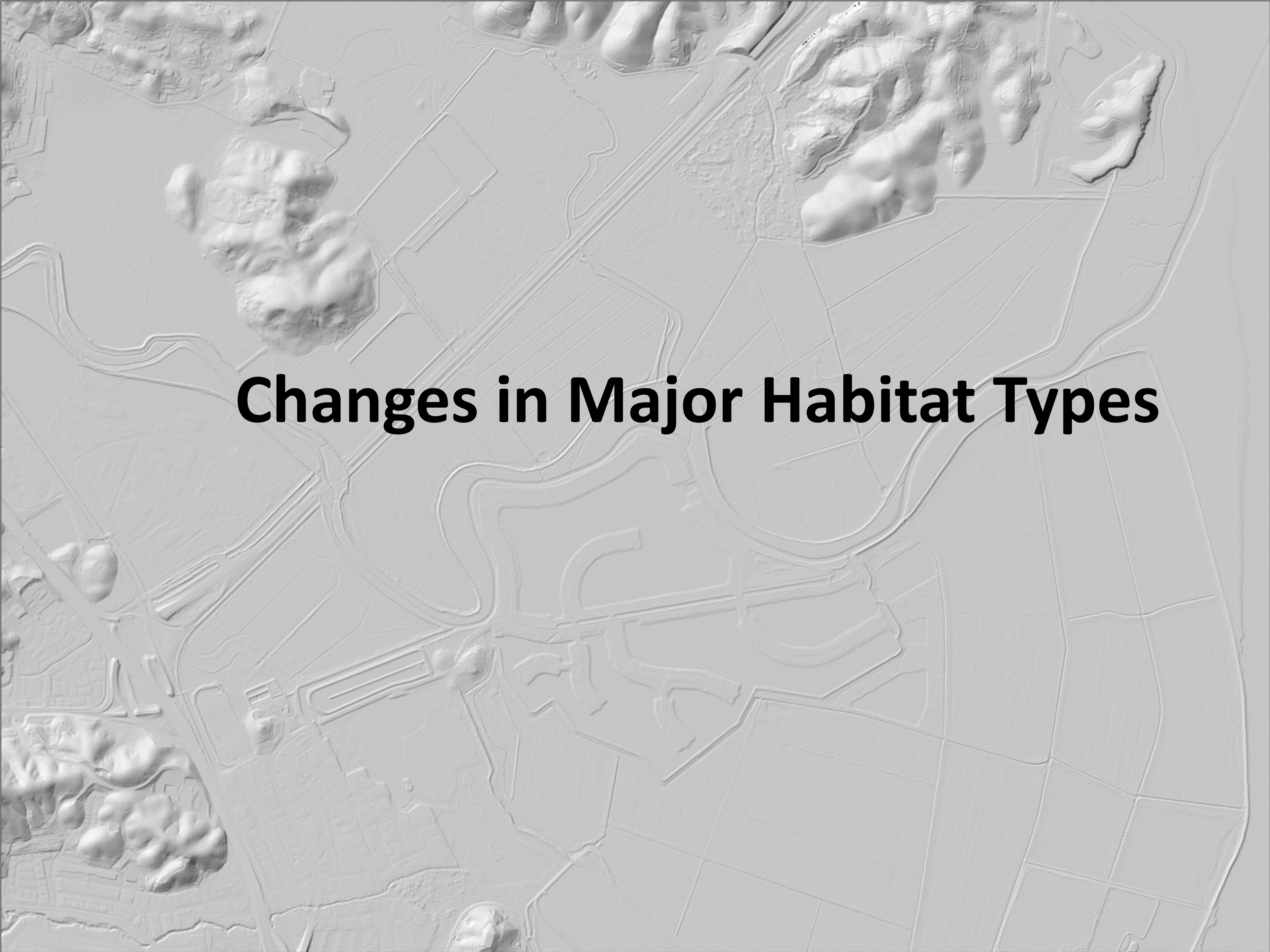


Rodgers/USCS 1854

Dickins/USC&GS 1897-8

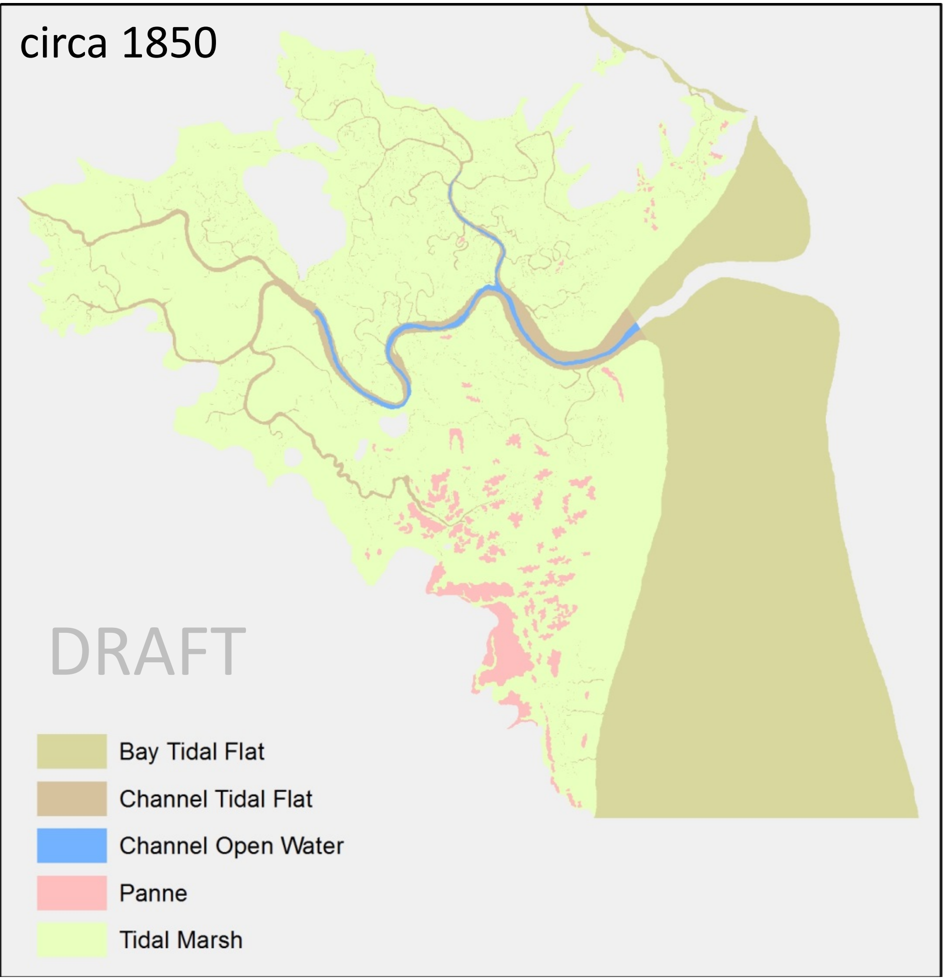


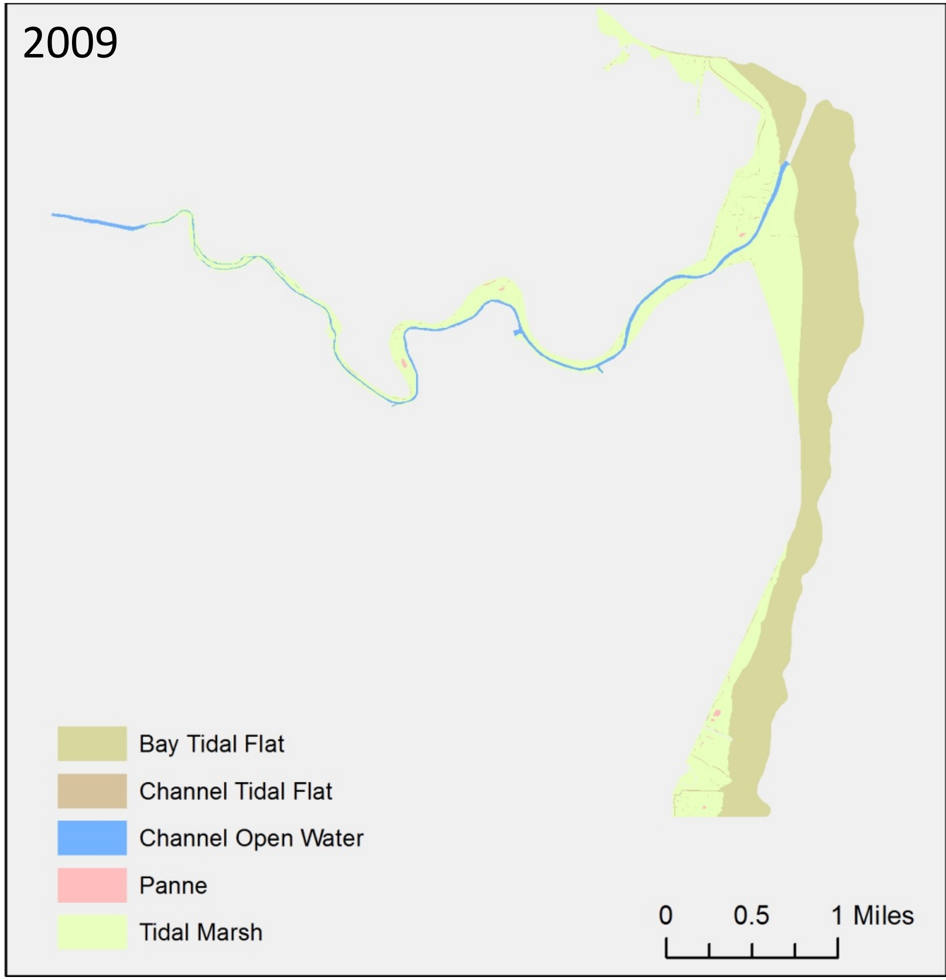
# Changes in Major Habitat Types



# Habitat Overview

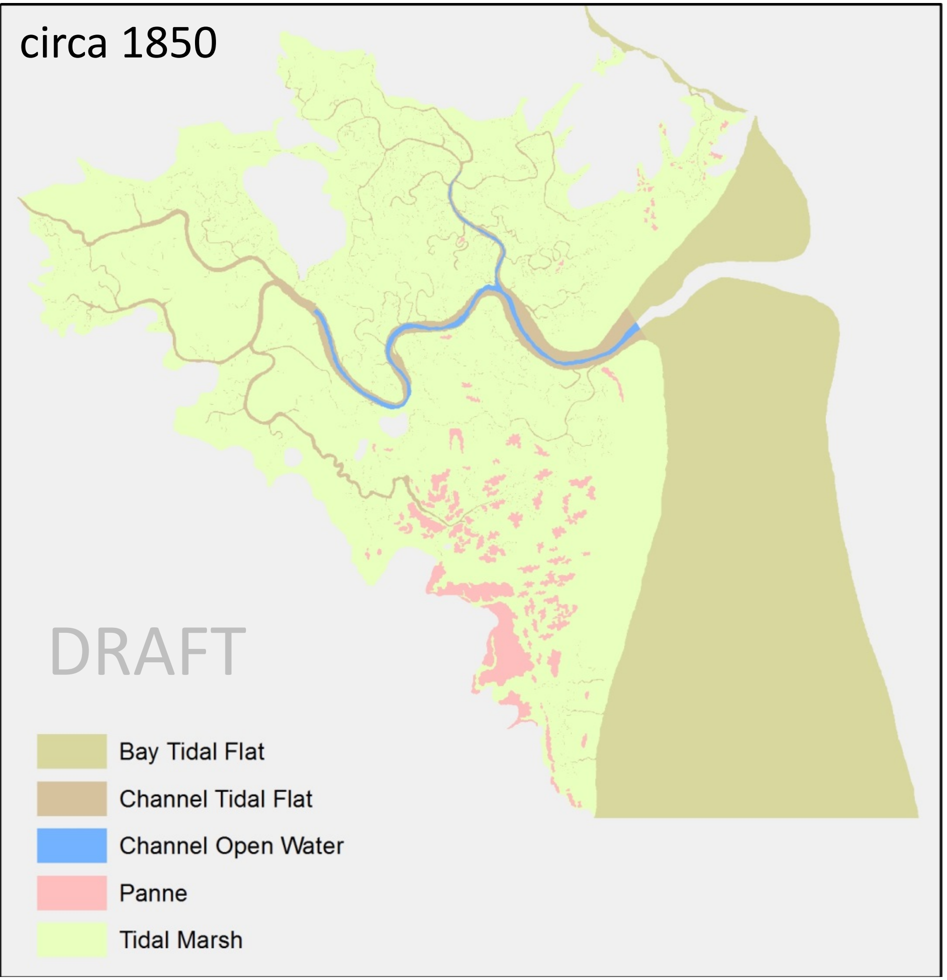
## Tidal Habitats

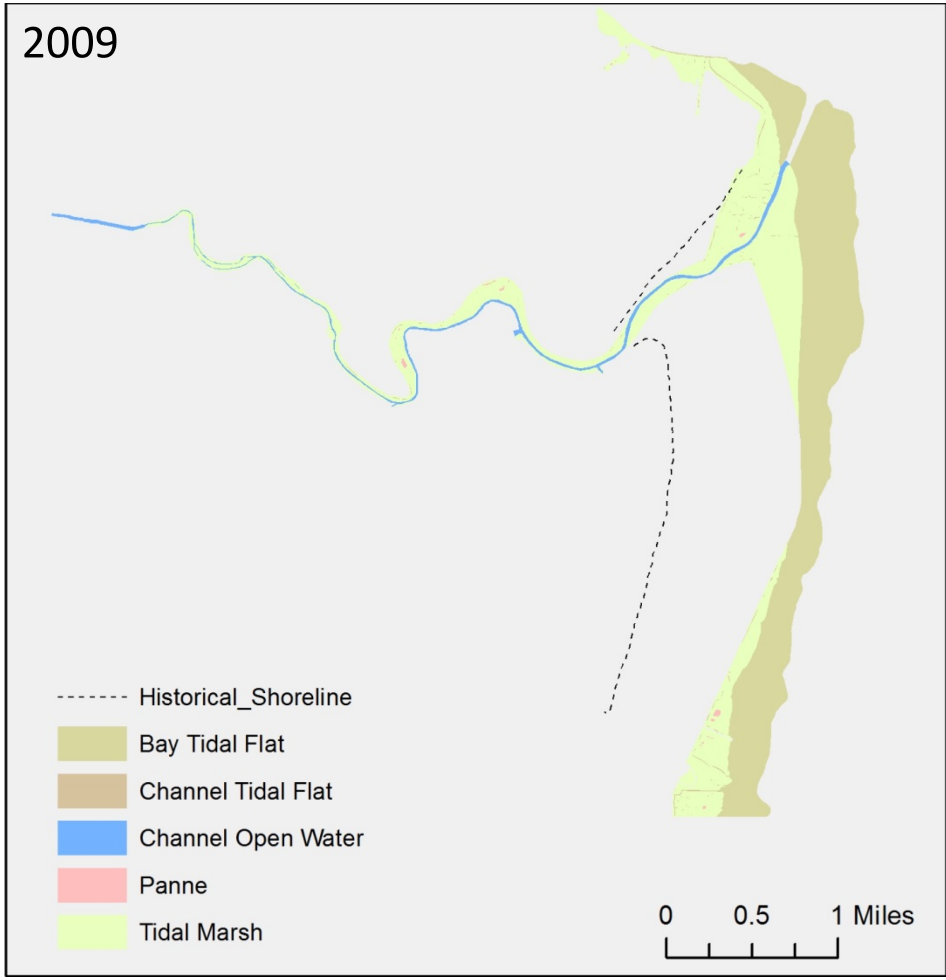


# Habitat Overview

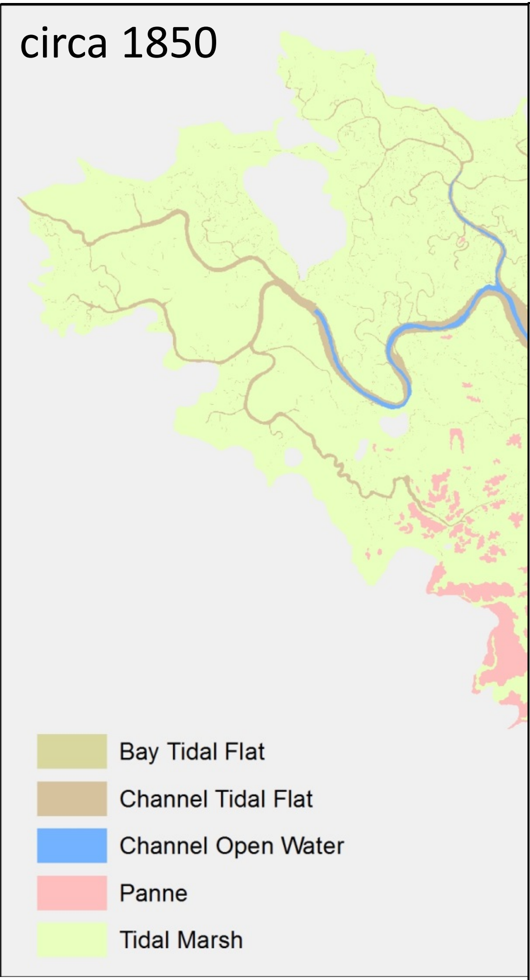
Tidal Habitats

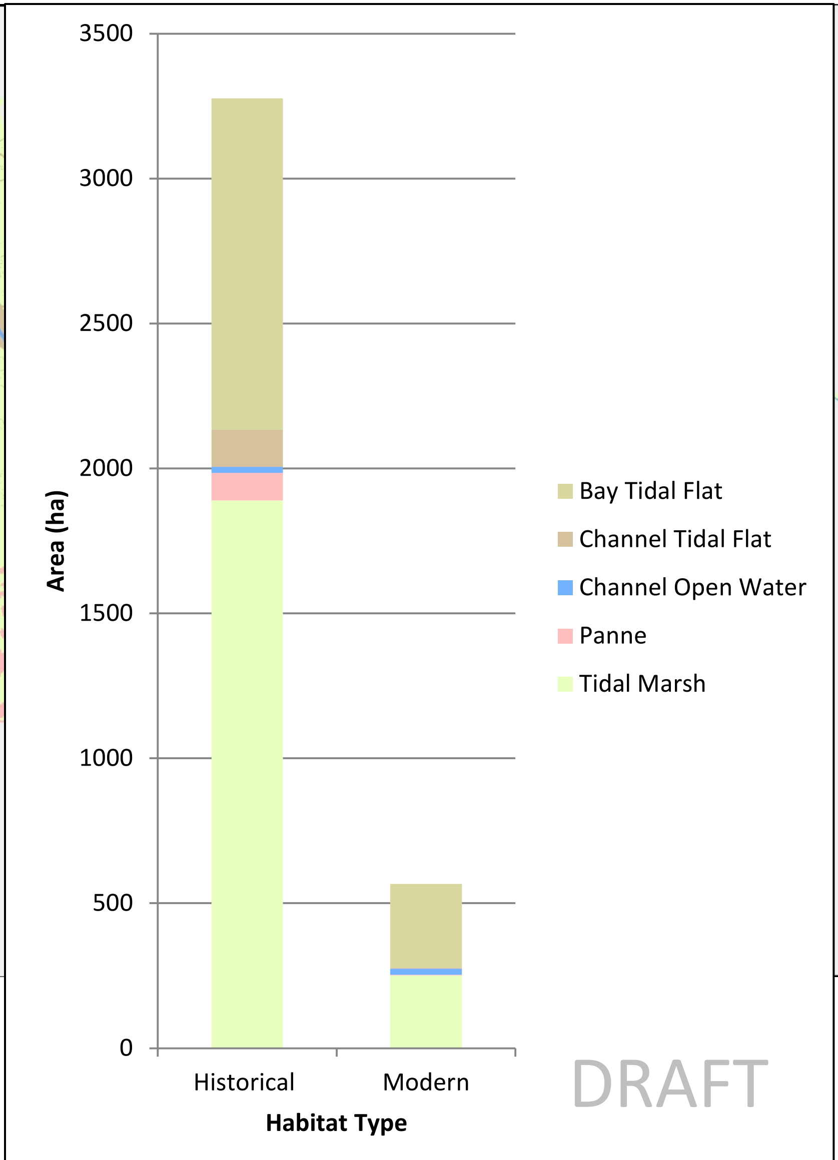


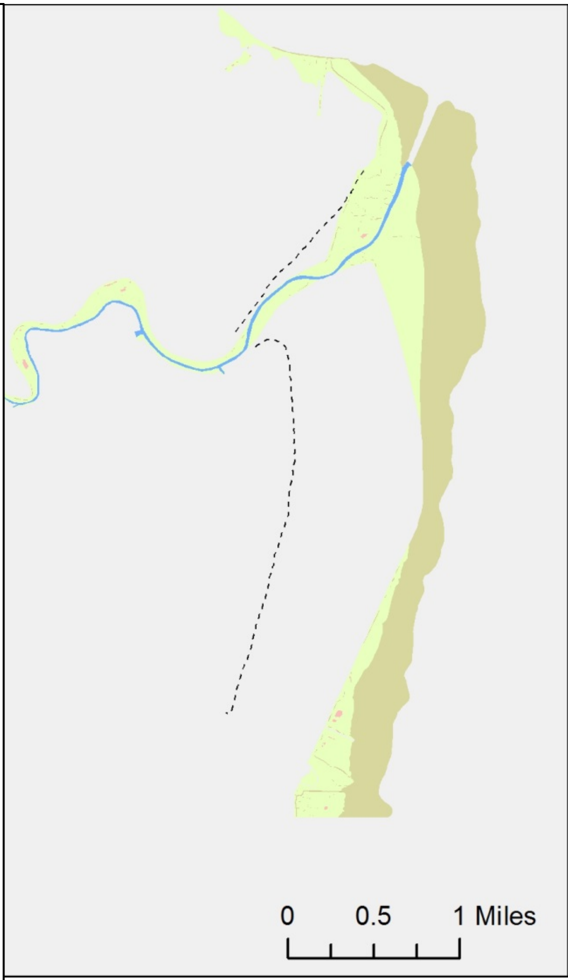



# Habitat Overview

## Tidal Habitats

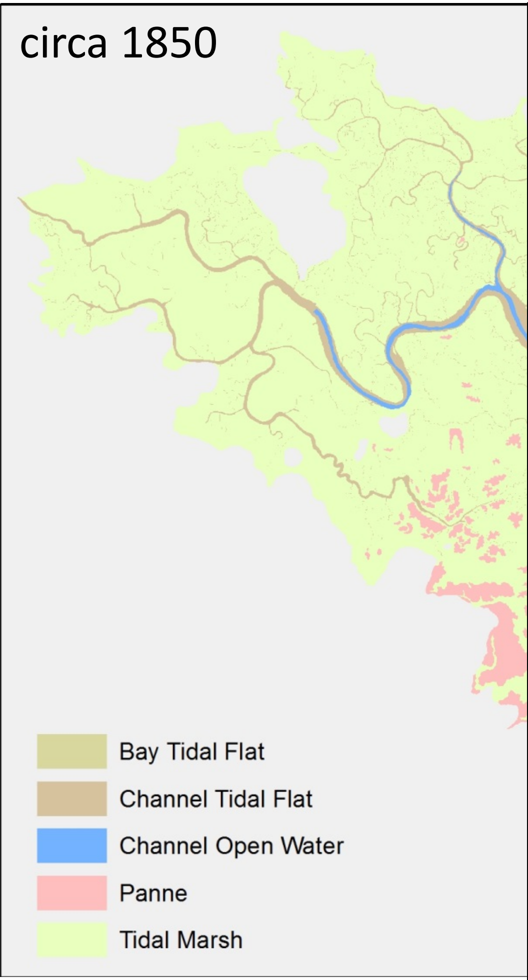


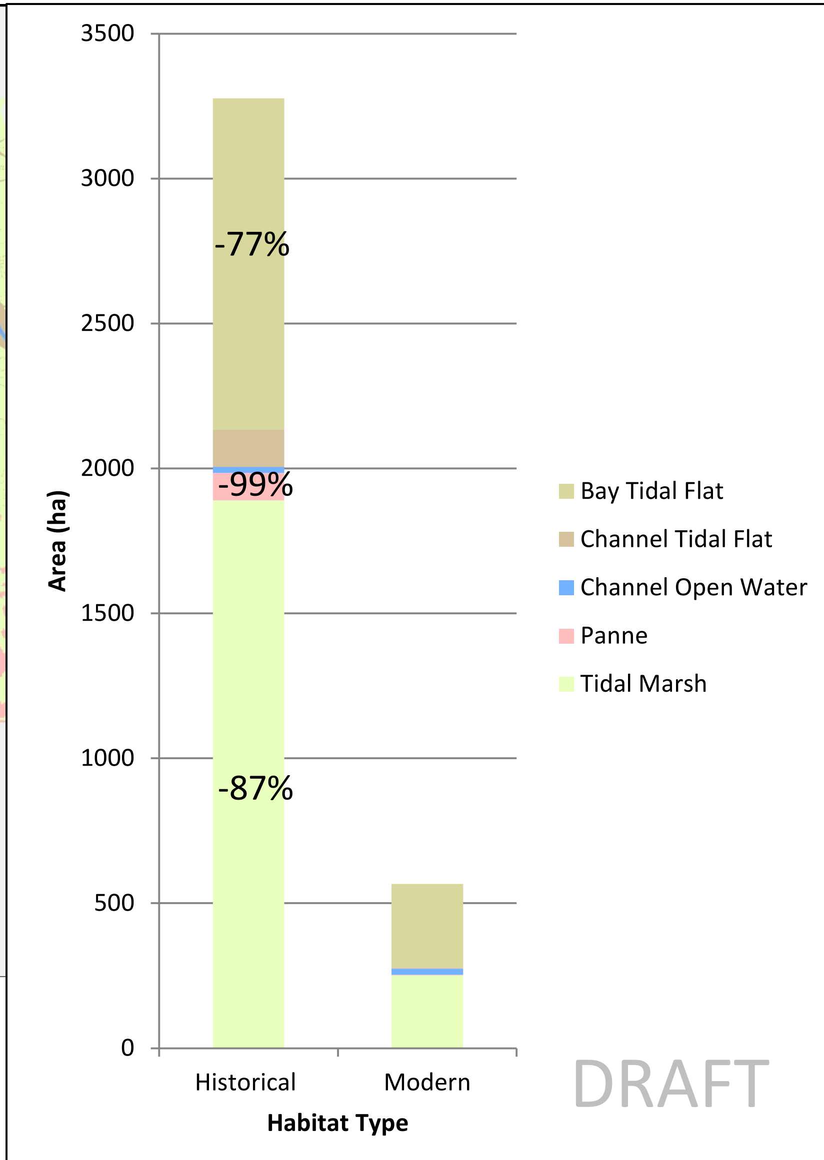



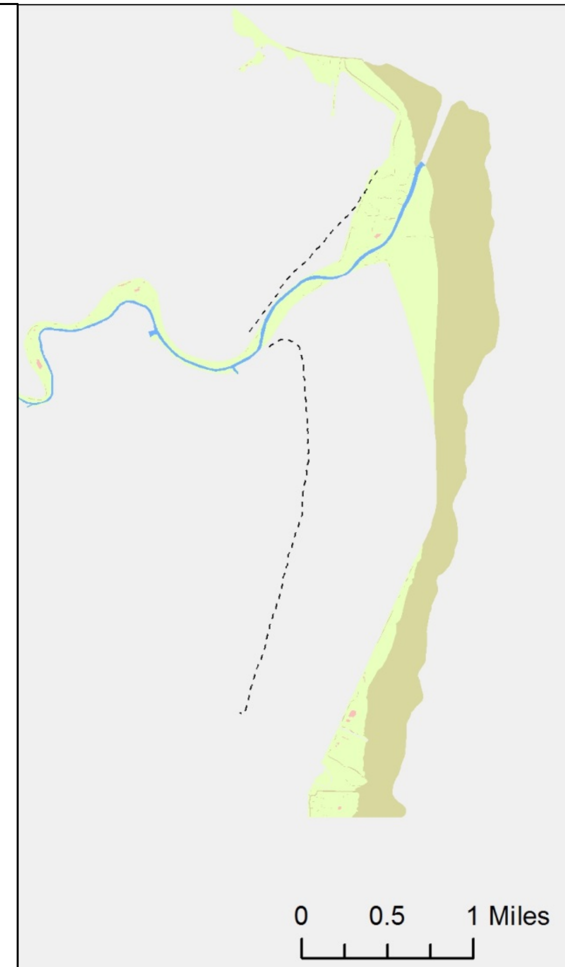



# Habitat Overview

## Tidal Habitats

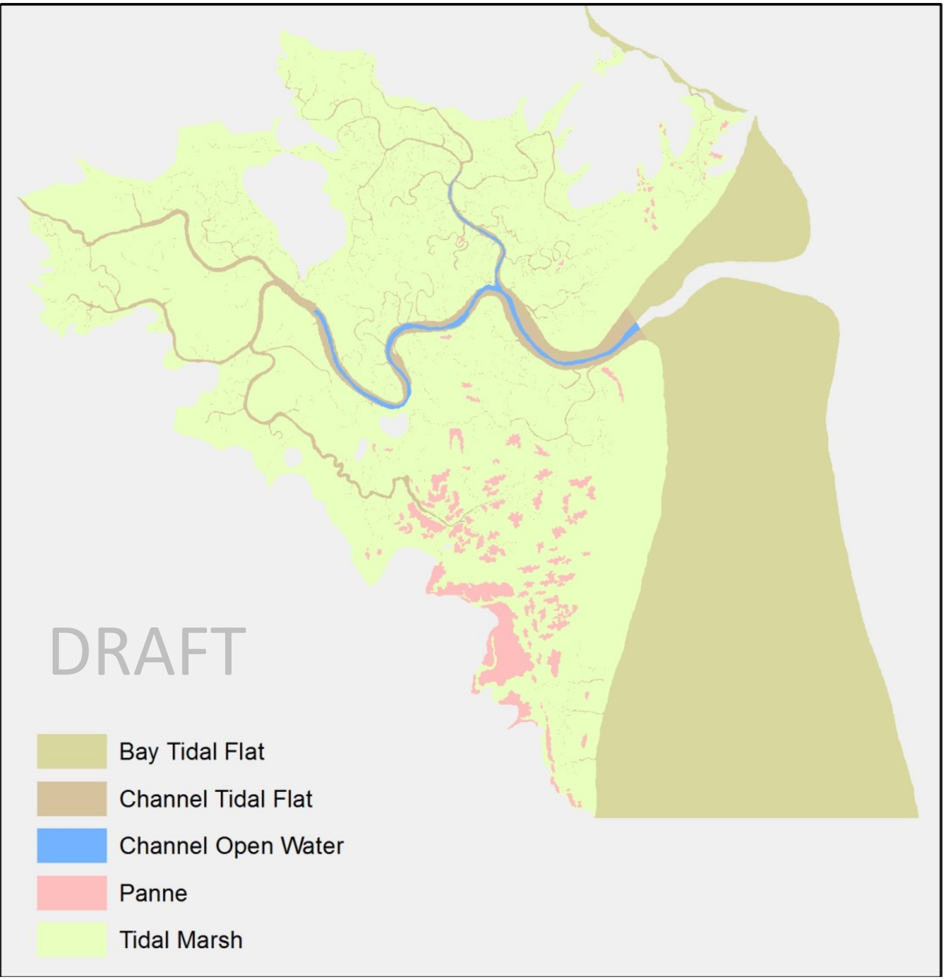


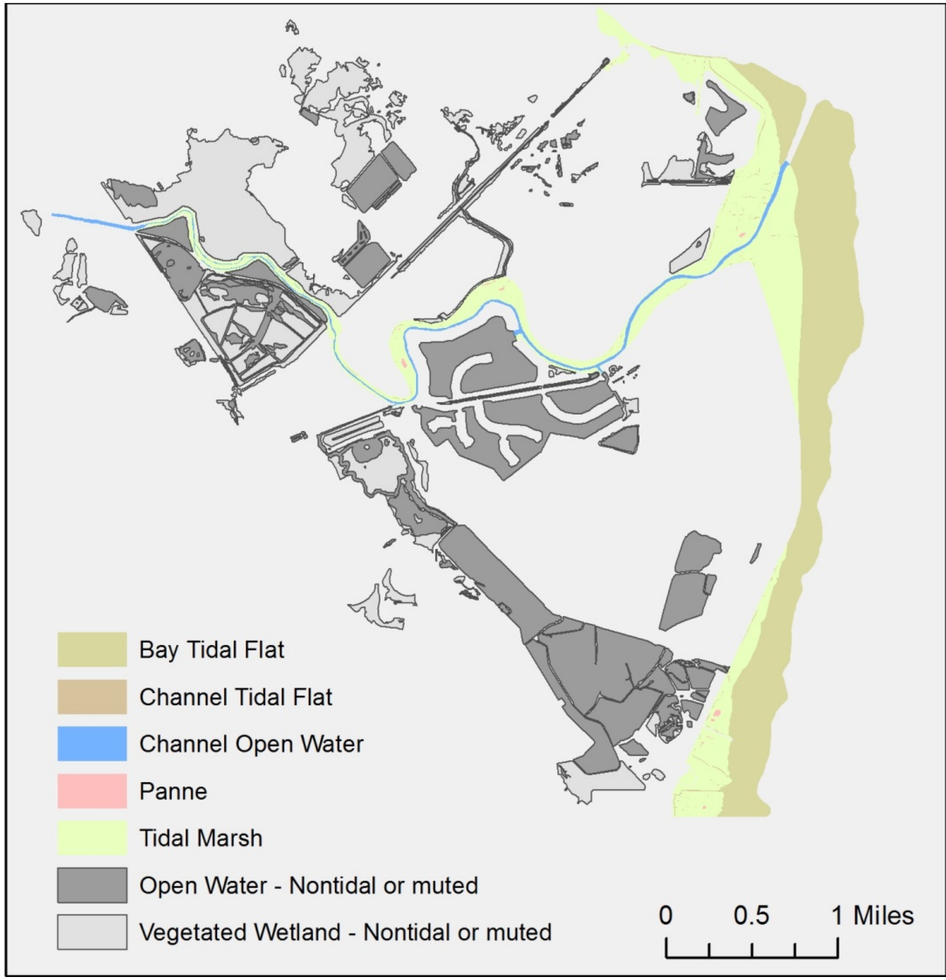



# Habitat Overview

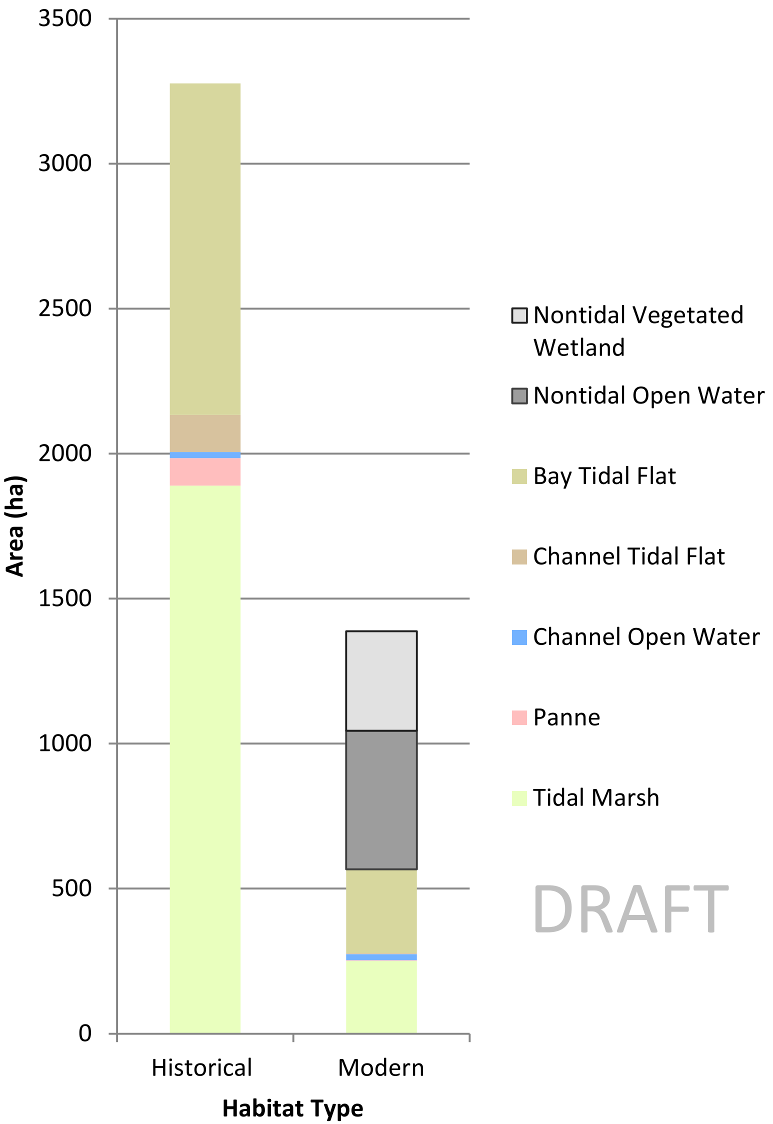
including nontidal & anthropogenic wetlands

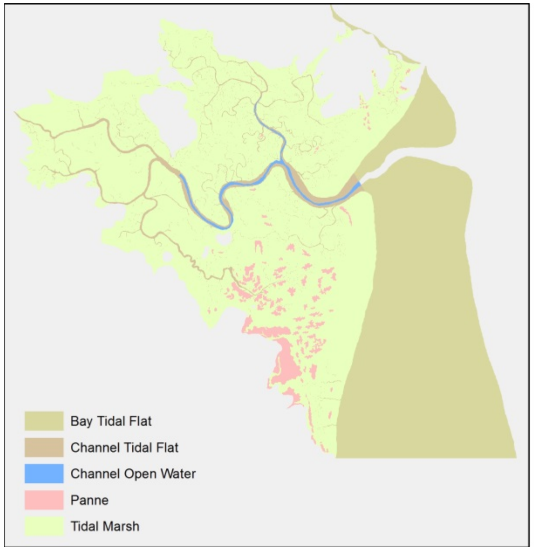


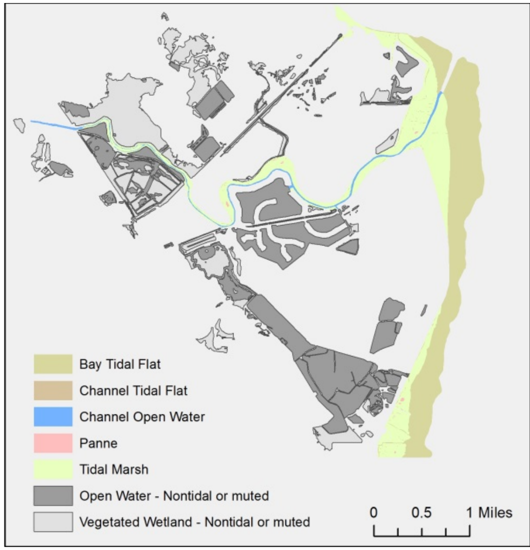



# Habitat Overview

including nontidal & anthropogenic wetlands

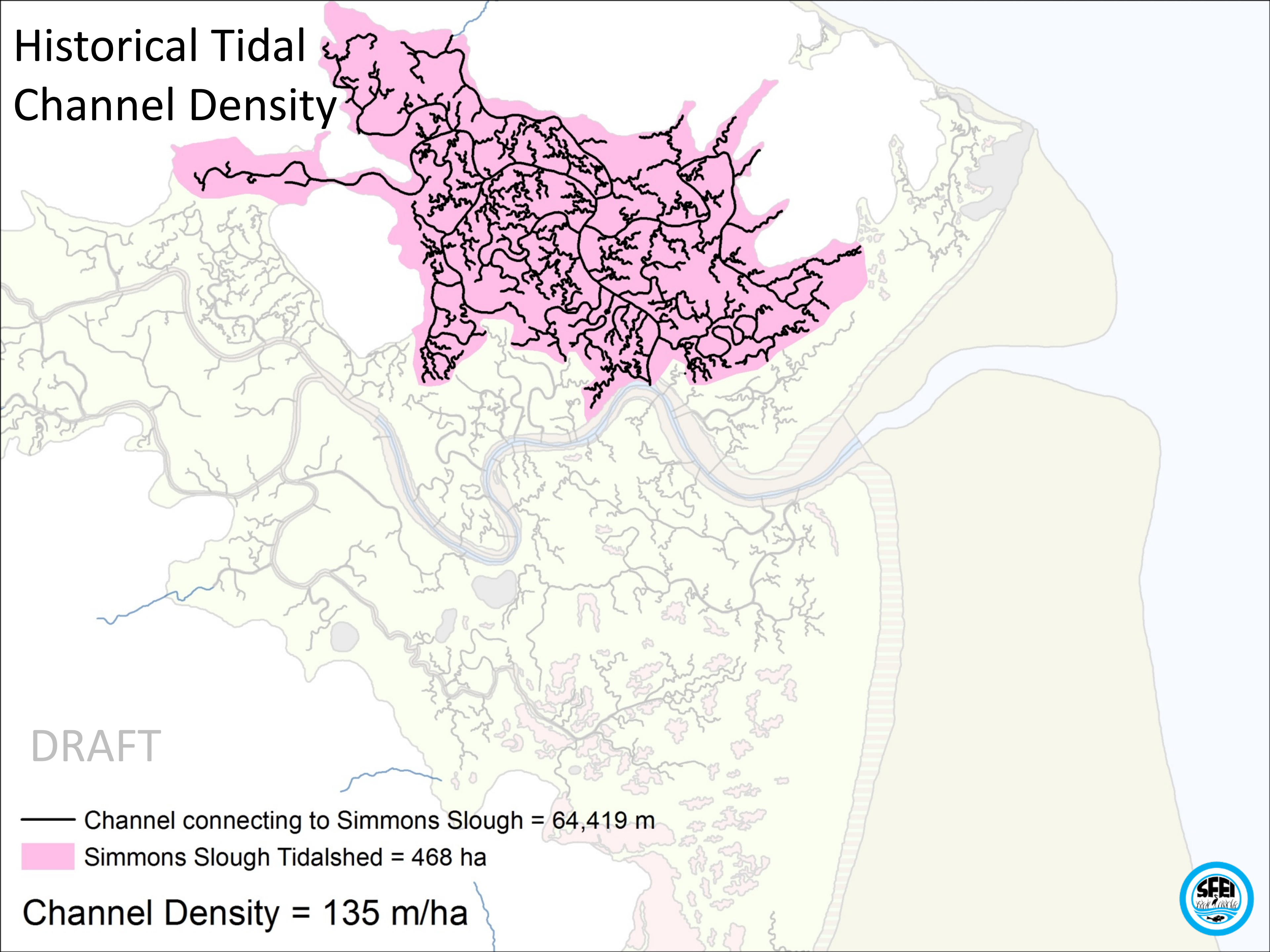


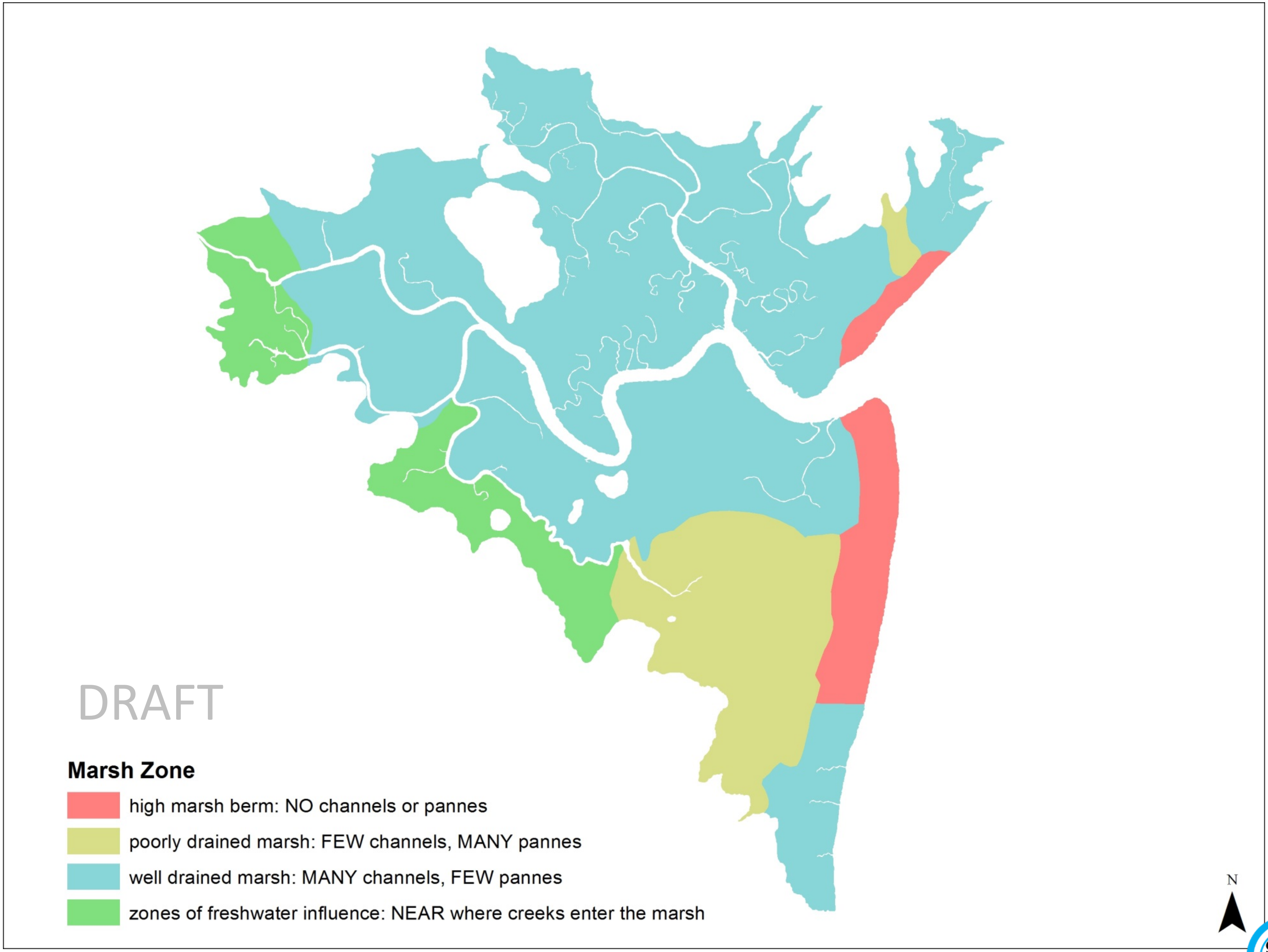



# Tidal Channel Length

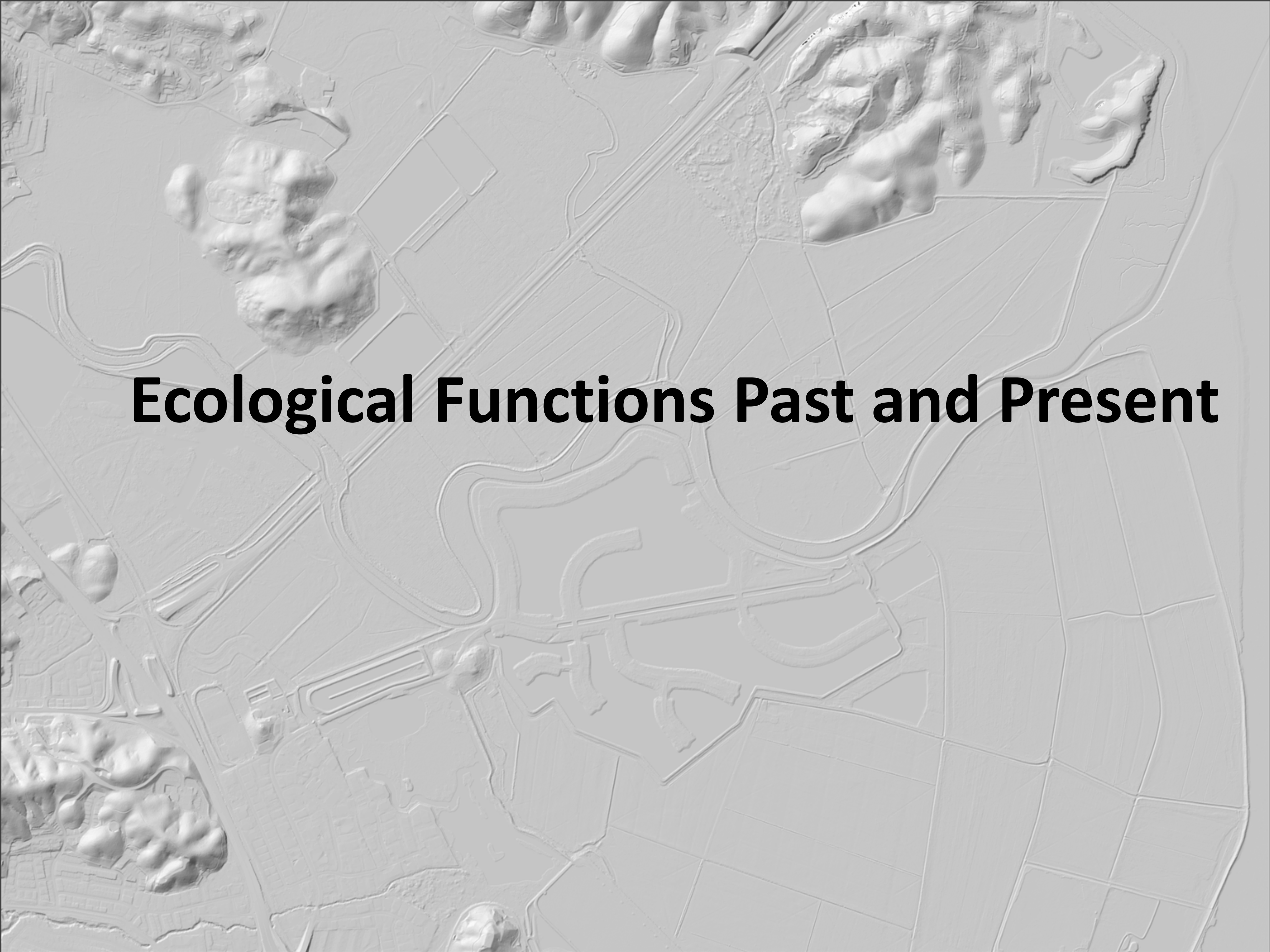
# Historical Tidal Channel Density




Channel Density = 135 m/ha


DRAFT
Marsh Zone
high marsh berm: NO channels or pannes
poorly drained marsh: FEW channels, MANY pannes
well drained marsh: MANY channels, FEW pannes
zones of freshwater influence: NEAR where creeks enter the marsh
N

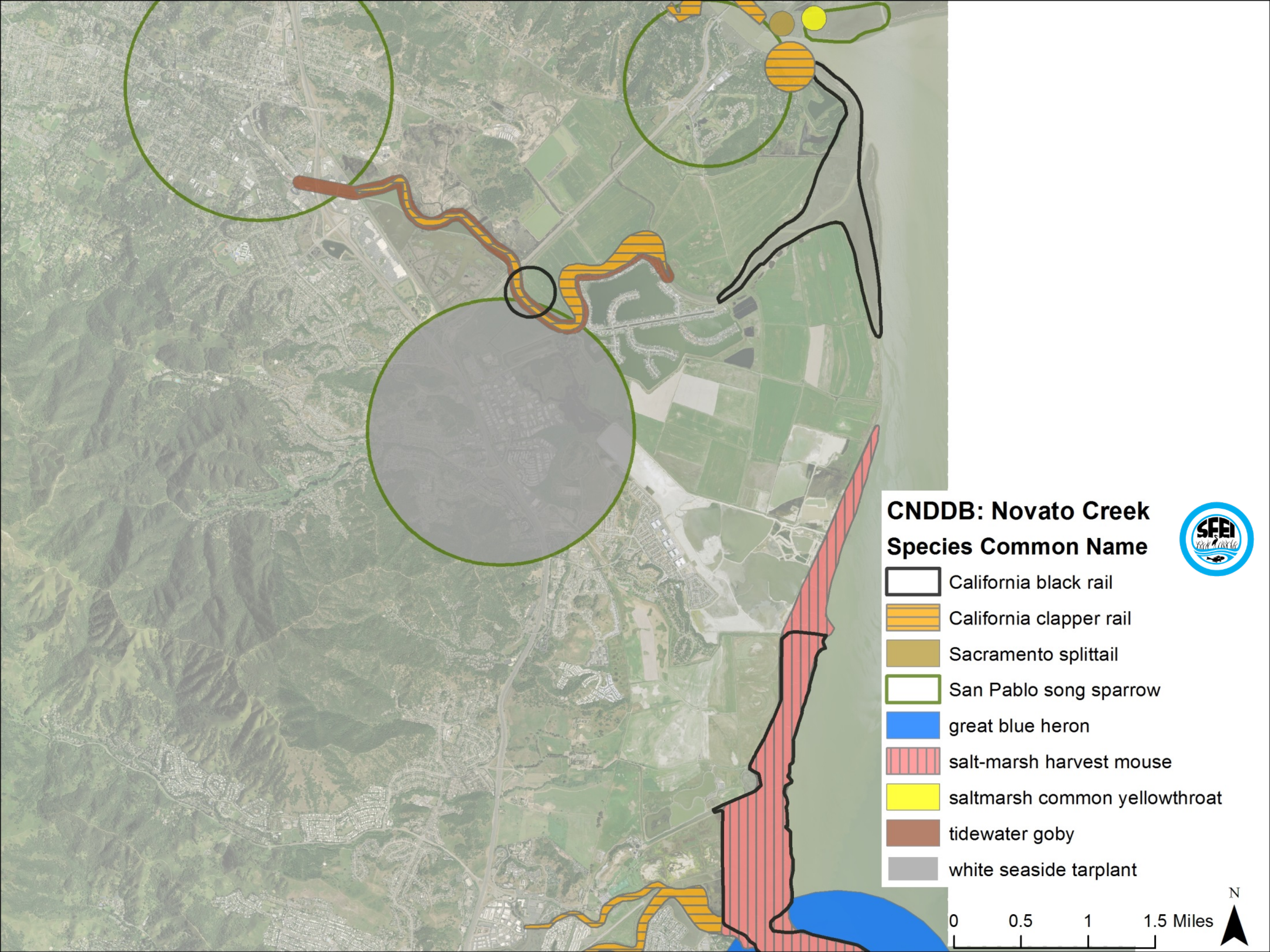
# Ecological Functions Past and Present



## Known T&E species at the site

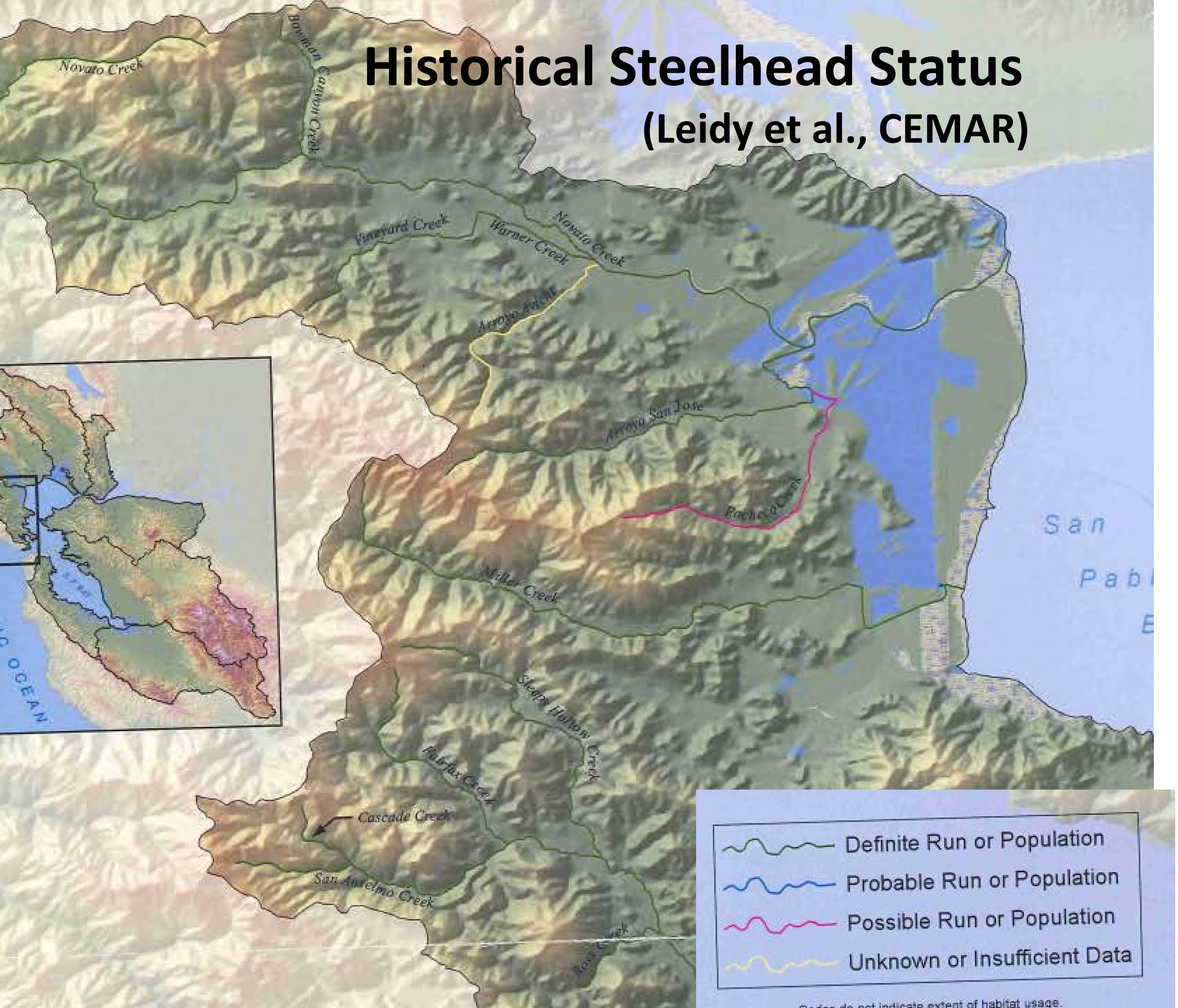
Tidewater goby *(not seen since 1950s)*
Steelhead
Chinook (*likely strays from Petaluma River*)
Northwestern pond turtle
California black rail
California clapper rail
Western burrowing owl
Salt marsh common yellow throat
San Pablo song sparrow
Salt marsh harvest mouse
Sacramento Splittail

Soft bird's beak
Pt Reyes bird's beak


CNDDB: Novato Creek
Species Common Name
California black rail
California clapper rail
Sacramento splittail
San Pablo song sparrow
great blue heron
salt-marsh harvest mouse
saltmarsh common yellowthroat
tidewater goby
white seaside tarplant
SFEI
N
0
0.5
1
1.5 Miles

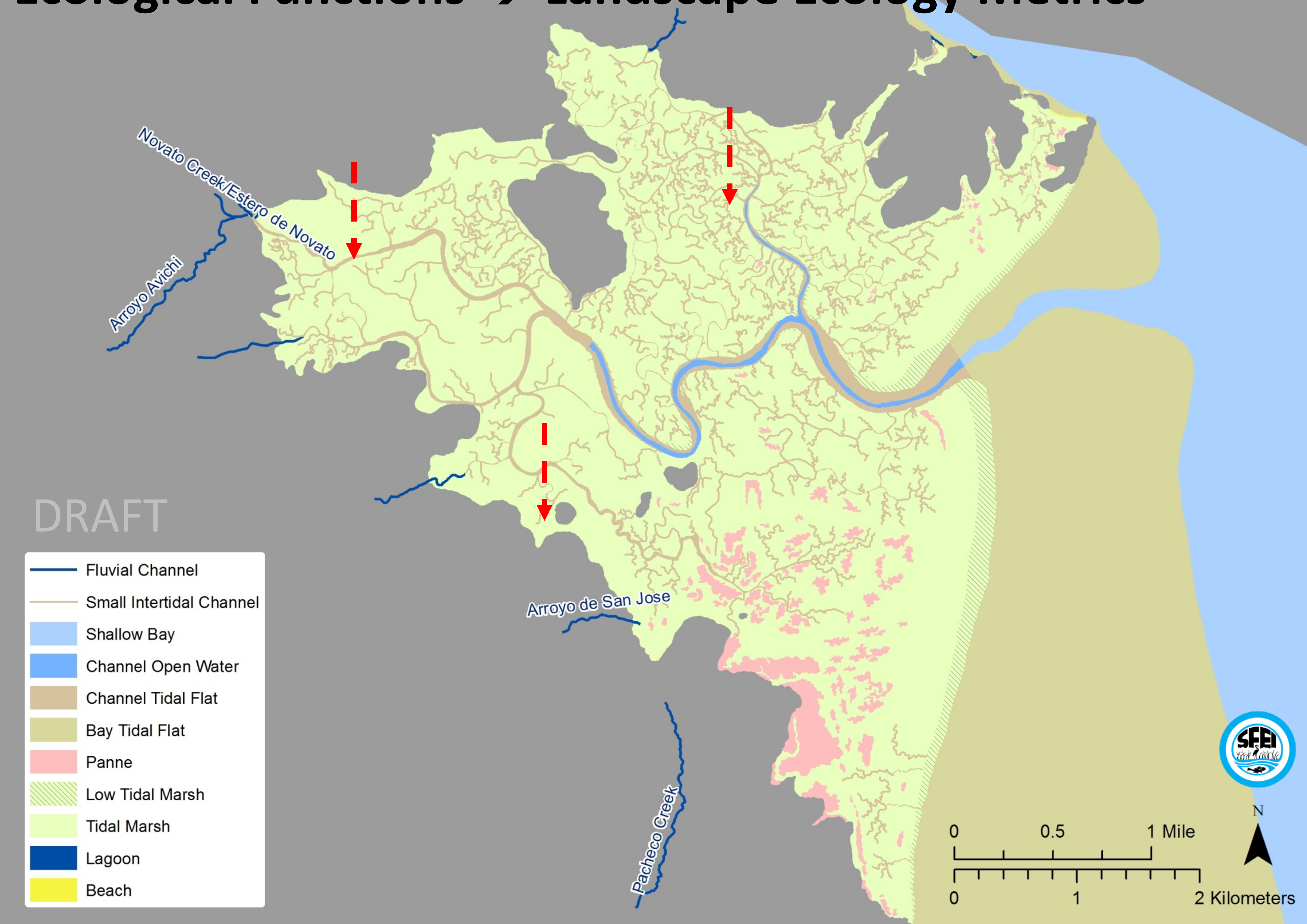

- The highest modeled habitat densities for Clapper Rails are along the western edge of San Pablo Bay, from Petaluma River to China Camp (Liu et al. 2012)

# Historical Steelhead Status
## (Leidy et al., CEMAR)



Novato Creek was one of the last places tidewater goby was found in the Bay before it was extirpated (Leidy 2007)

# Ecological Functions → Landscape Ecology Metrics



Shorebirds
Marsh Birds
Estuarine Fish
Transition Zone (Biodiversity)

*Based on Delta Landscapes and BEHGU Landscape Ecology Analyses*

# Shorebirds

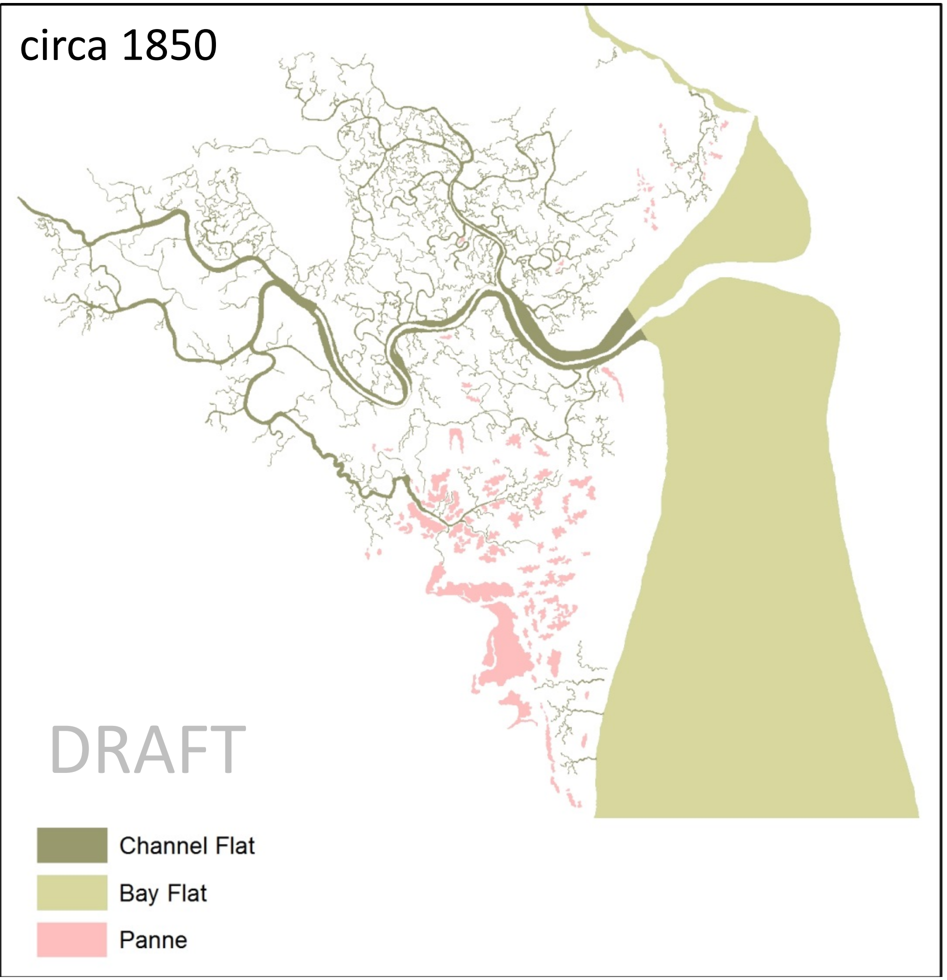
including sandpipers, dowitchers, curlews, avocets, stilts, godwits

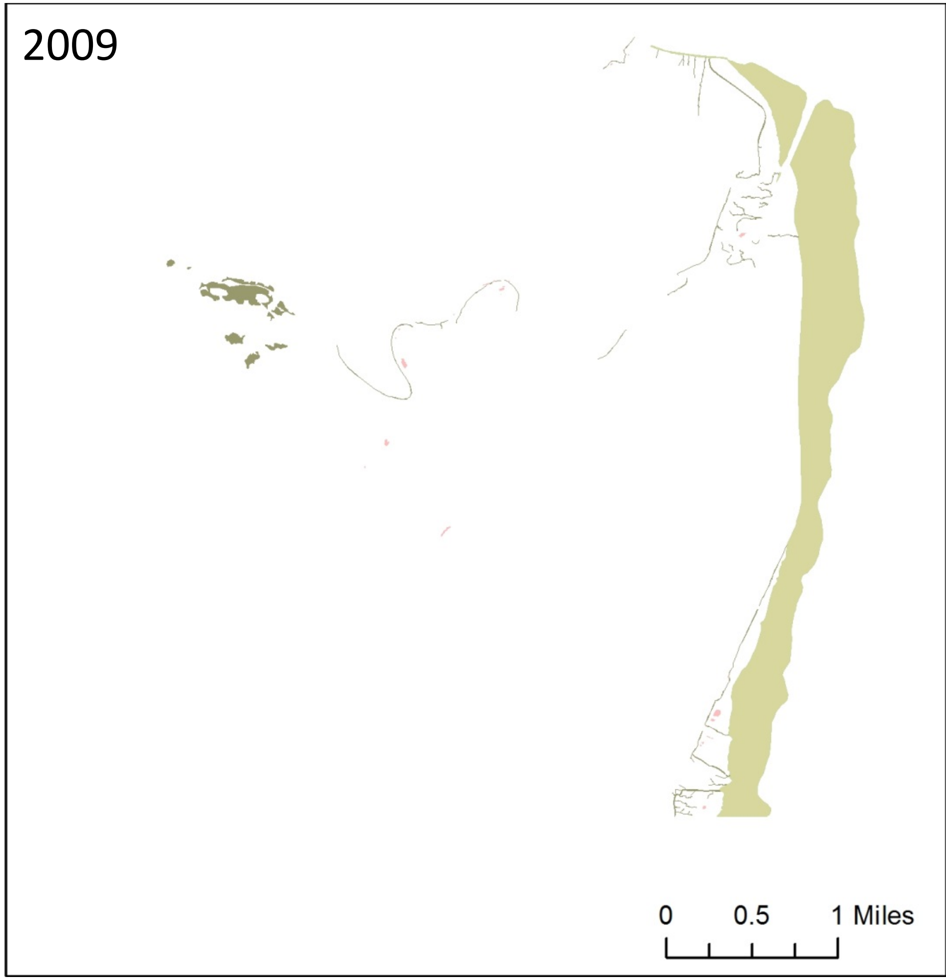
# Overview: Shorebirds

- Shorebirds forage on intertidal mudflats and pannes

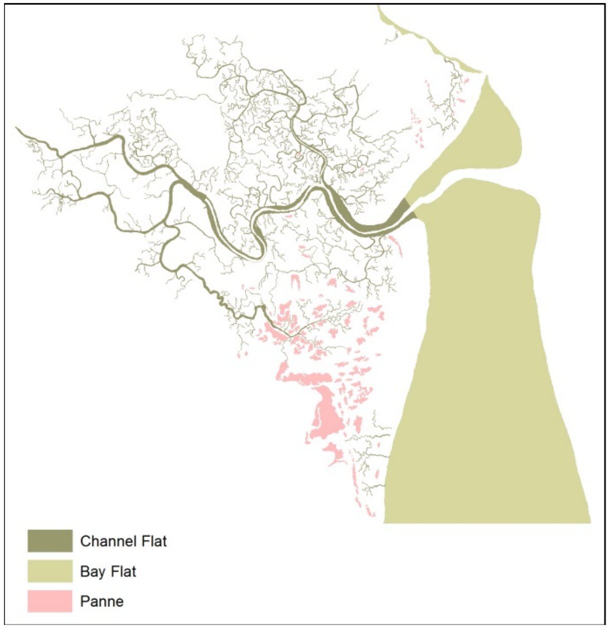
- Historical mudflats included most of the tidal channel network

# Shorebird foraging: Flats

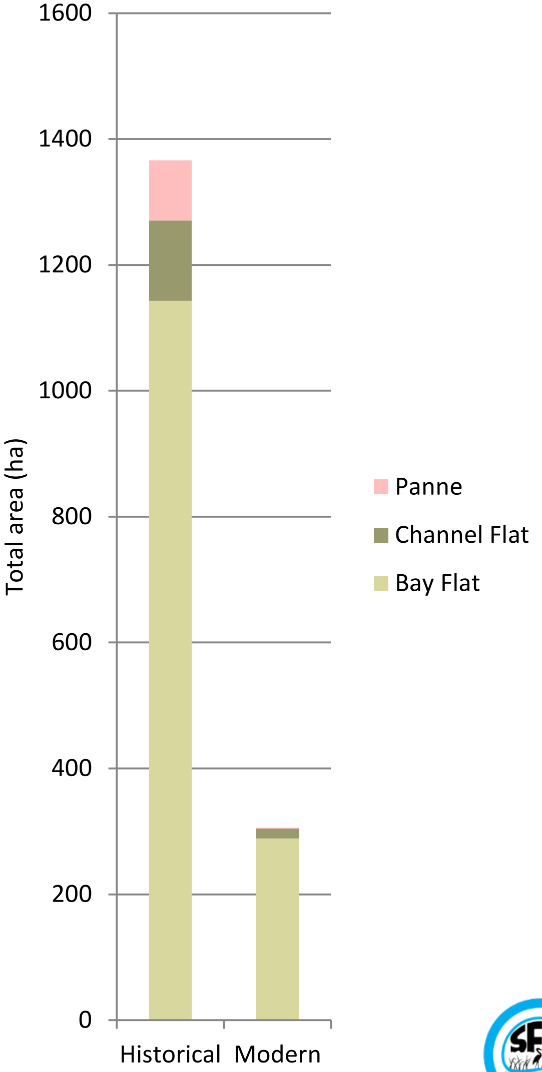


# Area by Type








DRAFT

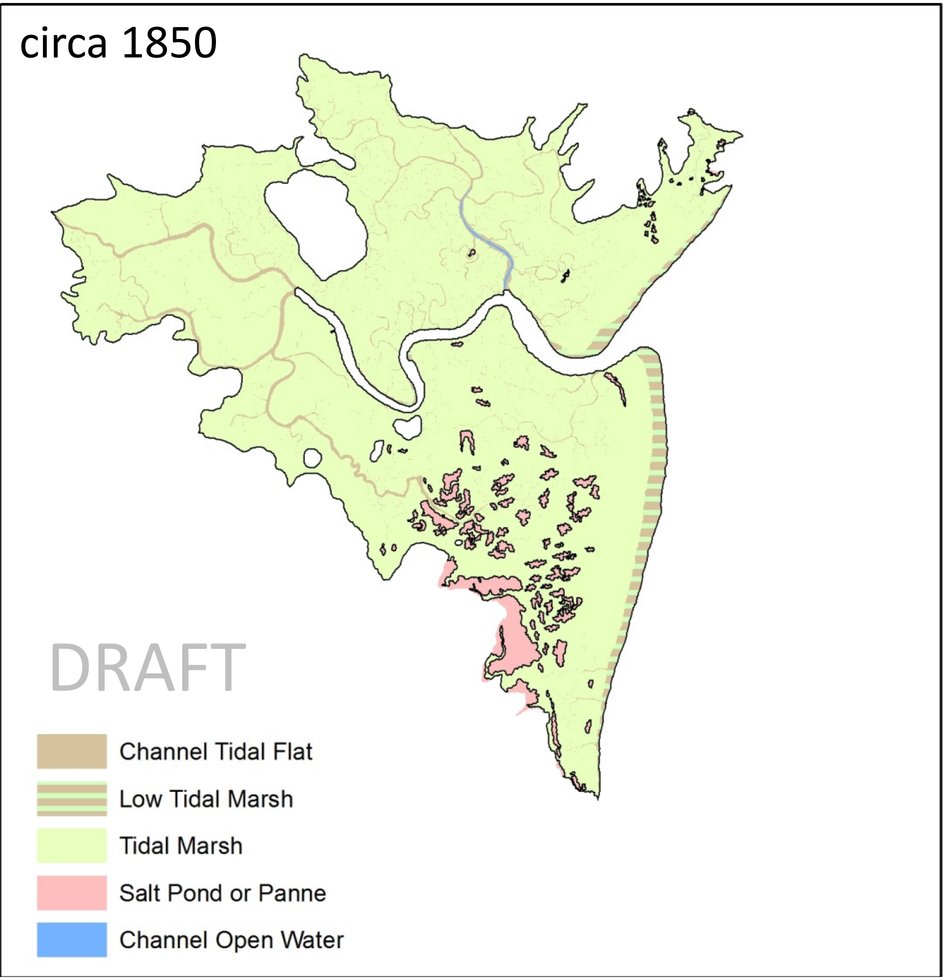
| Habitat Class | Historical area (ha) | Modern area (ha) |
|---|---|---|
| Bay Flat | 1143 | 289 |
| Channel Flat | 128 | 15 |
| Panne | 95 | 2 |

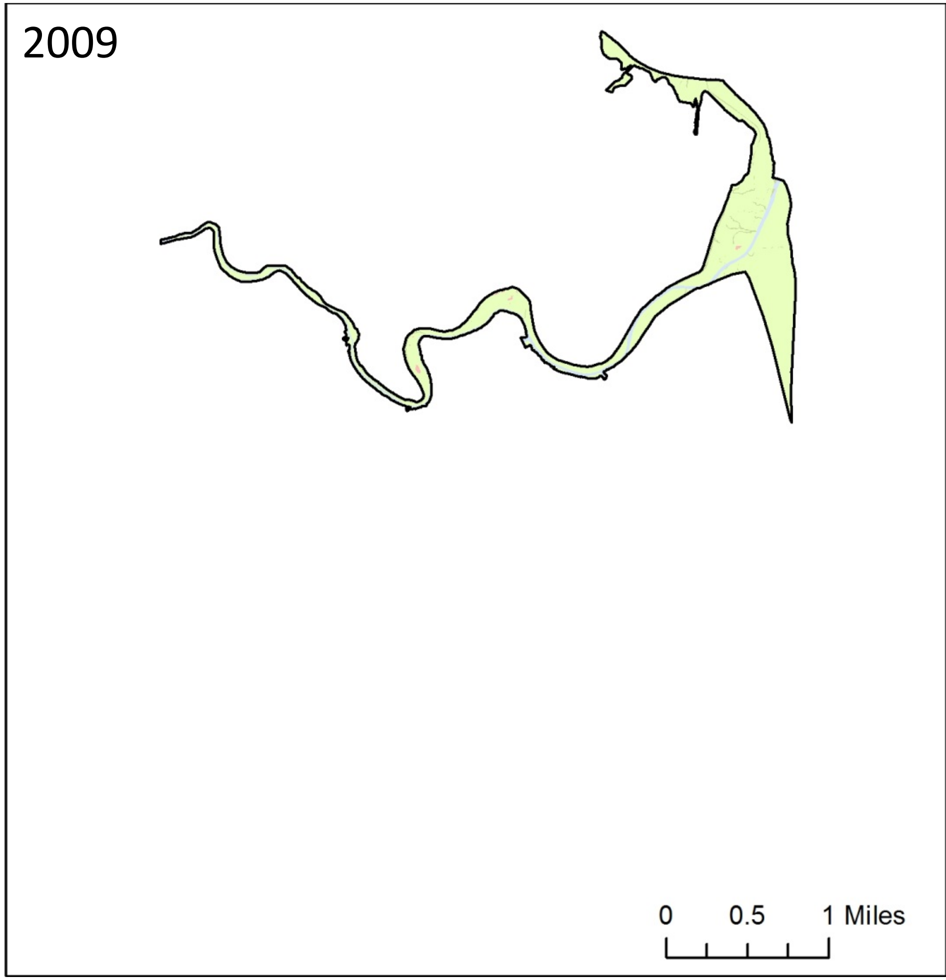
# Marsh Birds

California clapper rail, black rail

# Tidal Marsh for Rails

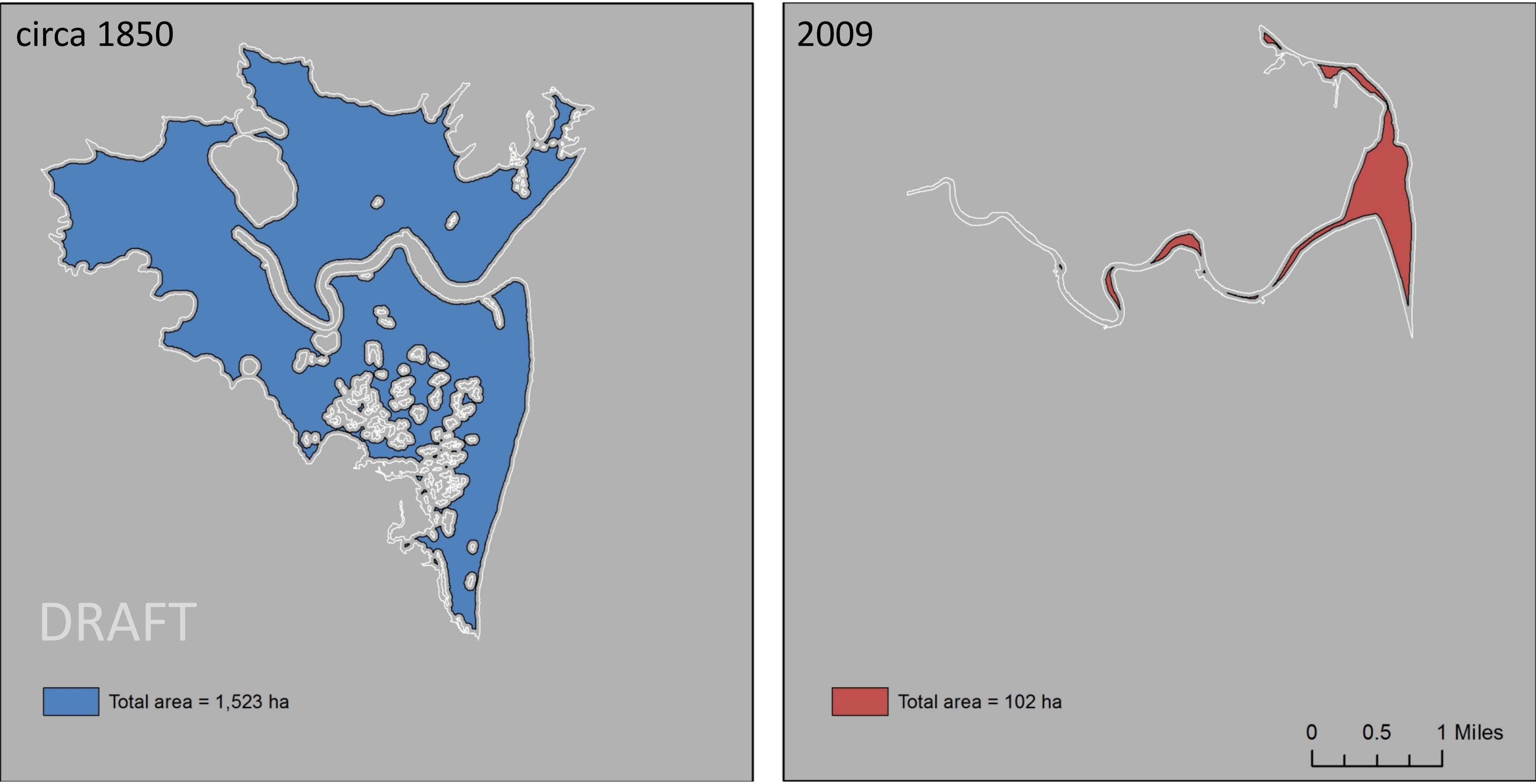
Including Low Marsh, and Channels/Flats < 200ft wide. Excluding Pannes



# Marsh Core Area

(50m internal buffer)

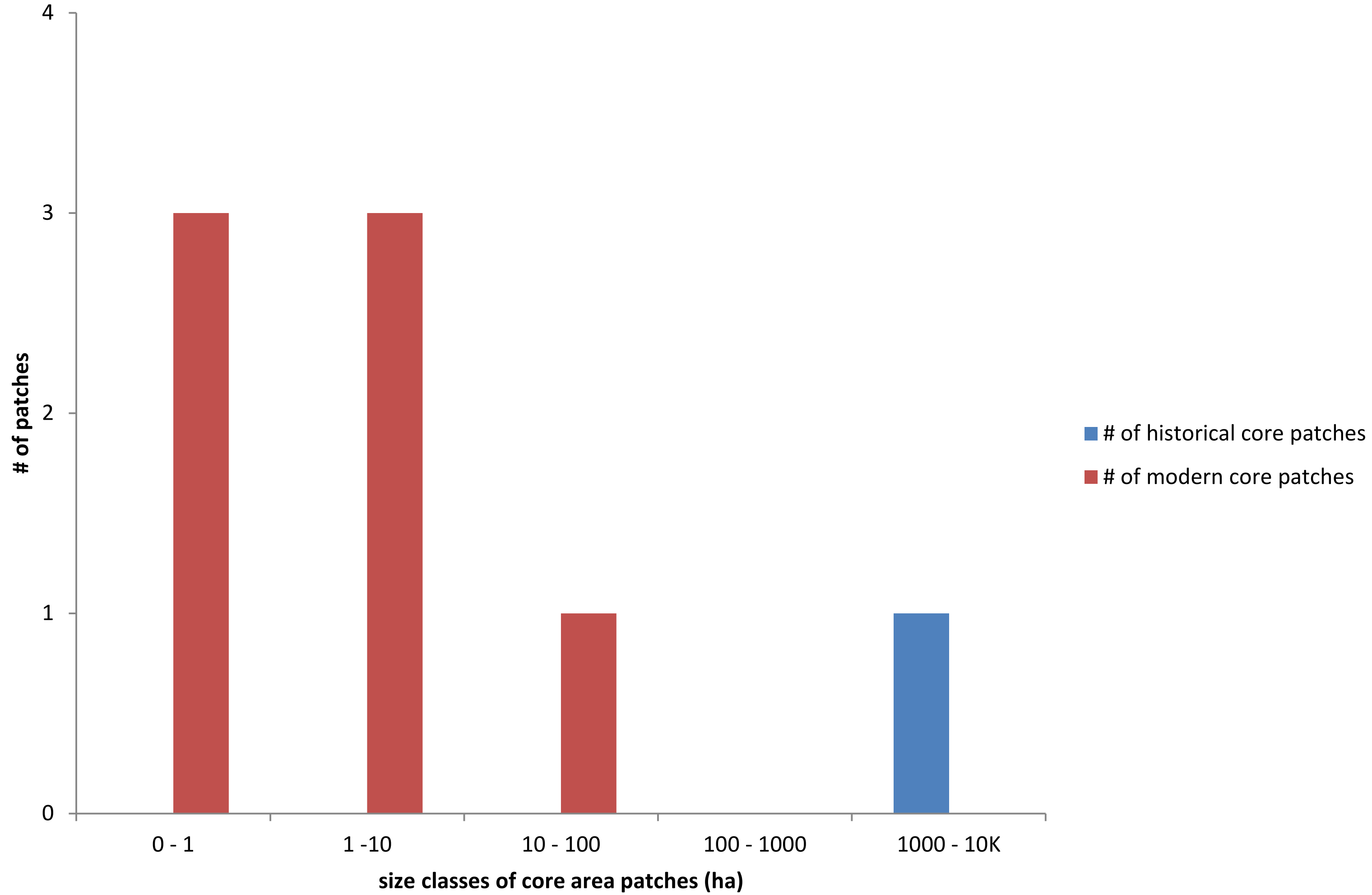



Historical: 1 large patch

Modern: 7 smaller patches

# Core area size distribution

more core patches today, but much smaller




DRAFT

# Estuarine Fish

rainbow trout/steelhead
three-spined stickleback
California roach
Sacramento pikeminnow
prickly sculpin
tidewater goby (now extirpated)
(Leidy 2007)

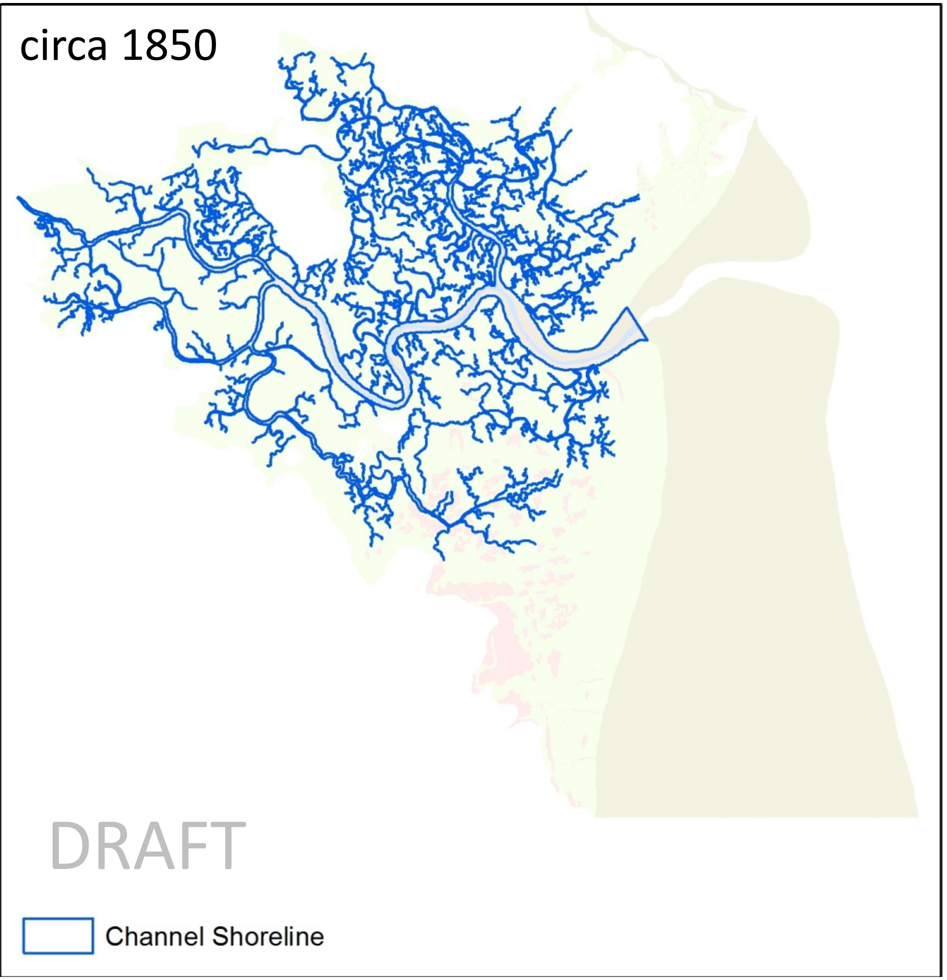
# Shoreline Length by Adjacent Marsh polygon size

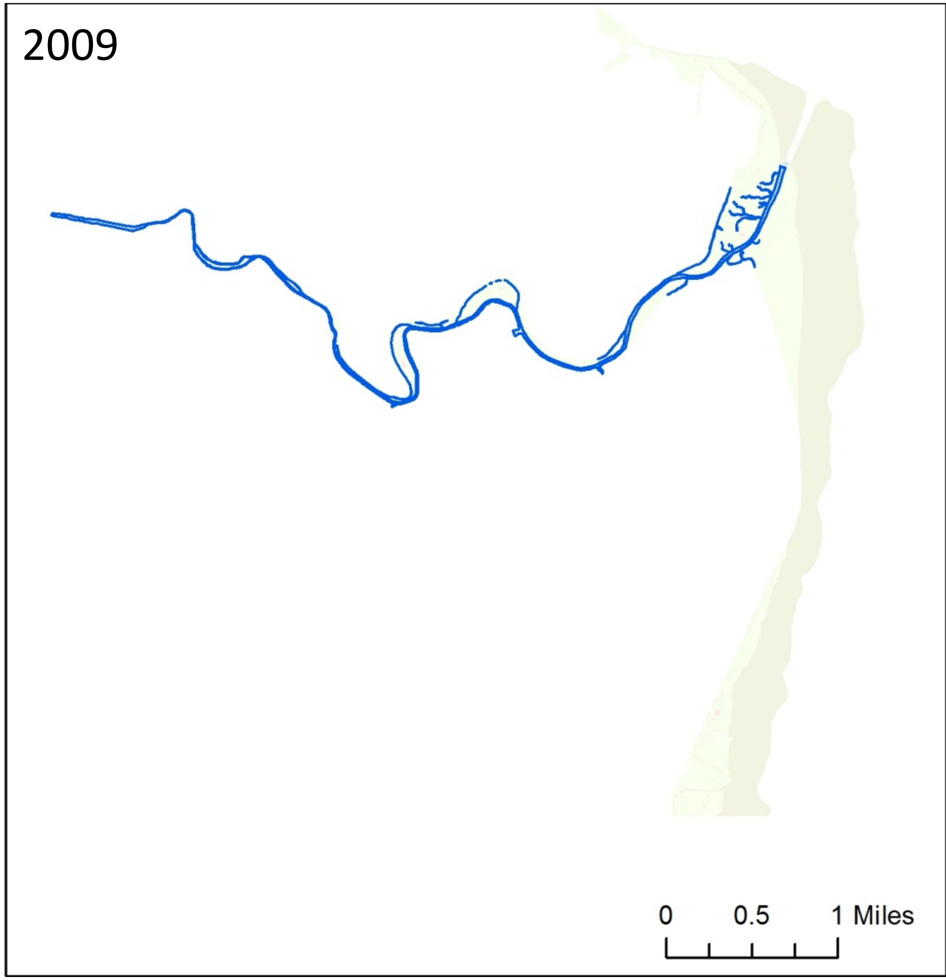
- Shoreline length (channel edges) provides important functions for estuarine fish:
  - Hiding places
  - Shelter from strong currents
  - Adjacent marshes provide food

- Larger adjacent marshes provide more

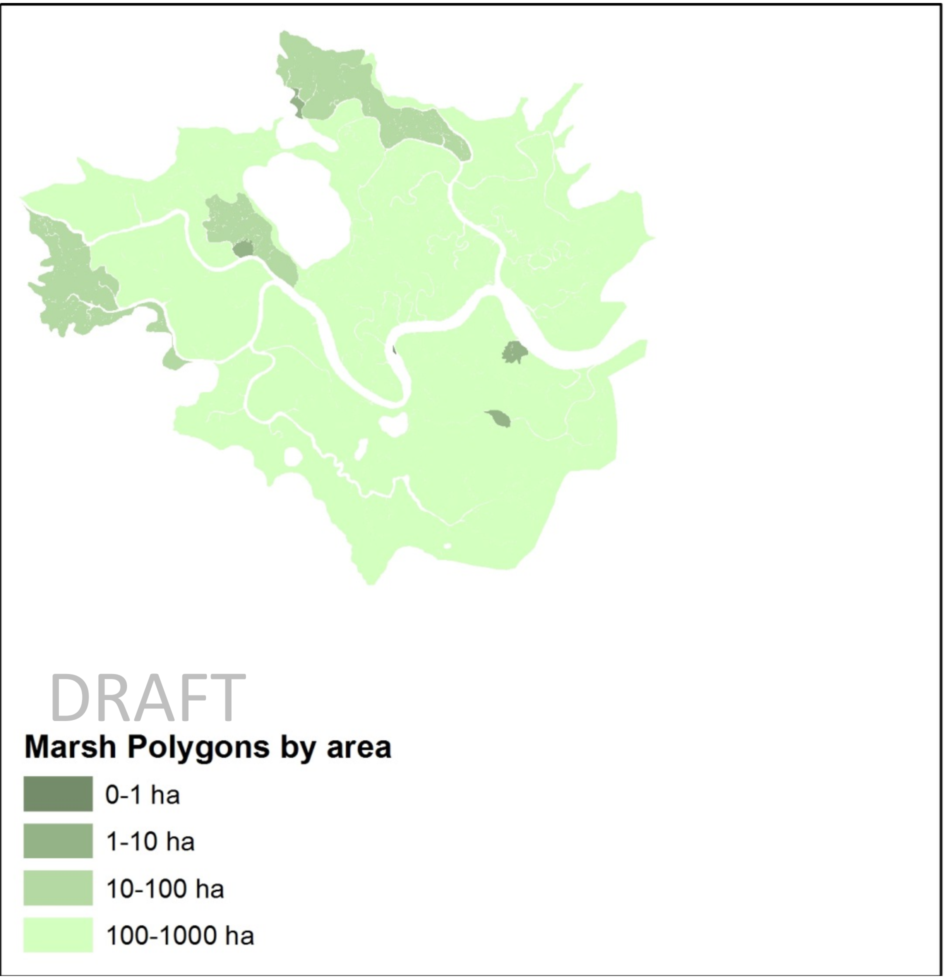
- Metric: shoreline length by adjacent marsh polygon size
  - reflects both services

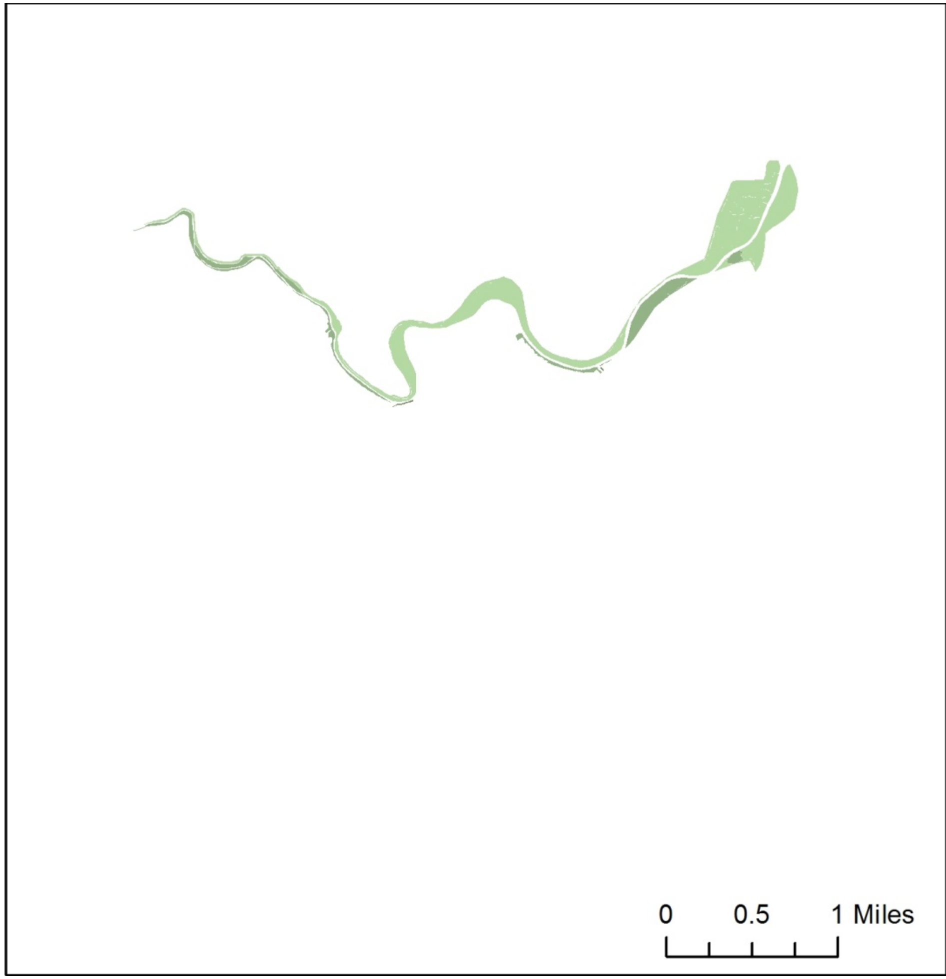
# Shoreline Length



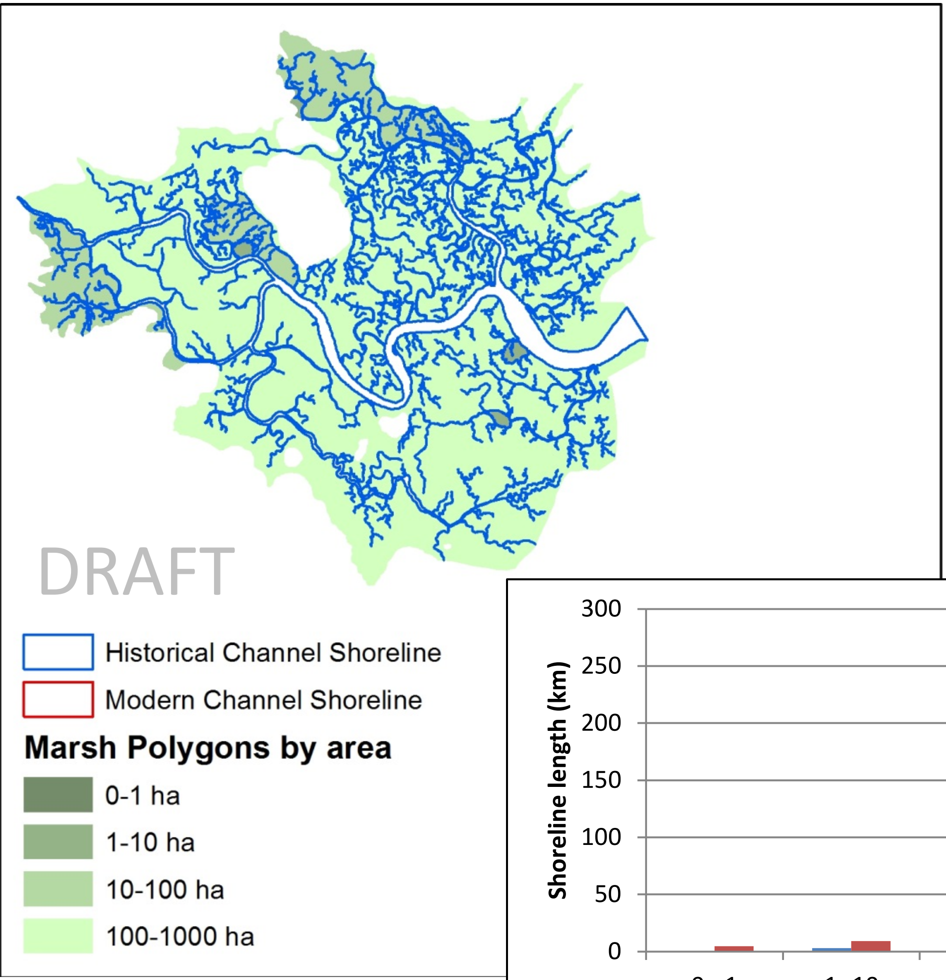



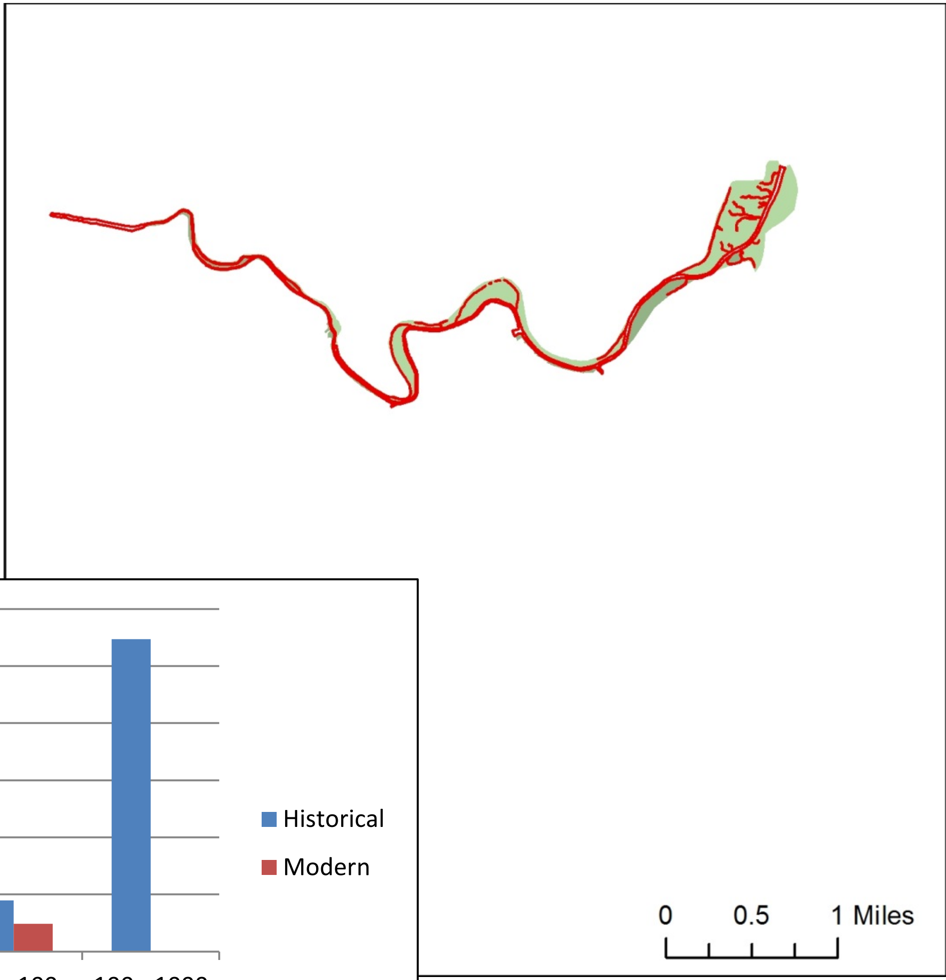
# Adjacent Marsh polygon sizes

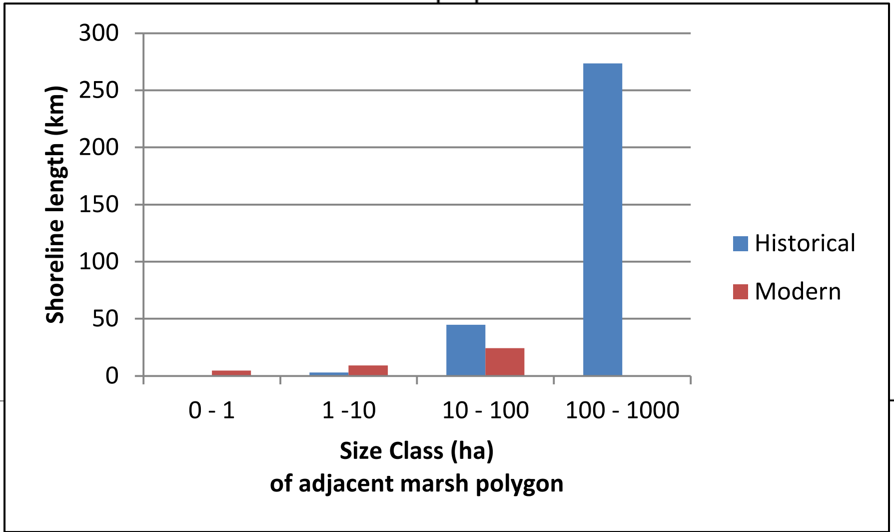


# Shoreline Length by Adjacent Marsh polygon size



# Transition Zone

Tidal – Terrestrial interface

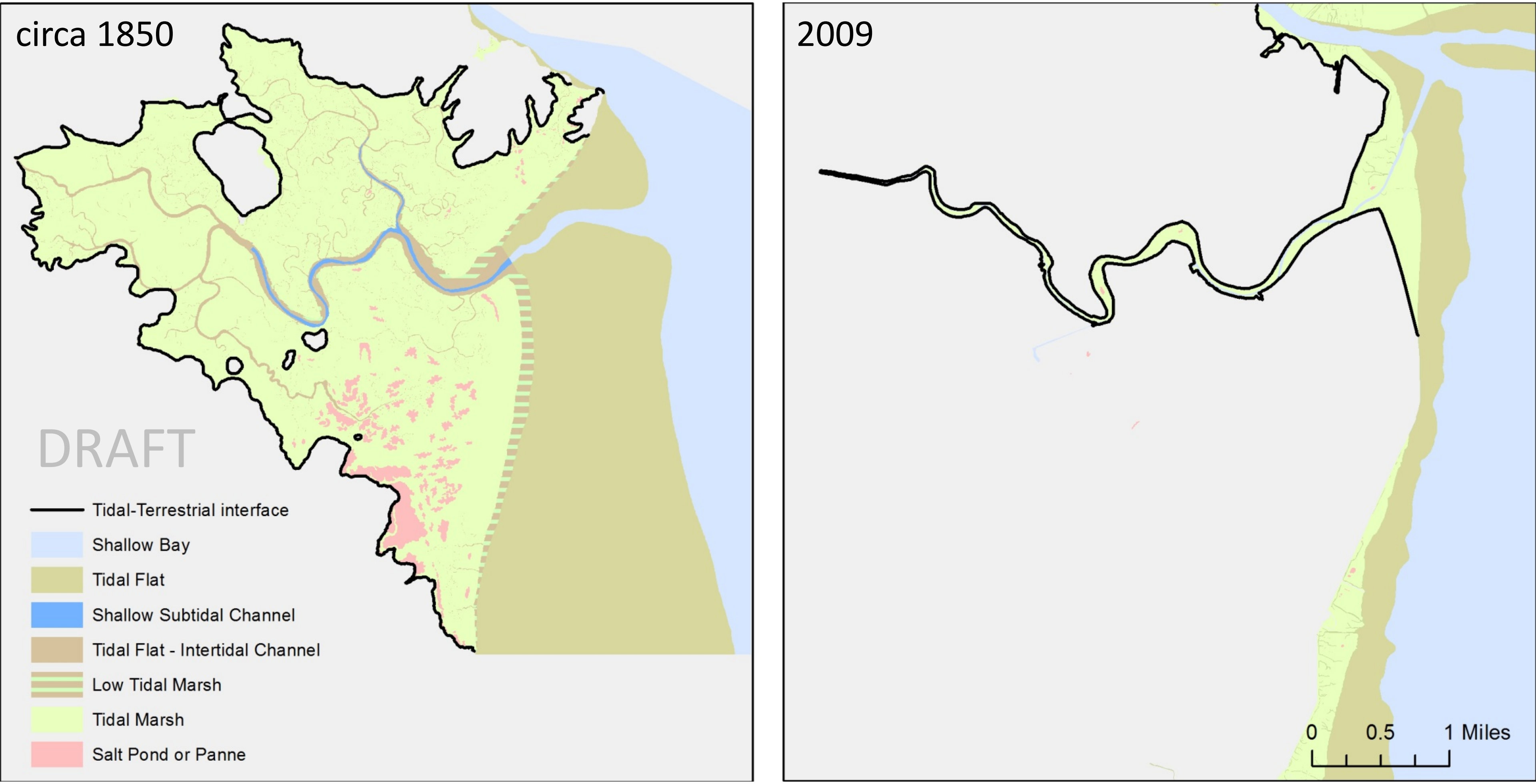
- Salt Marsh Harvest Mice and other small mammals use the Tidal-Terrestrial interfaces as refugia during high and extreme high tides

- Link to terrestrial species

- In the Bay, interfaces between fluvial systems and tidal marshes were often historically broad (100s or 1000s of meters) and have largely been developed

- The large number of bedrock islands within Tidal Marsh is typical for eastern Marin, but somewhat rare in other parts of the Bay

# Tidal-Terrestrial Interface



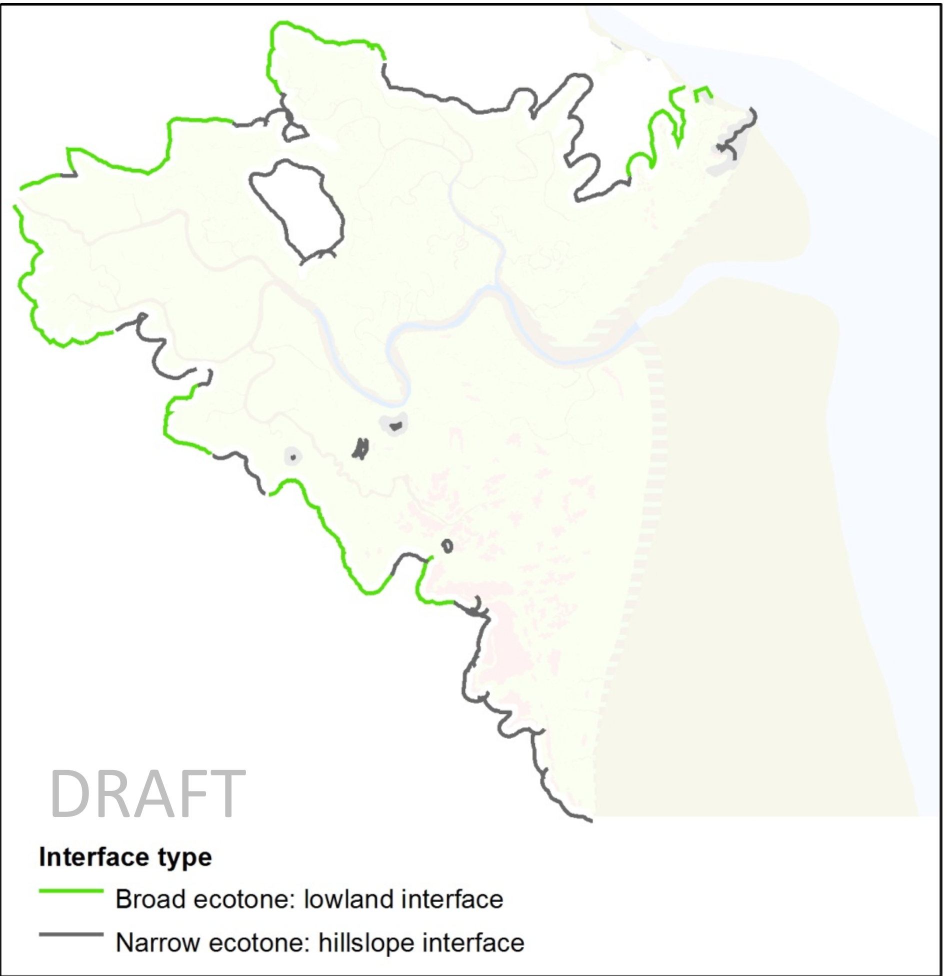
# About the Interfaces

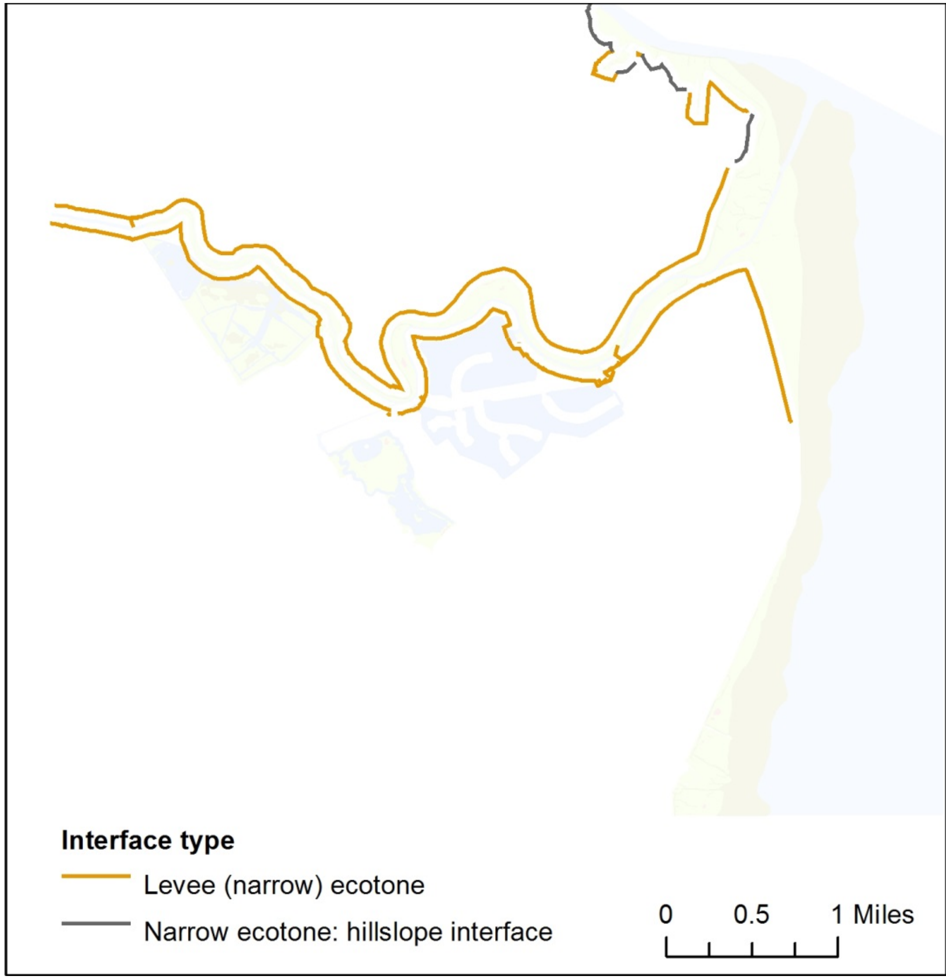
- Low-gradient transition zone: bottom/alluvial land<->tidal marsh
  - Broad lowland interface
  - herbaceous vegetation
  - potential freshwater wetlands

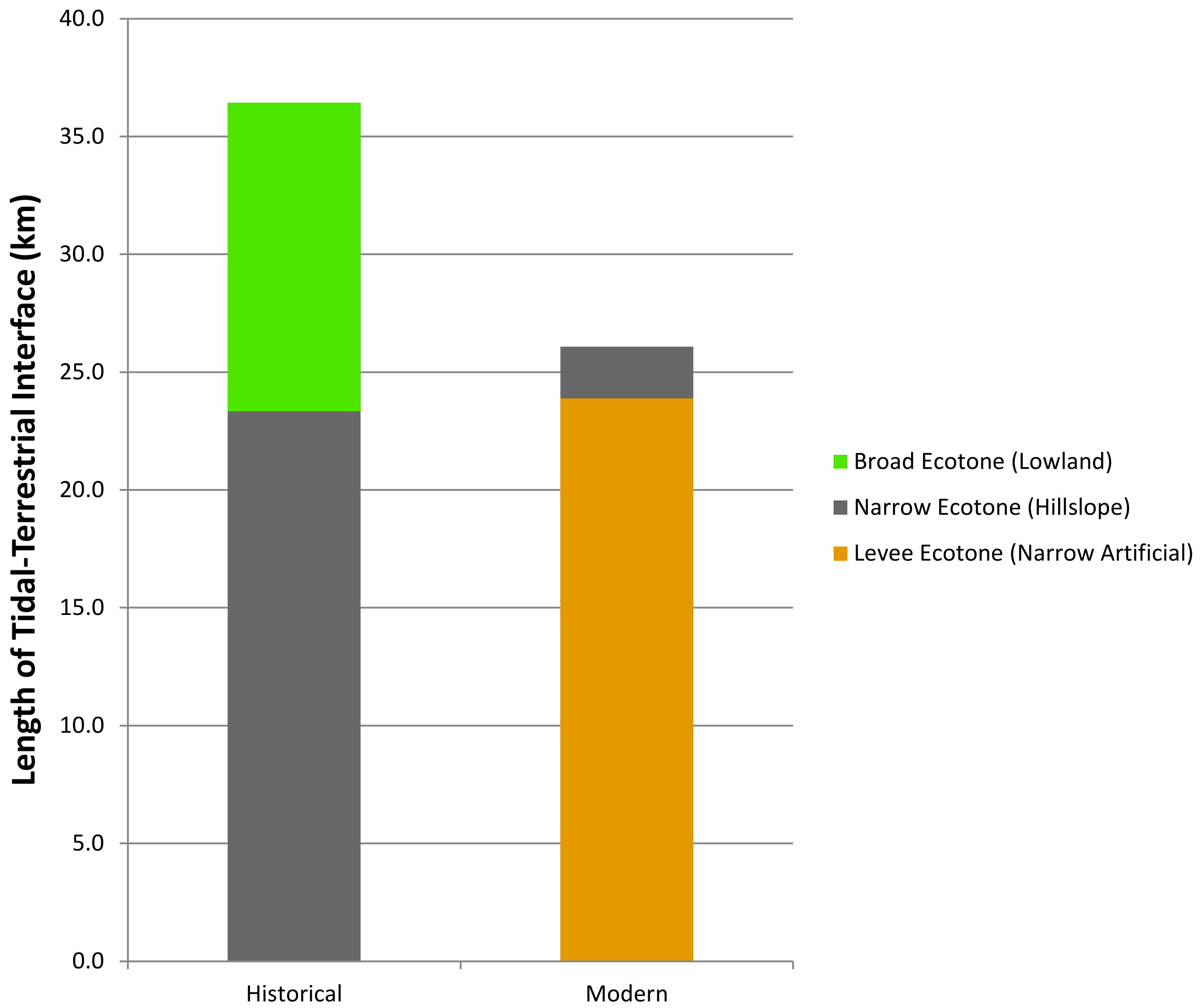
- Steeper transition zone: hillslope<->tidal marsh
  - steep vegetated slopes, oaks, grassland

- Levees: artificial levee/dike-tidal marsh
  - dry, upland vegetation including non-natives and invasives typical
  - may be topped by roads
  - Normally steep-sloped (narrow T-zone)
  - Could be constructed with gentle slopes (broader T-zone)

# T-zone types


DRAFT
Interface type
Broad ecotone: lowland interface
Narrow ecotone: hillslope interface


Interface type
Levee (narrow) ecotone
Narrow ecotone: hillslope interface
0 0.5 1 Miles


Length of Tidal-Terrestrial Interface (km)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Historical
Modern
Broad Ecotone (Lowland)
Narrow Ecotone (Hillslope)
Levee Ecotone (Narrow Artificial)

# Potential Baylands Landscape Ecology Design Elements

Freshwater-brackish tidal marsh
Tidal marsh with high density channel networks
Poorly drained tidal marsh with large pannes
Wave-built high marsh terrace

Bay flats
Channel flats

Core marsh areas
Tidal marsh channels adjacent to large marsh patches
Low gradient and steeper tidal-terrestrial transition zones

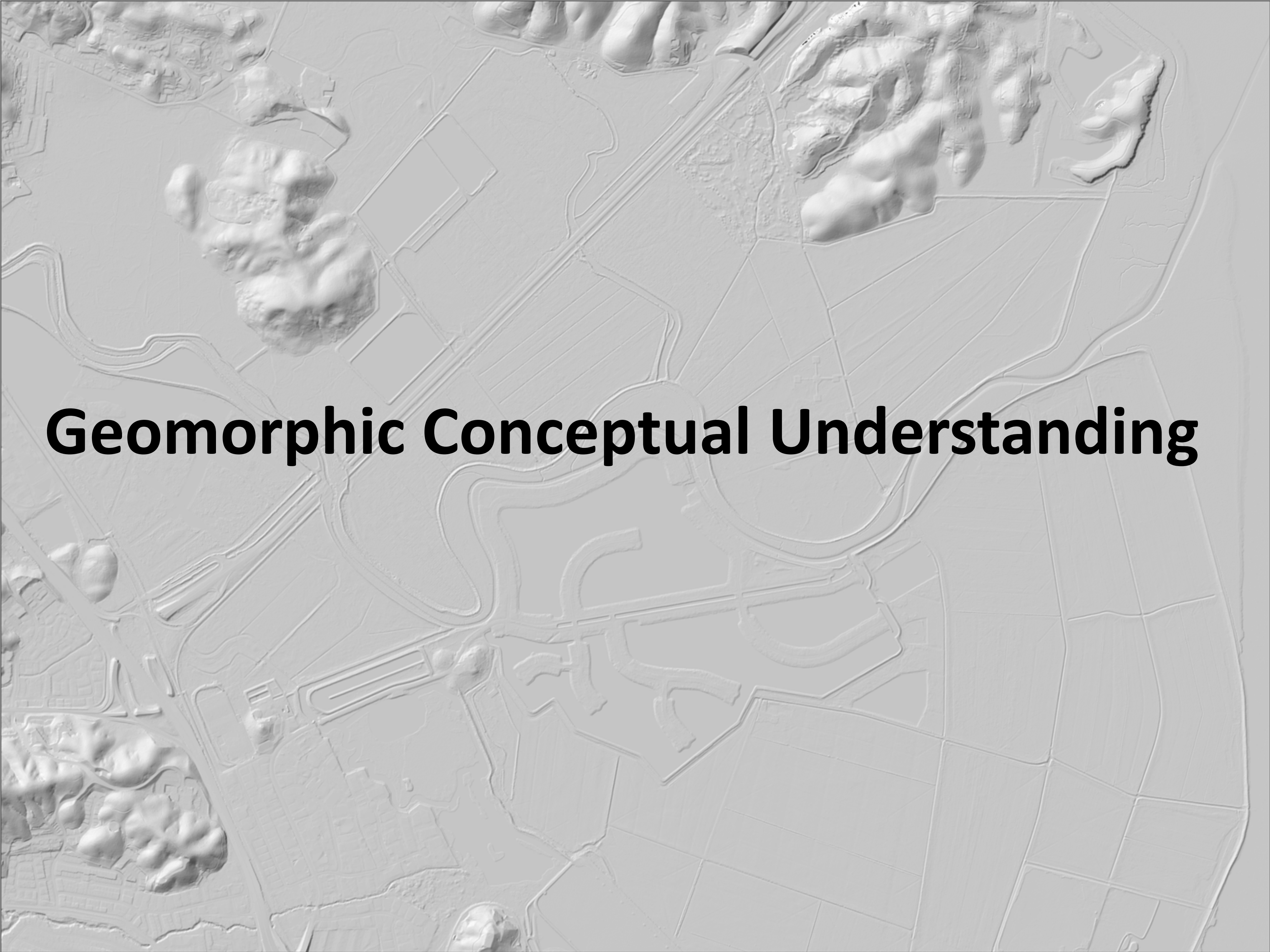
# Goals Project (1999): Unique restoration opportunities

- major expansion of <u>California clapper rail</u> into very wide marshes
- enhance tidal marsh in areas where natural <u>marsh/upland transitions</u> can be restored
- expand and reintroduce populations of <u>rare plant species</u> (e.g Point Reyes bird’s-beak and johnny-nip
- enhance <u>flood protection</u> in the Novato Creek area by expanding tidal prism
- treated wastewater : opportunity to develop freshwater managed wetlands for waterfowl

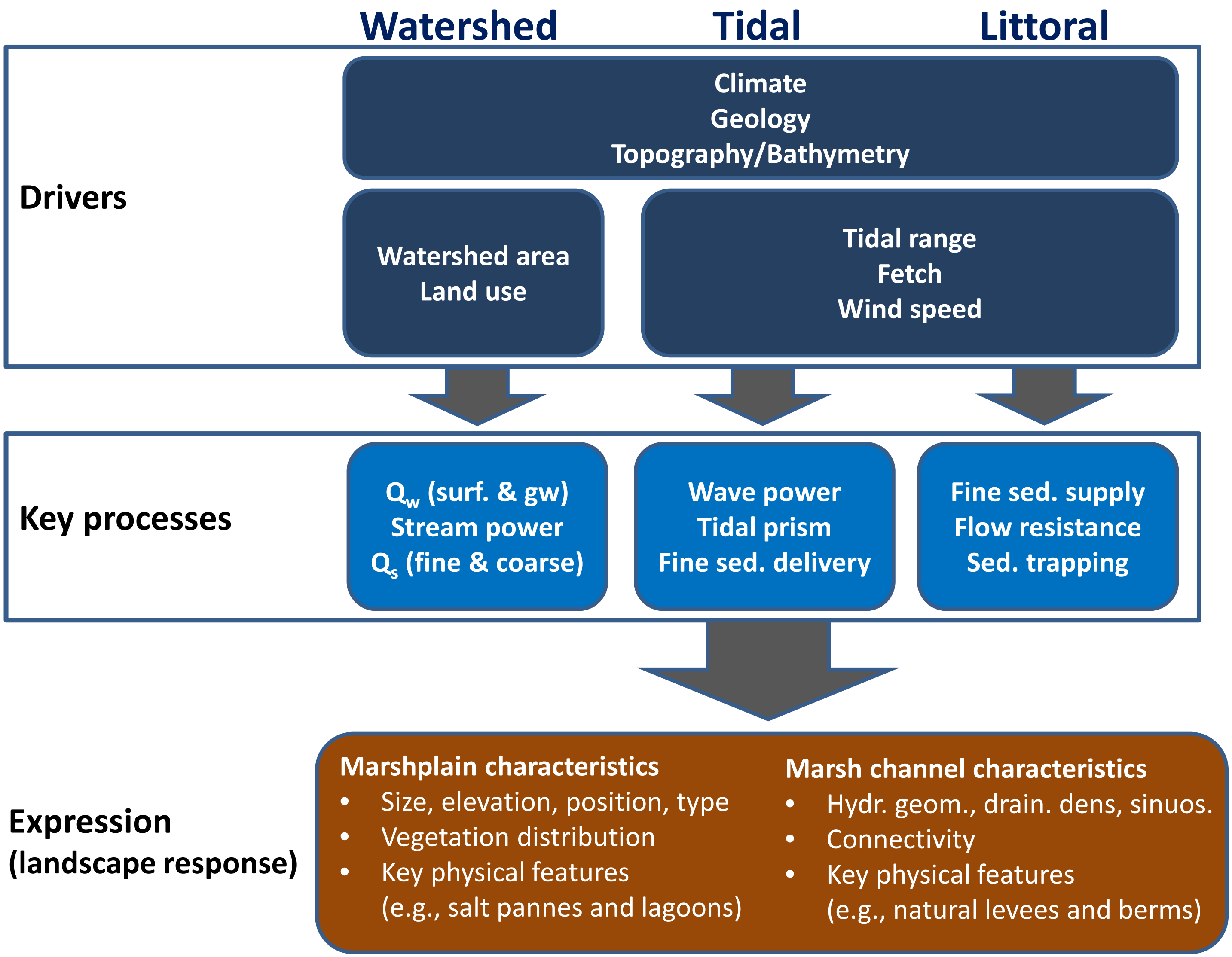
# Goals Project (1999): Recommendations

- between Black Point and Gallinas Creek, and along Gallinas Creek and Novato Creek.
  - Restore a <u>wide, continuous band of tidal marsh</u> along the bayfront
  - Ensure a <u>natural transition to uplands</u> throughout
  - provide an <u>upland buffer</u> outside the baylands boundary.
- Establish managed marsh or enhanced seasonal pond habitat on agricultural baylands that are not restored to tidal marsh.

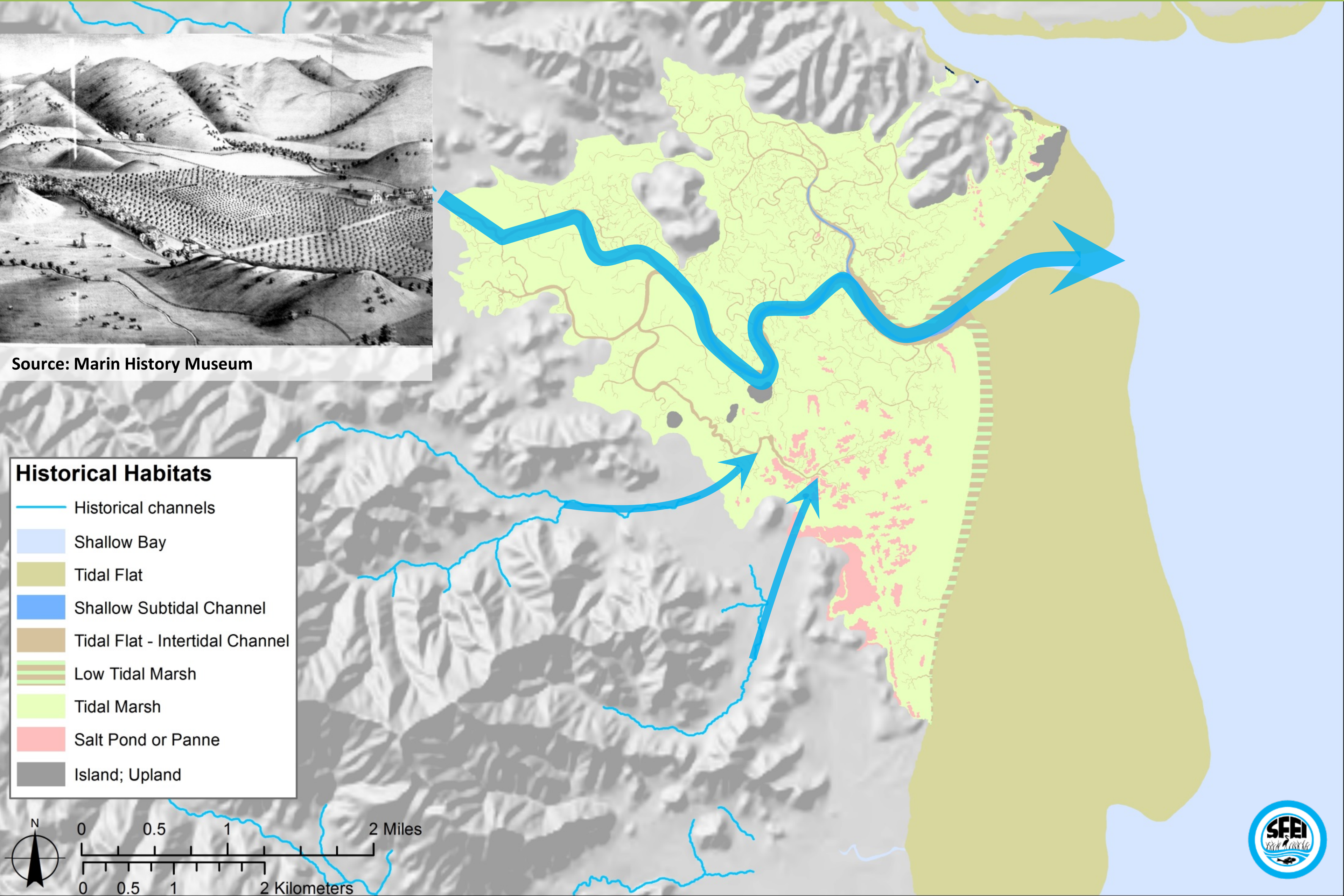
# Geomorphic Conceptual Understanding



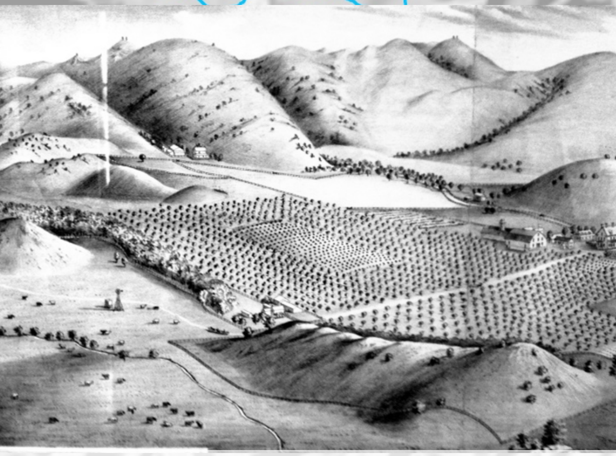
# Conceptual Framework for Marshland Establishment & Evolution



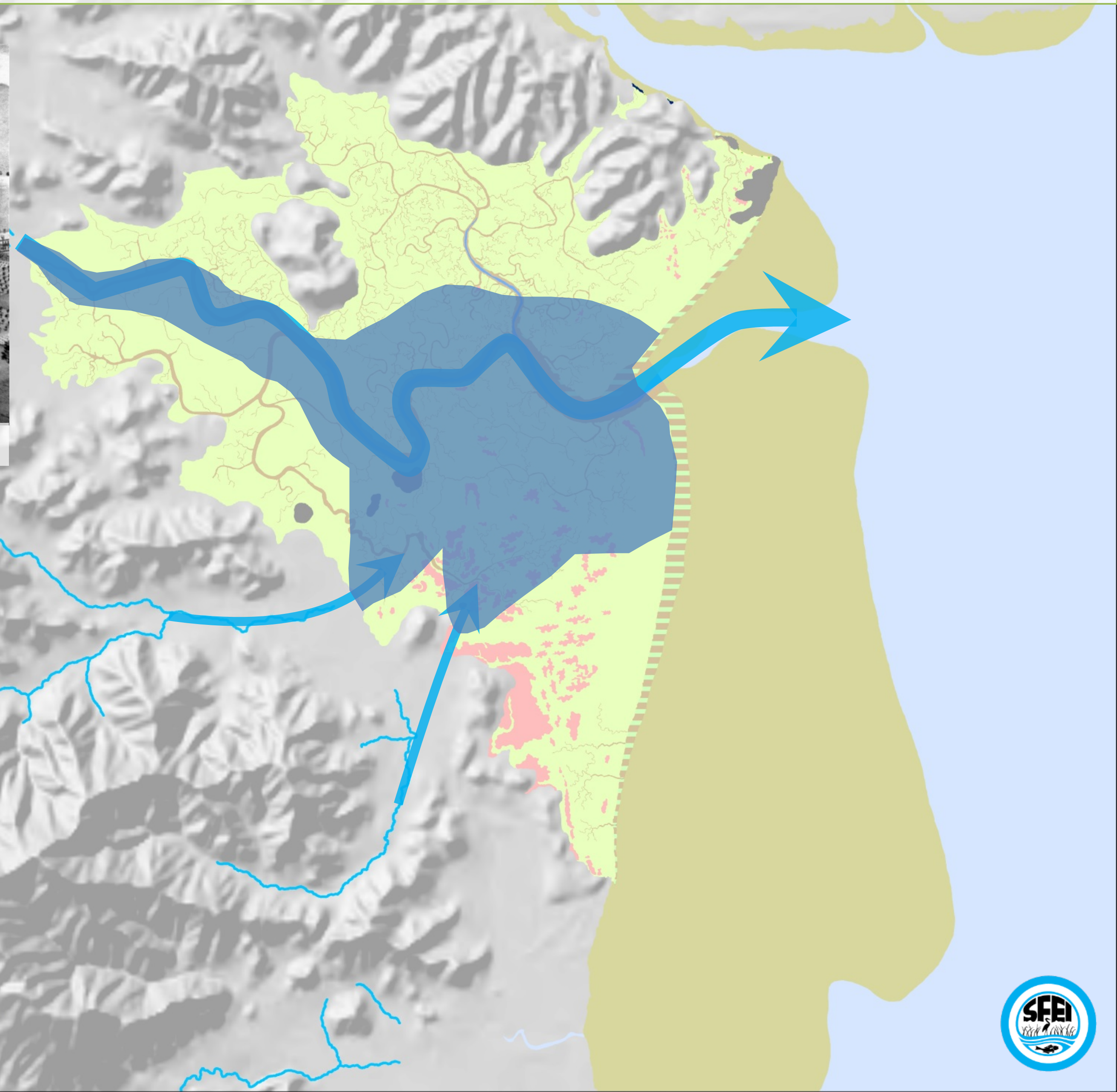
# Historical Watershed Processes: $Q_{sed}$ & $Q_{water}$



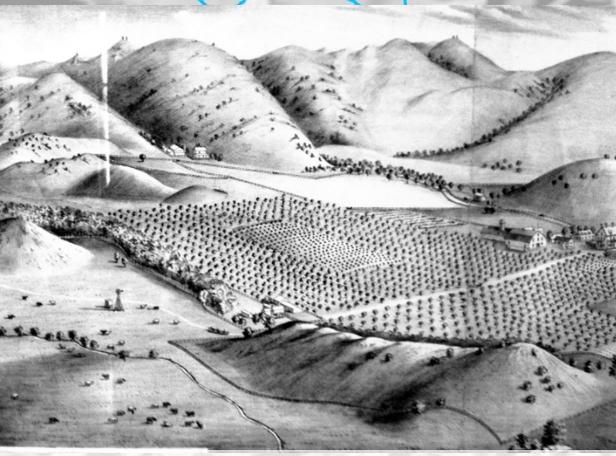
# Historical Watershed Processes: $Q_{sed}$ & $Q_{water}$



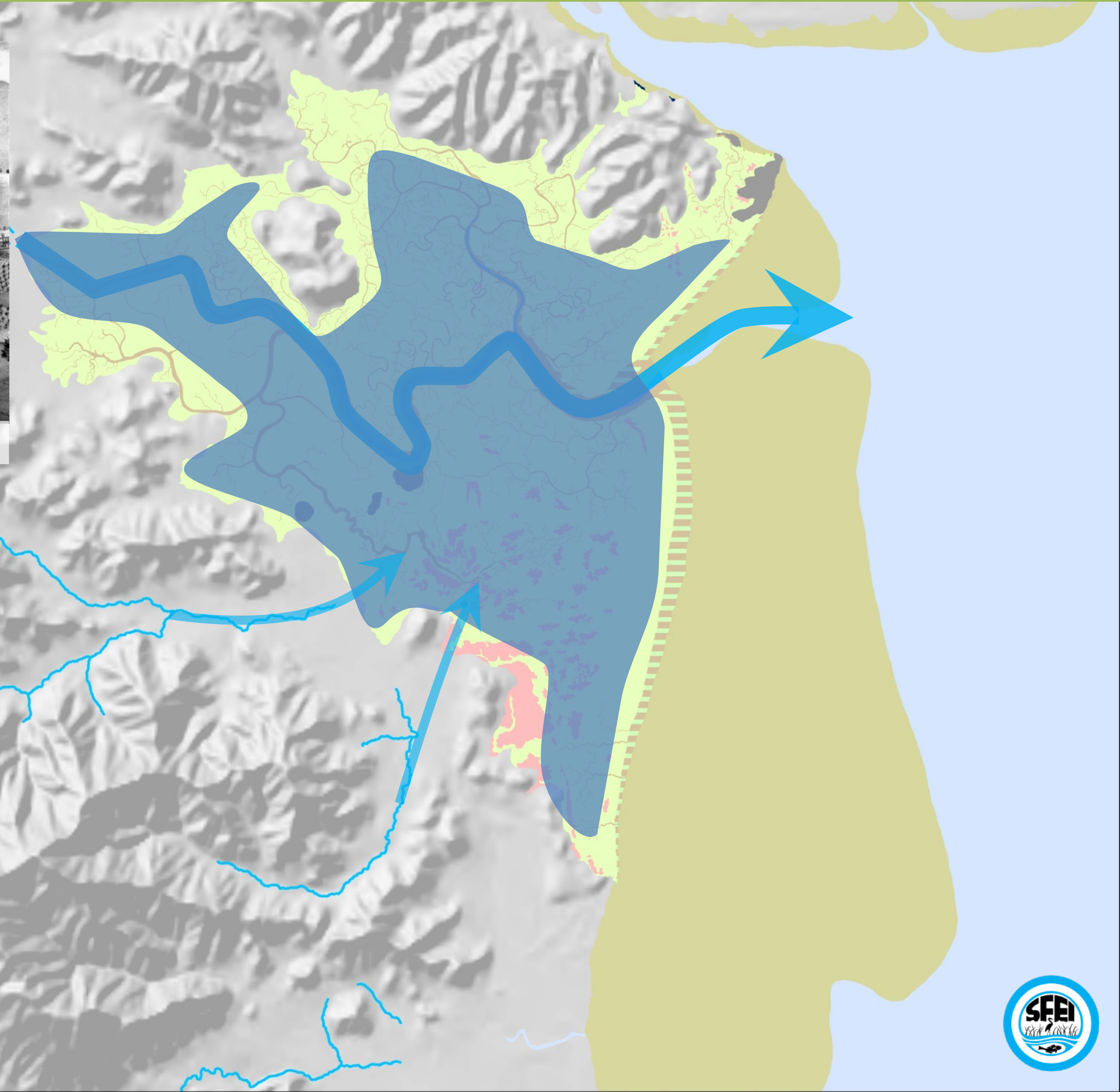
Source: Marin History Museum



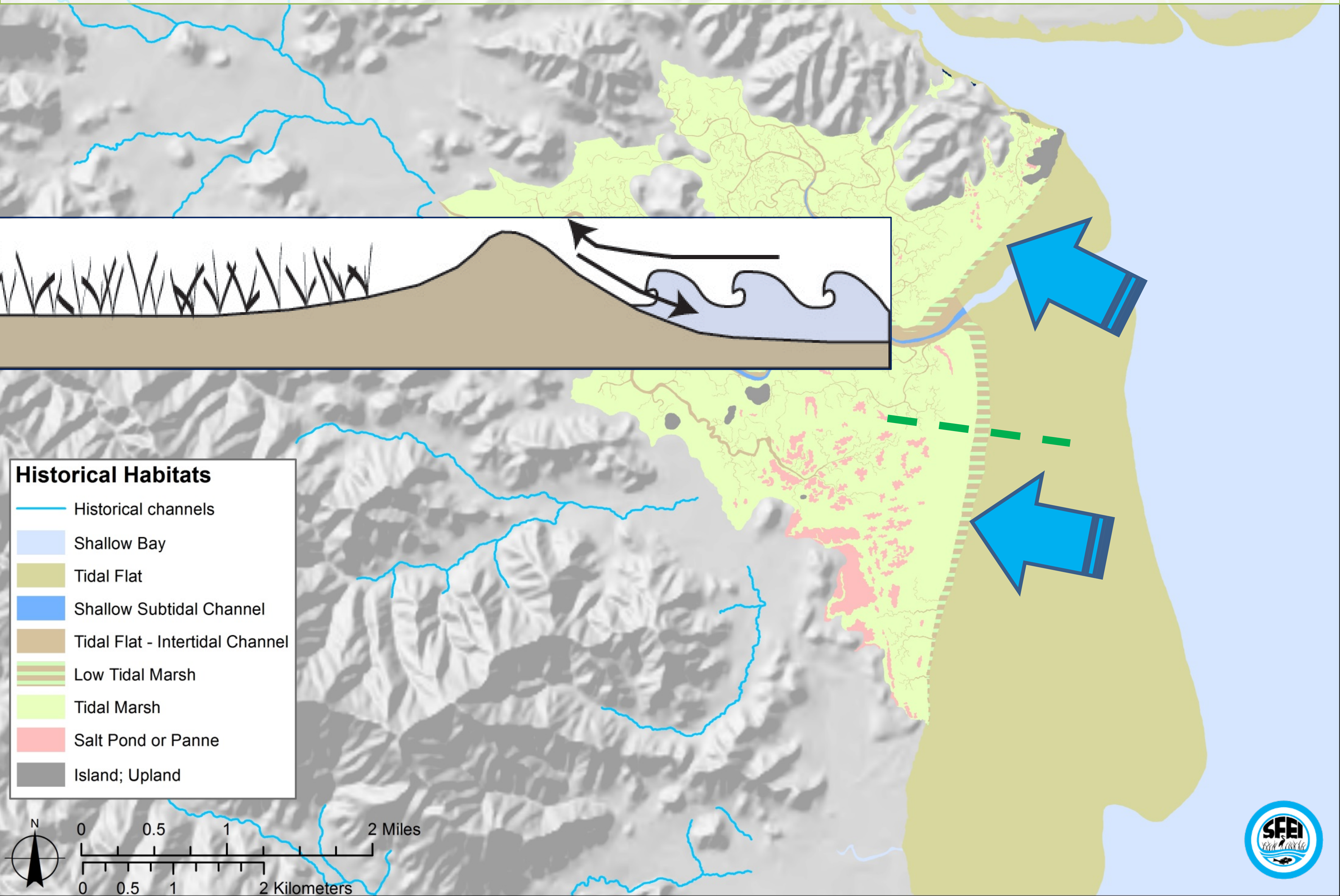
# Historical Watershed Processes: $Q_{sed}$ & $Q_{water}$



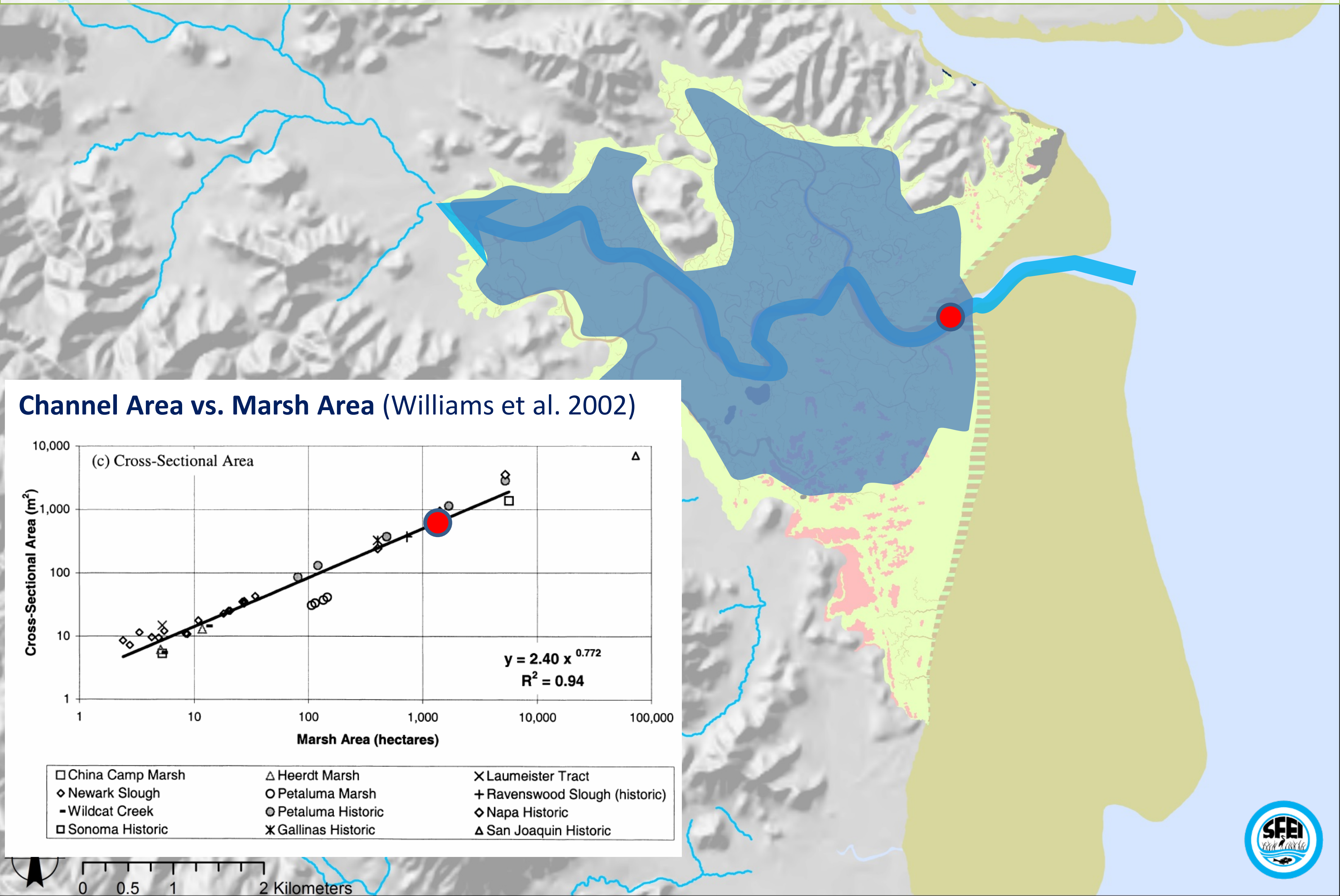
Source: Marin History Museum



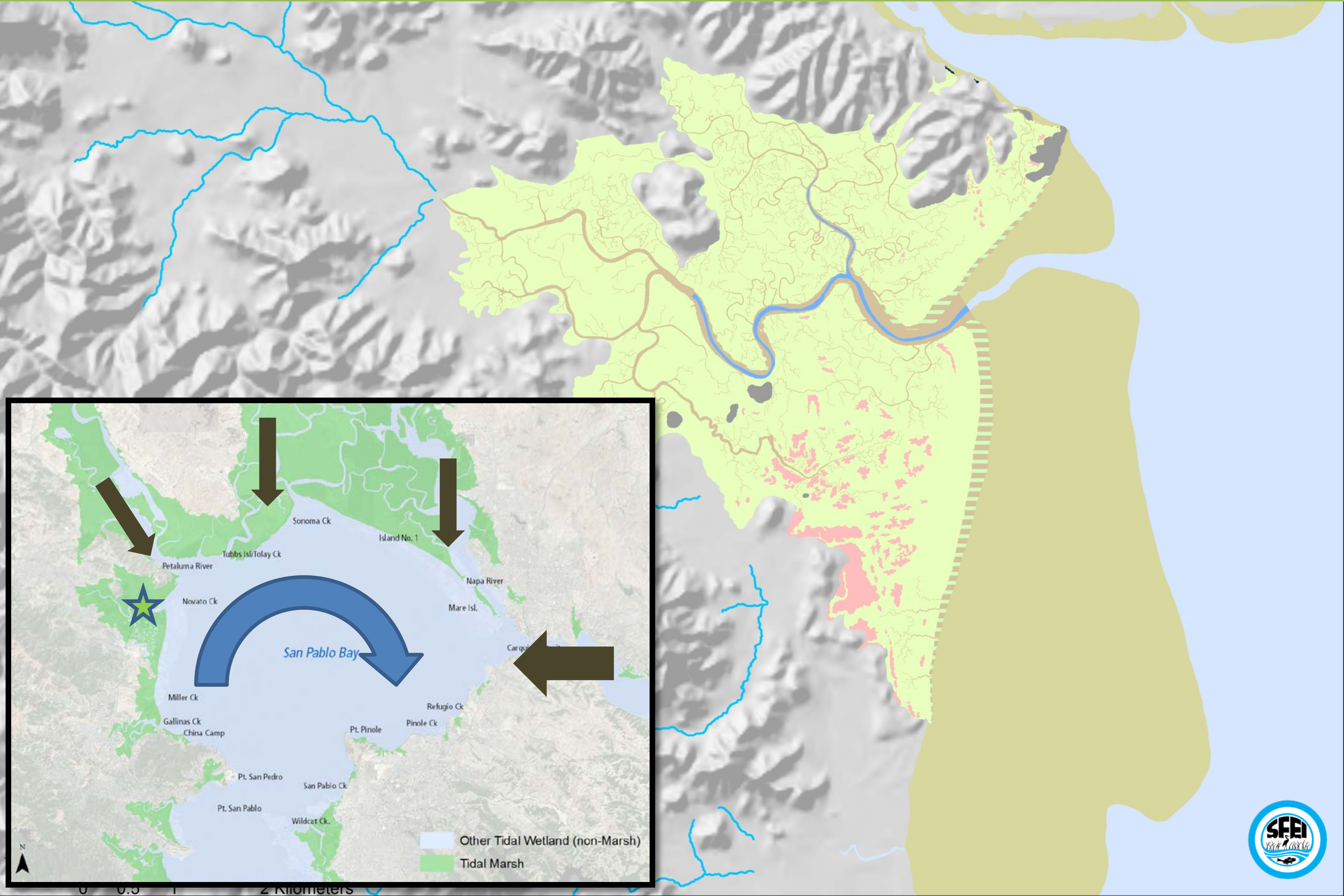
# Historical Tidal Processes: Wave Power & Tidal Prism



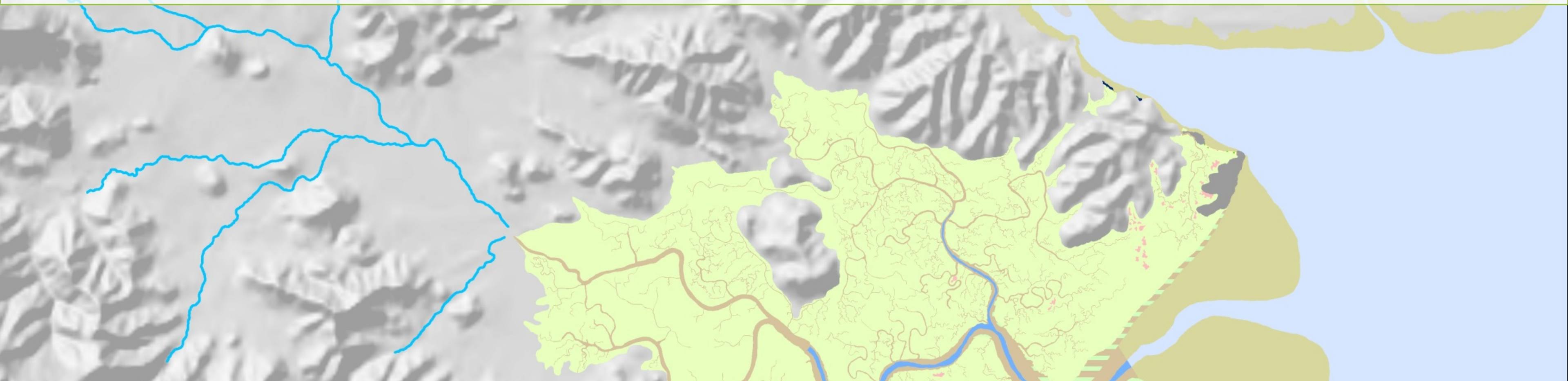
# Historical Tidal Processes: Wave Power & Tidal Prism



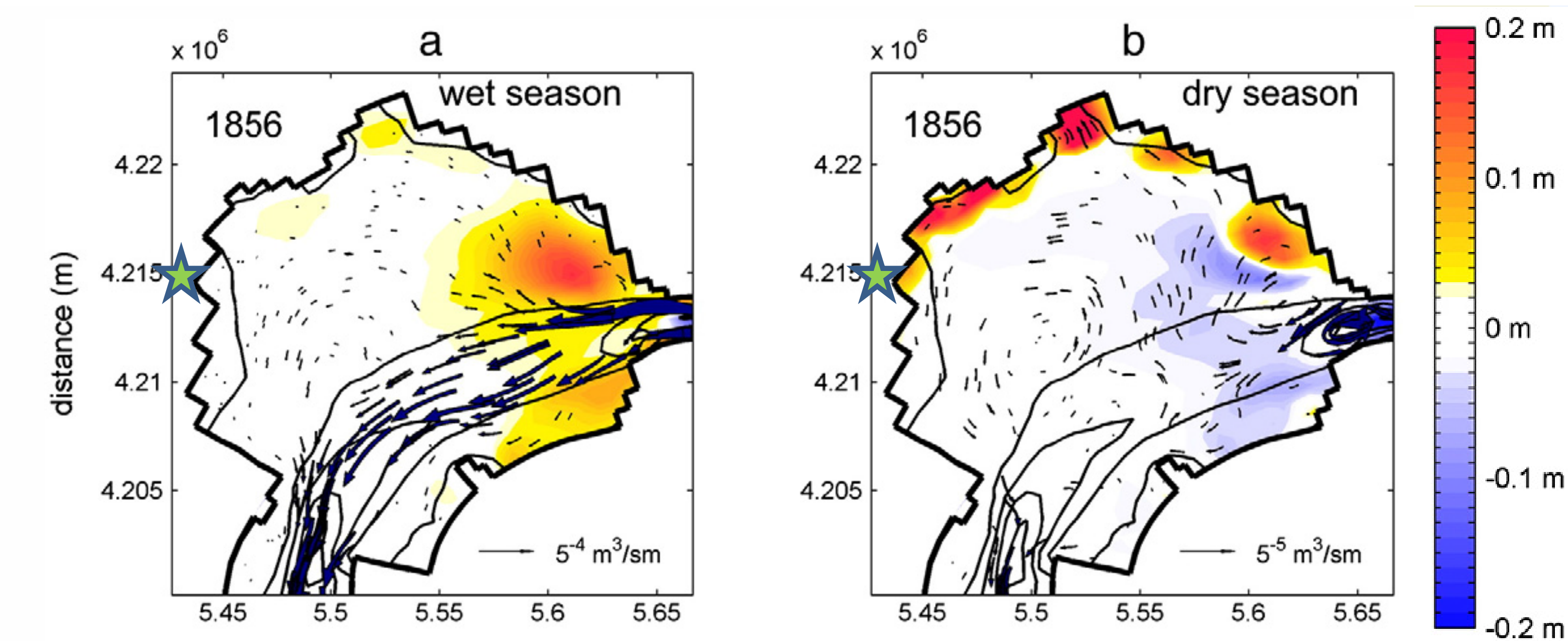
# Historical Littoral Processes: Circulation & Sediment Deposition



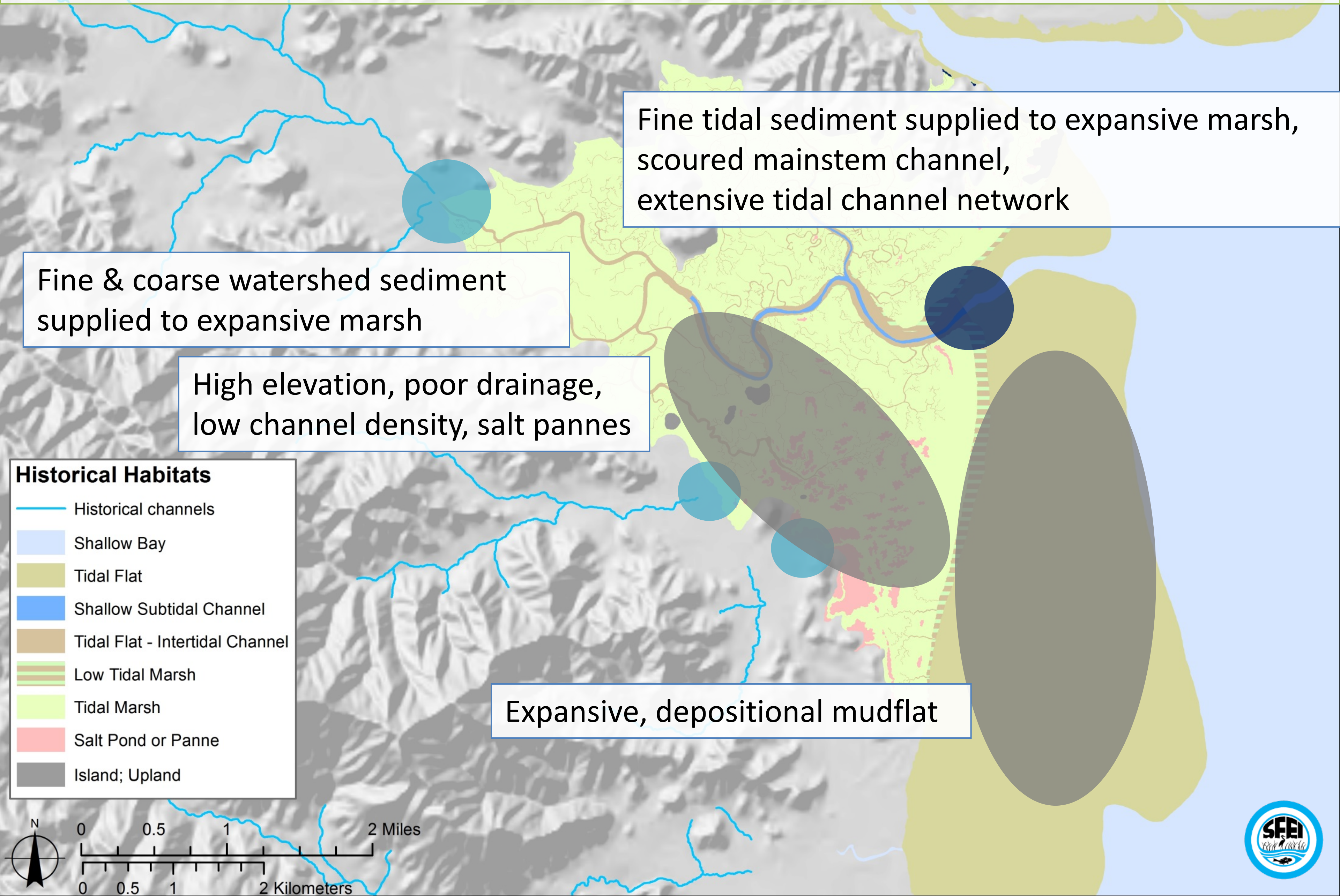
# Historical Littoral Processes: Circulation & Sediment Deposition



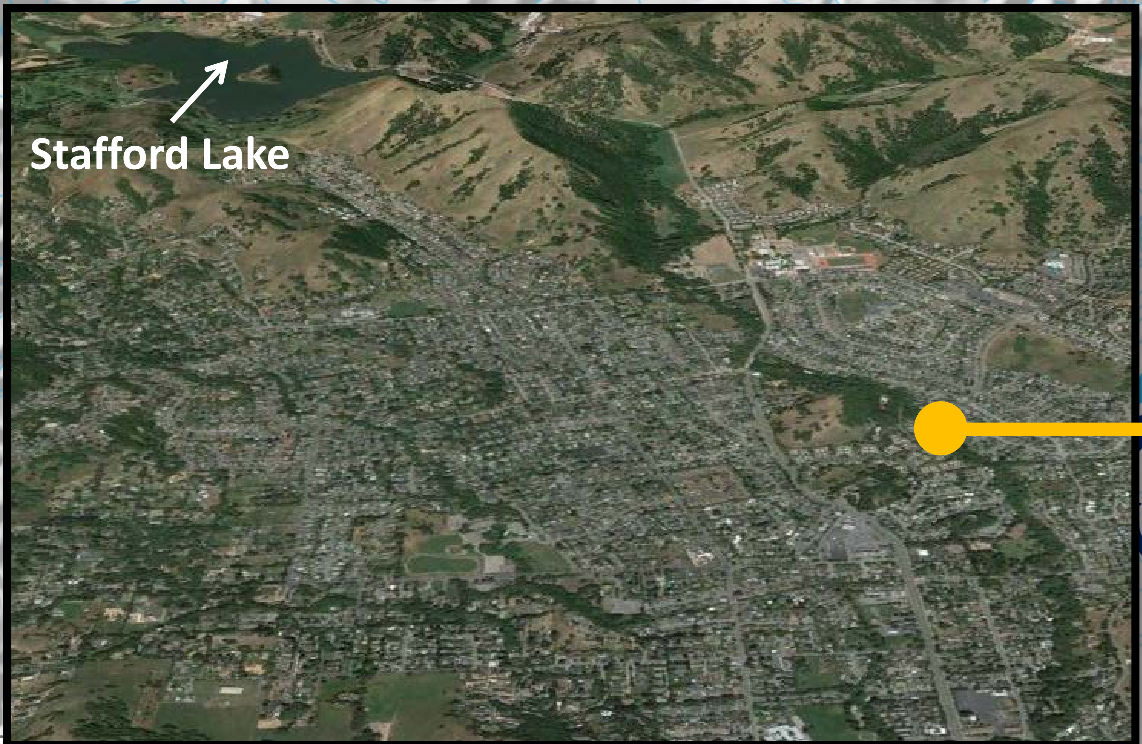
**Residual sediment transport rate** (van der Wegen & Jaffe 2013)



# Historical Marsh Landscape

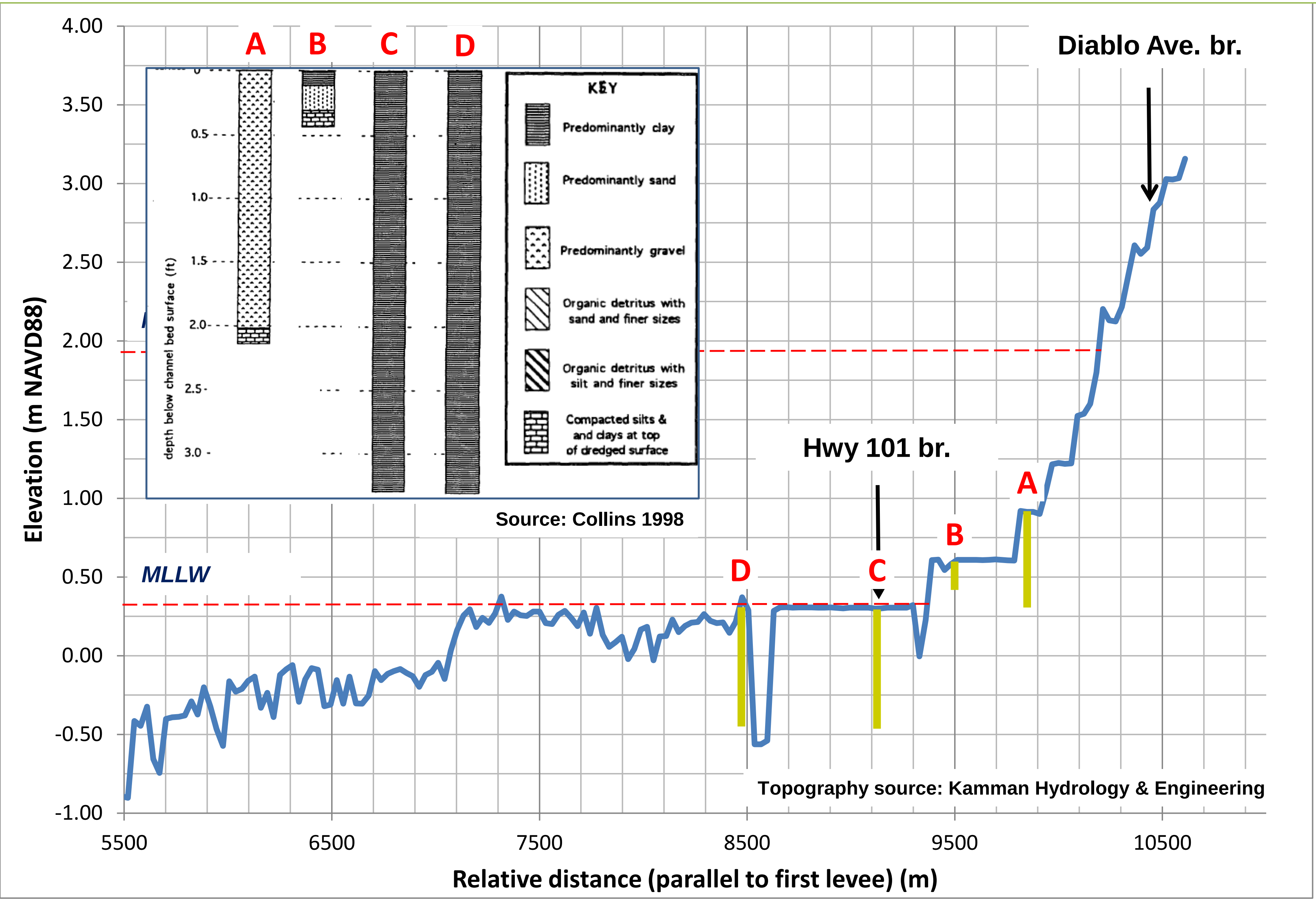


# Current Watershed Processes: $Q_{sed}$ & $Q_{water}$

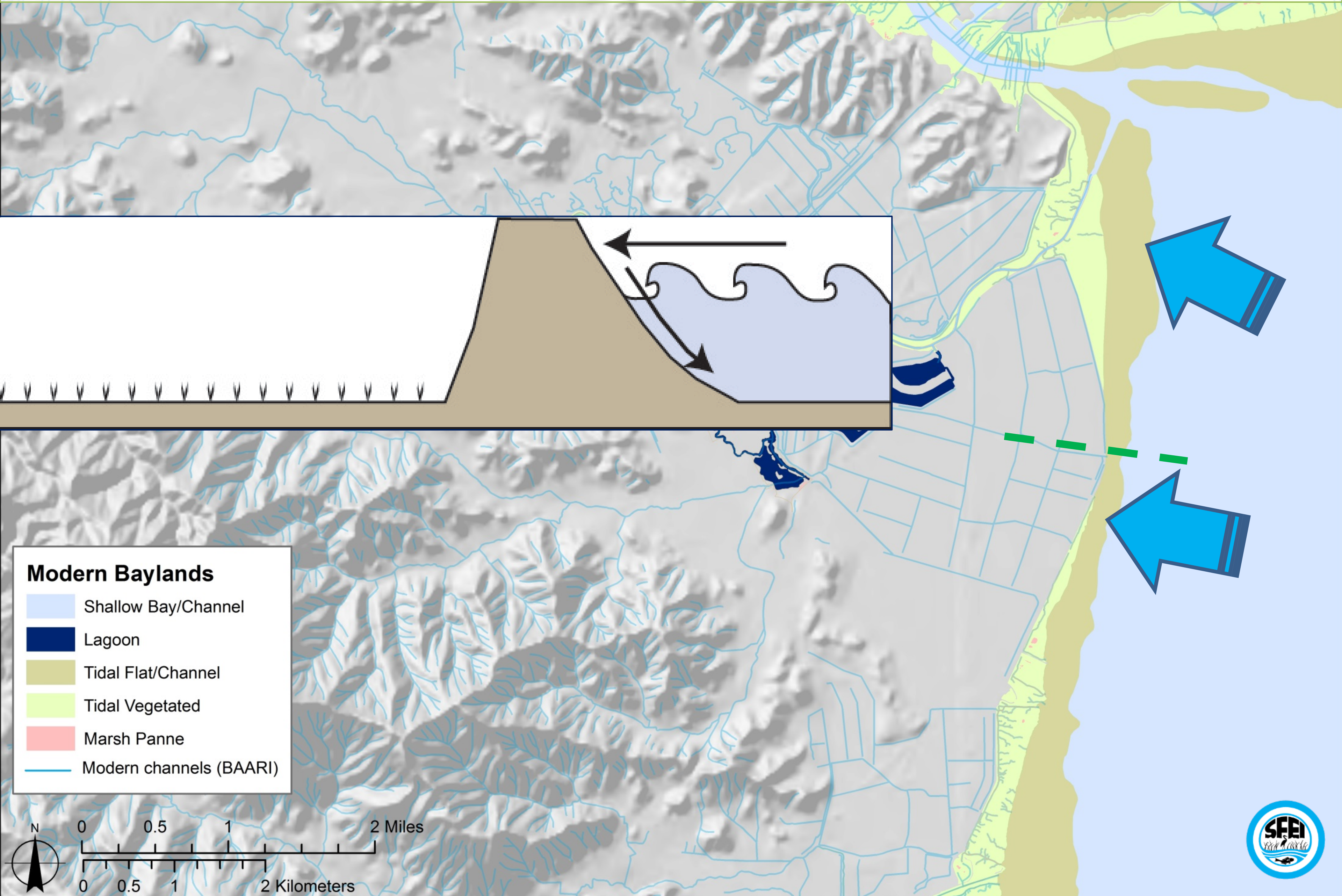




# Current Watershed Processes: $Q_{sed}$ & $Q_{water}$

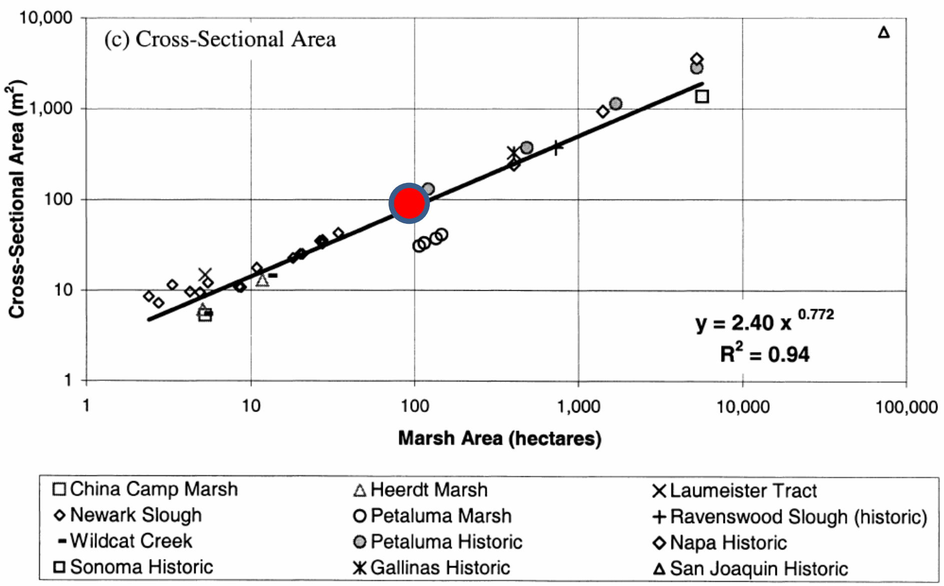


# Current Tidal Processes: Wave Power & Tidal Prism

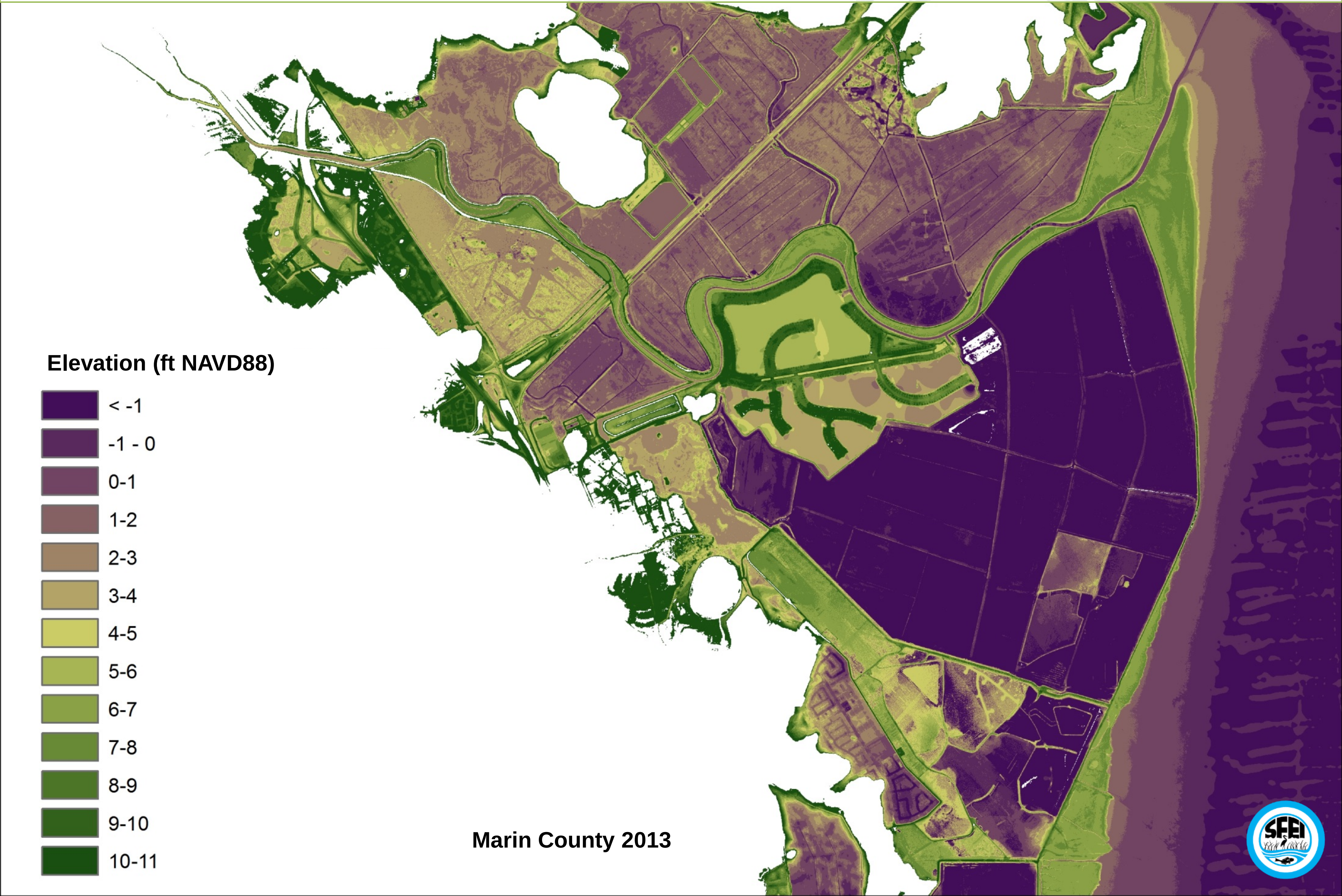


# Current Tidal Processes: Wave Power & Tidal Prism


**Channel Area vs. Marsh Area** (Williams et al. 2002)

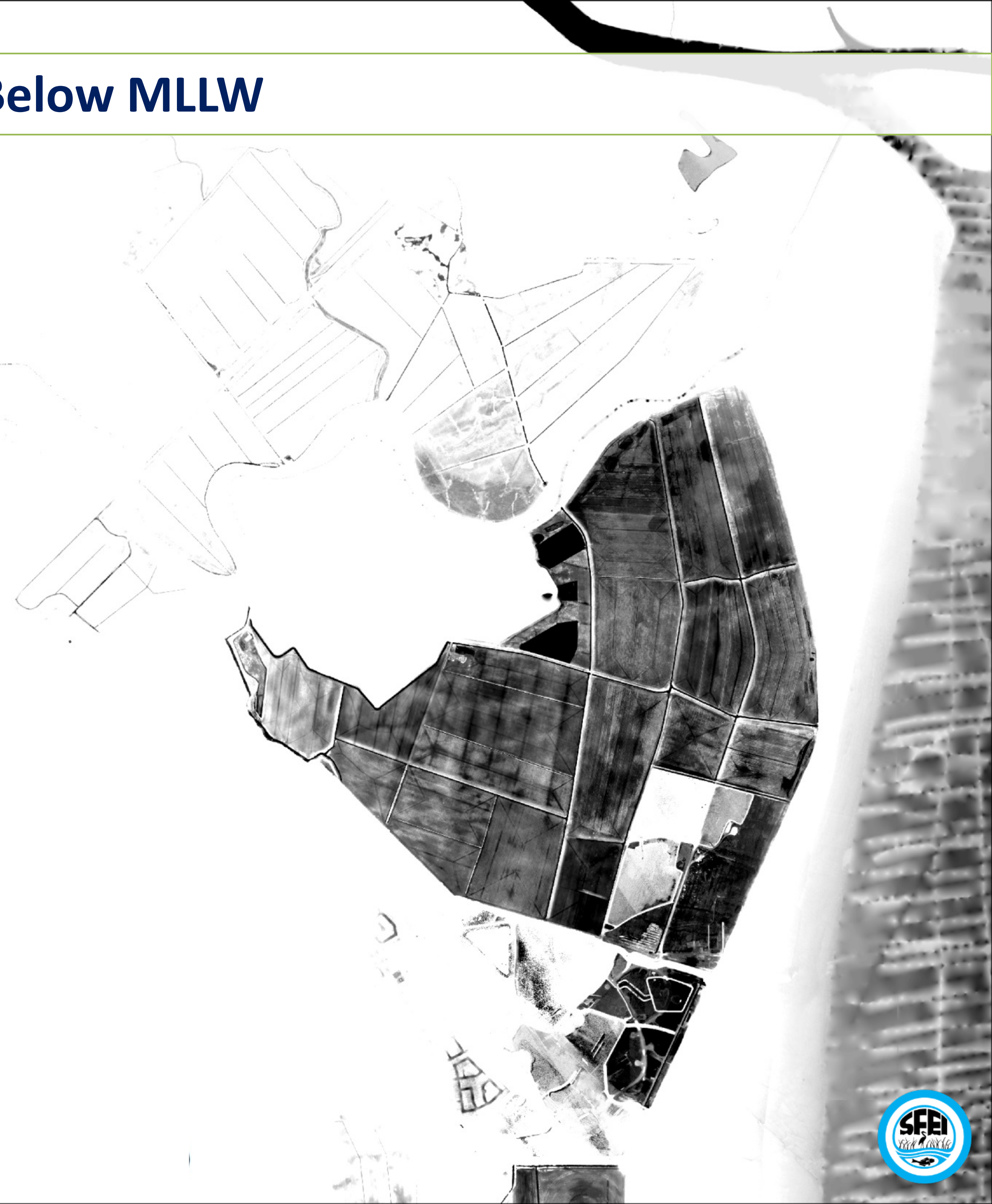


# Current Marsh and Mudflat Elevations



# Current Marsh Elevations Below MLLW

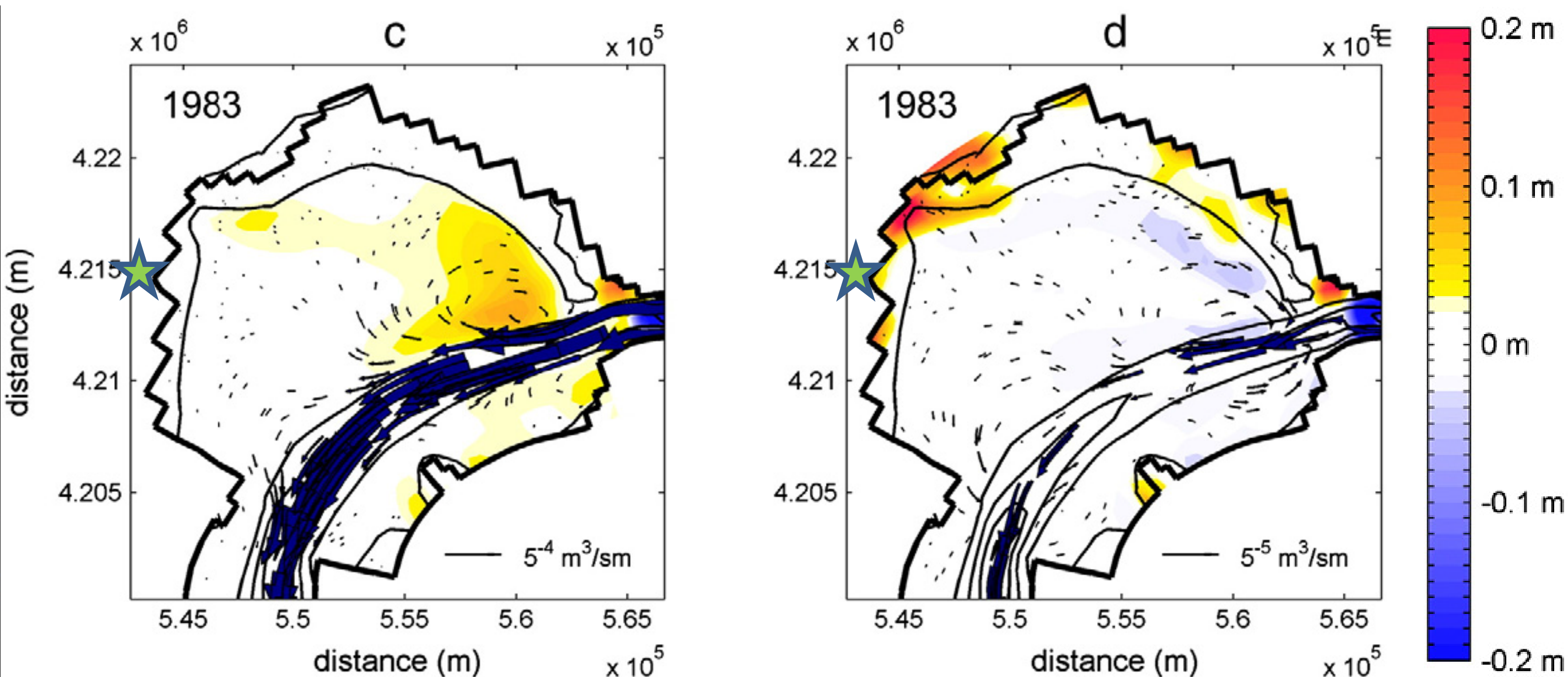
MLLW @ Hamilton = 0.2 ft NAVD88



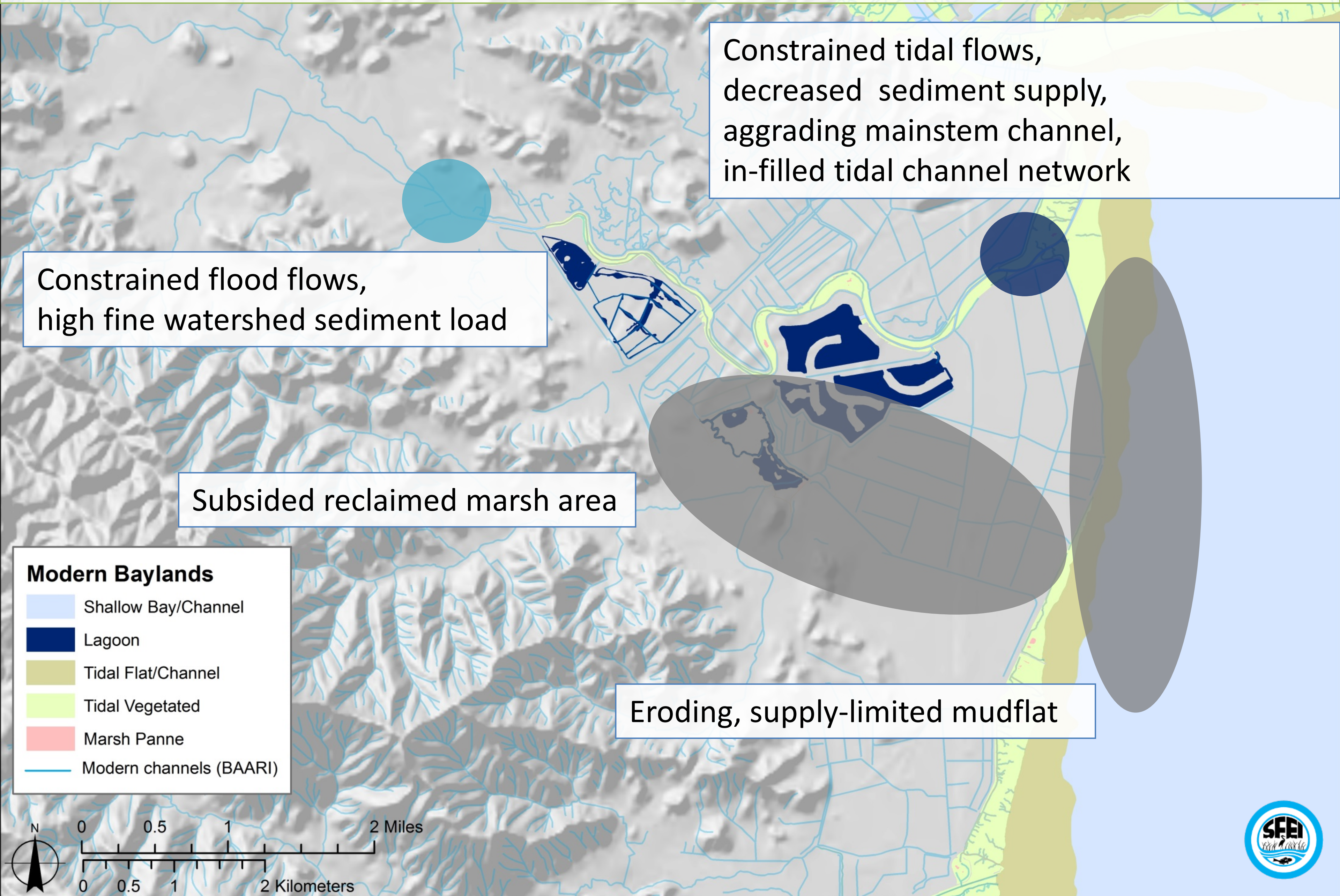
Marin County 2013

# Current Littoral Processes: Circulation & Sediment Deposition

**Residual sediment transport rate** (van der Wegen & Jaffe 2013)



# Current Marsh Landscape



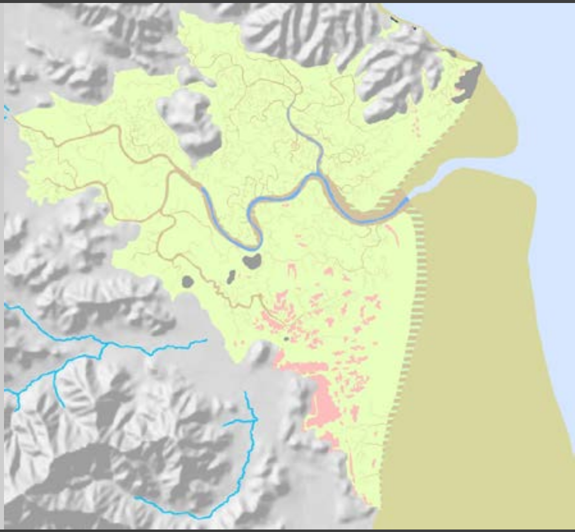
# Looking towards the future…

## Excess watershed fine sed. + confined channel + hardened shoreline

- Aggrading channel that required frequent dredging
- Subsiding reclaimed lands
- Locally eroding marsh and mudflat areas

## Climate change impacts

- Rising sea level = increased channel aggradation
- Potential increased ‘storminess’ = increased watershed fine sediment loading & increased wave power and localized mudflat erosion



# THANK YOU

**Questions?**

**Contact**

**Robin Grossinger** robin@sfei.org
**Scott Dusterhoff** scottd@sfei.org
**Micha Salomon** micha@sfei.org