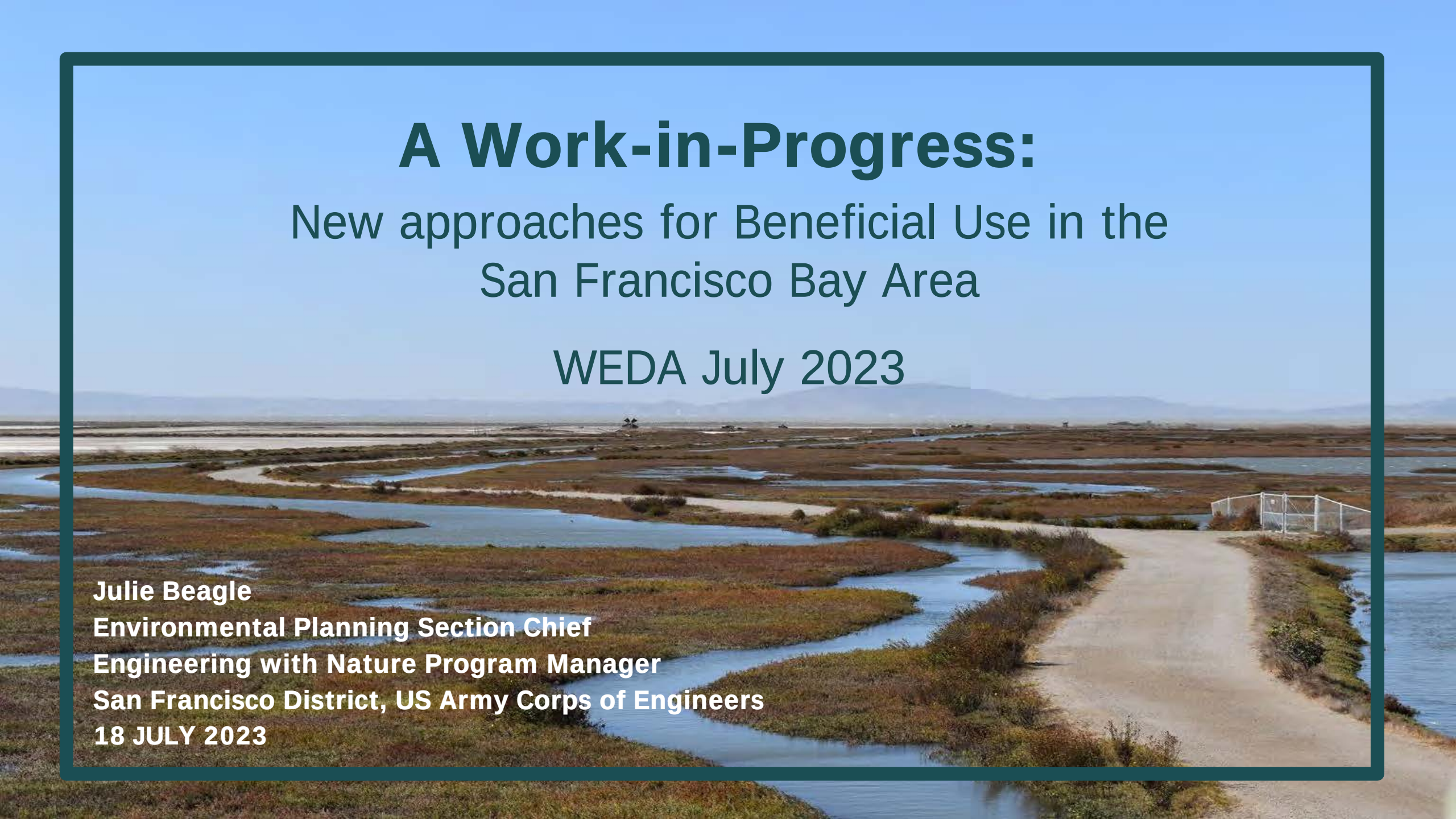
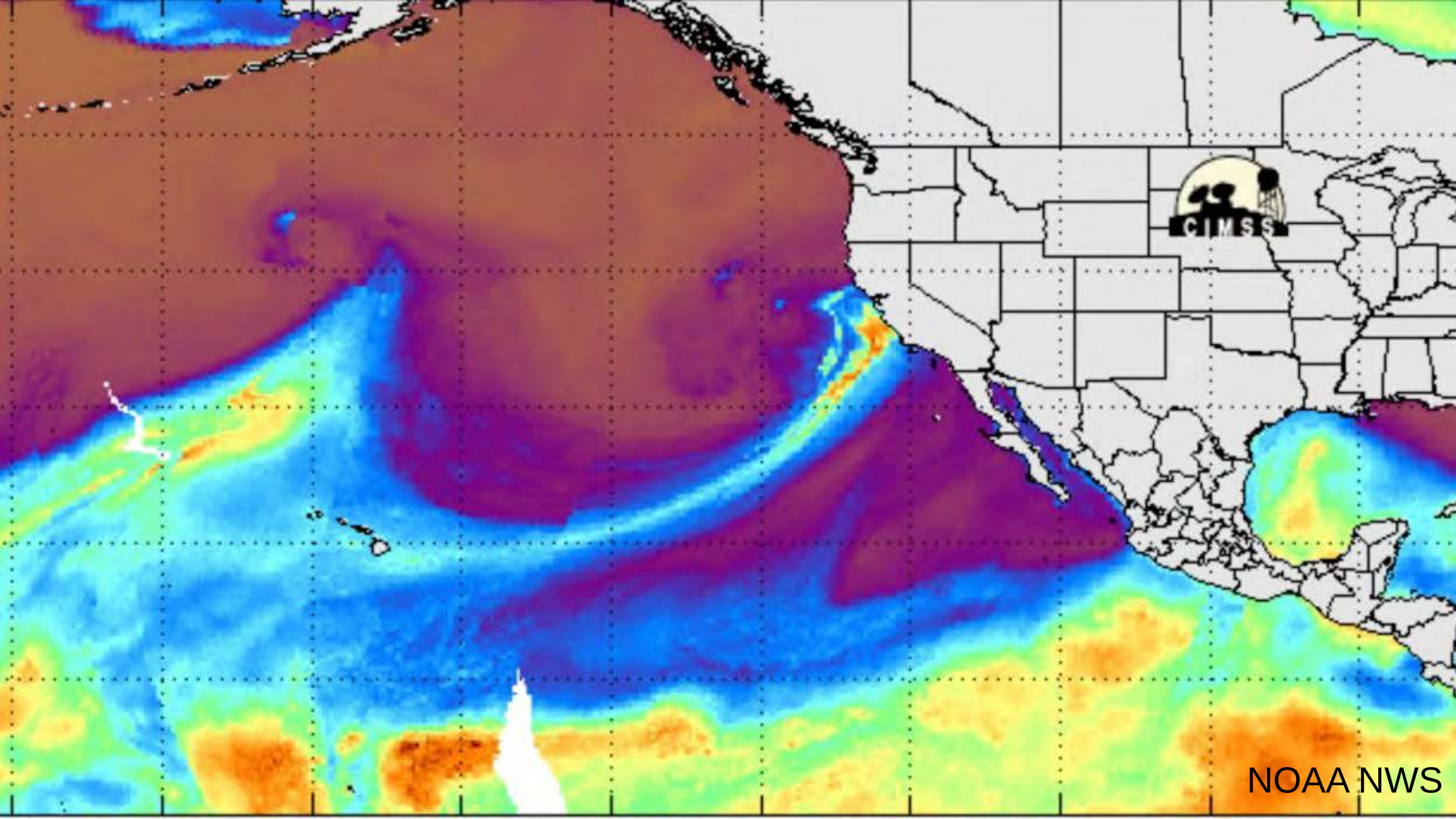
A Work-in-Progress:

New approaches for Beneficial Use in the San Francisco Bay Area

WEDA July 2023



Julie Beagle
Environmental Planning Section Chief
Engineering with Nature Program Manager
San Francisco District, US Army Corps of Engineers
18 JULY 2023


CIMSS
NOAA NWS

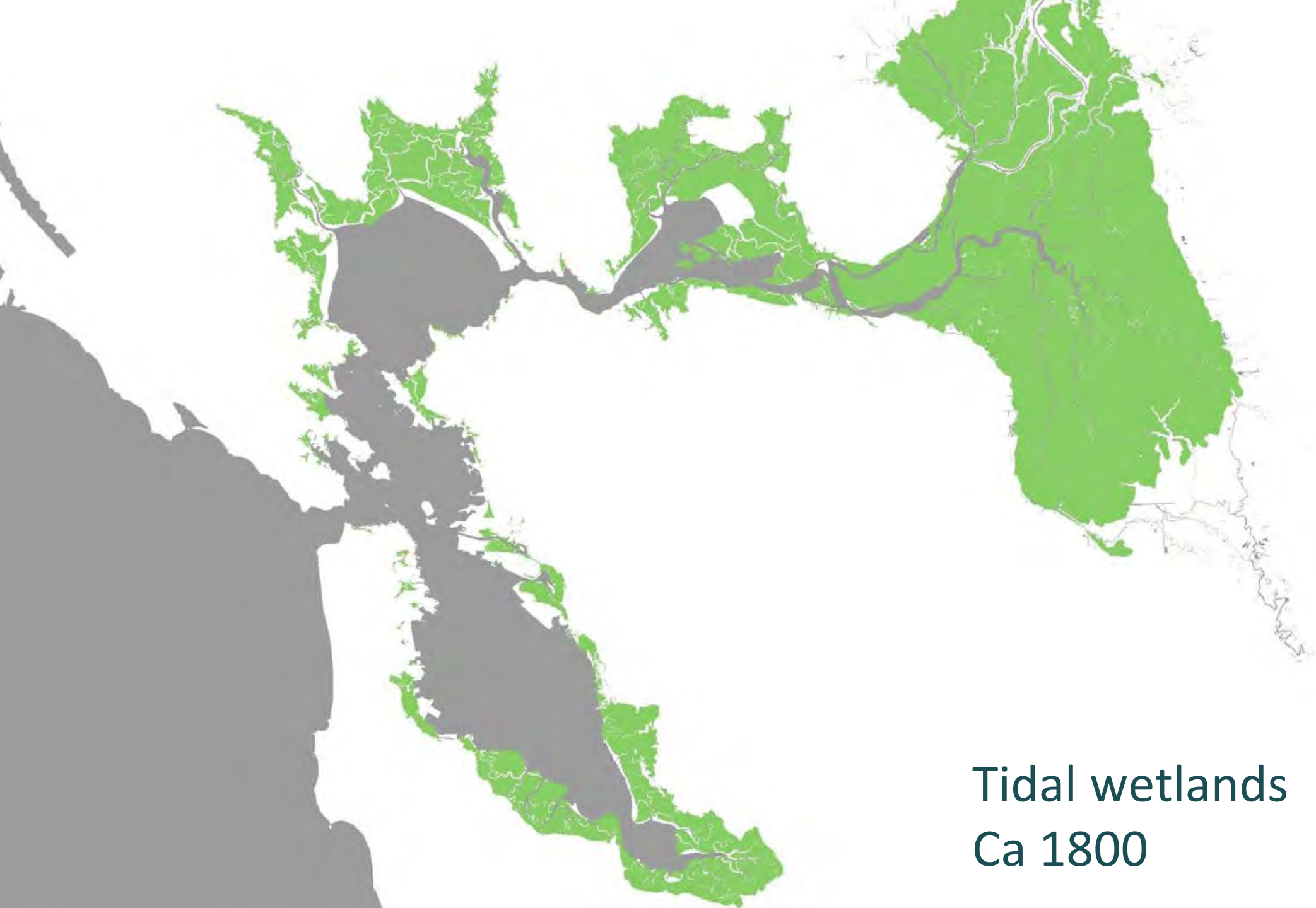
Wall Street Journal: Capitola shoreline

KSBW News: San Lorenzo River in Felton CA

SF CHRON
JAN 3 2023


Bay Nature: Mill Valley, CA

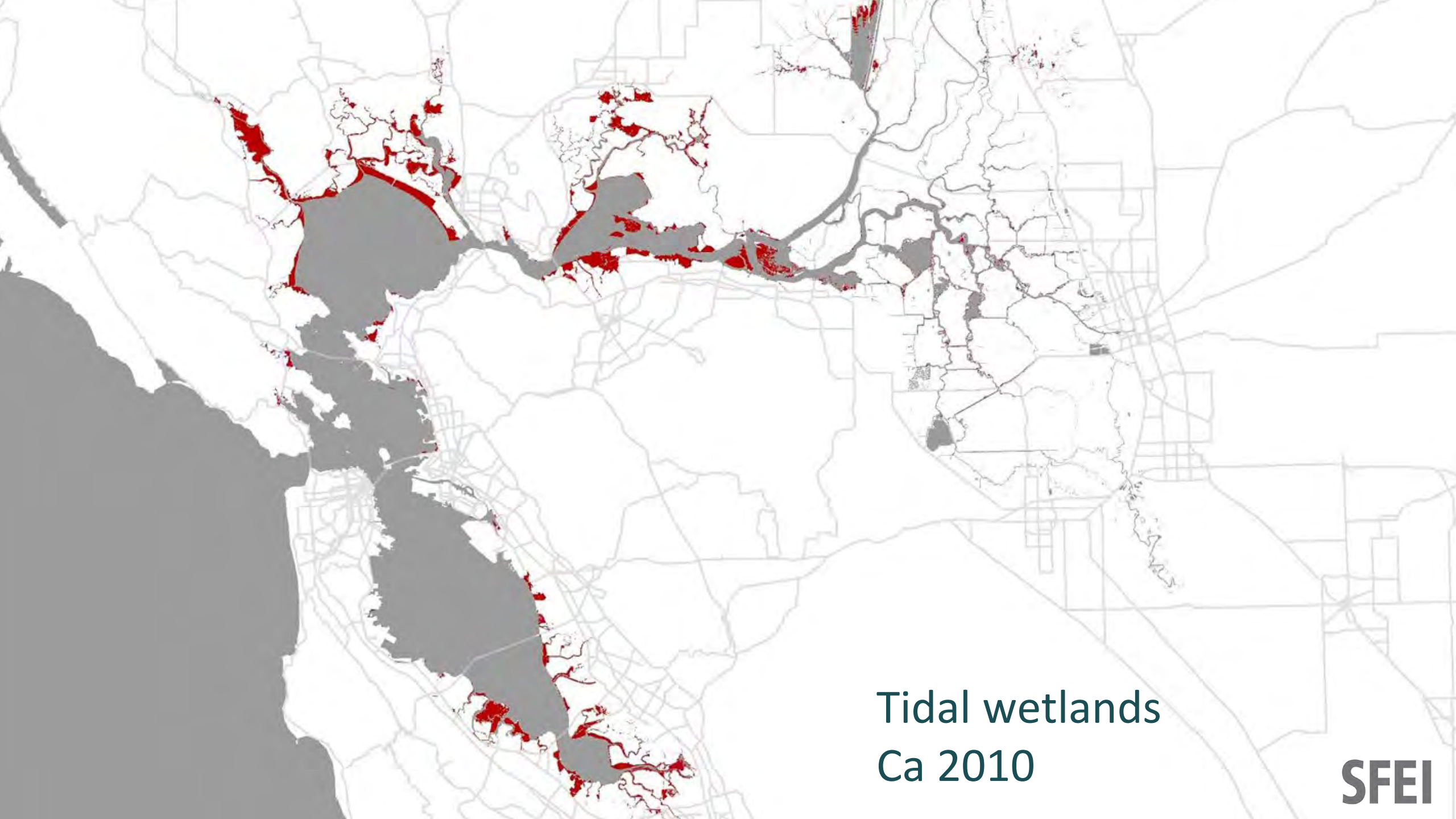

SF Gate
8 Jan 2022



Tidal wetlands
Ca 1800

SFEI


1952
Development History
Low-level fill development
High-level fill development



Tidal wetlands
Ca 2010

SFEI

ENGINEERING WITH NATURE (EWN)

An engineering philosophy that uses natural and engineering processes to deliver economic, environmental, and social benefits, including:

- Flood, coastal storm, and erosion risk mitigation
- Ecosystem restoration
- Equitable outcomes for EJ communities
- Recreation
- Climate resilience

Nature-based solutions referred to as Natural and Nature-based Features (NNBF) in EWN context.

What is nature-based adaptation?

Actions that **harness biodiversity and ecosystem services** to **reduce vulnerability** and **build resilience** to climate change.

Eelgrass

Oysters

Mudflats

Marshes

Ecotone levee
(marsh + levee)

Range from fully natural → Hybrid (natural + engineered)

SFEI

Yolo Bypass (Sacramento River Flood Control Project) 1917

Hamilton Wetlands (BUDM for wetland restoration)

Engineering With Nature

HISTORY OF CHALLENGES AT USACE

- **Lack of multi-benefit approaches**, budgeting, planning, policies, and business lines
- Knowledge **gaps** and unfamiliarity with options
- Inability to **measure benefits equitably**
- **How to pay for the incremental Cost above the Federal Standard?**
- “We’ve **always** done it this way”
- **Short-term** impact for **long-term** ecological benefit

PROVING GROUND NETWORK

Proving Grounds

Implement. Document. Share.

EWN Proving Grounds are USACE districts and divisions committed to the broad integration of EWN principles and practices into all business lines in the form of constructed projects. Proving grounds are places where innovative ideas are tested on the ground, throughout USACE missions. They document processes, project milestones, and lessons learned in the implementation of EWN measures so others can learn from their experience.

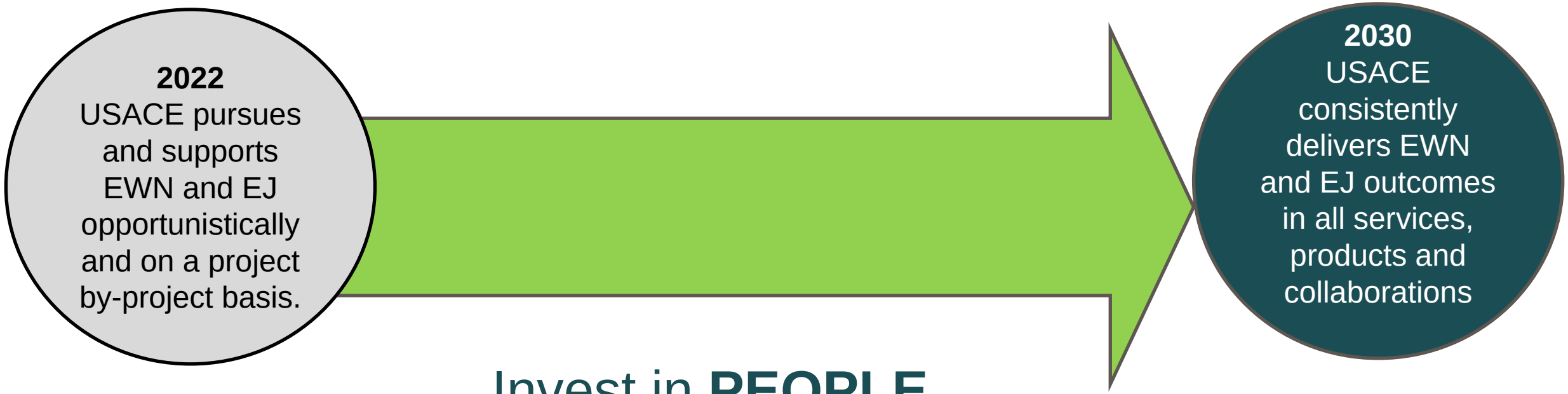
Mobile District

San Francisco District

St. Louis District

https://ewn.erdc.dren.mil/

INSTITUTIONALIZING EWN



Invest in **PEOPLE**
Build **PORTFOLIO**
Develop **PROCESS**
Develop and test **POLICY**
Grow **PARTNERSHIPS**

SEDIMENT IS A RESOURCE

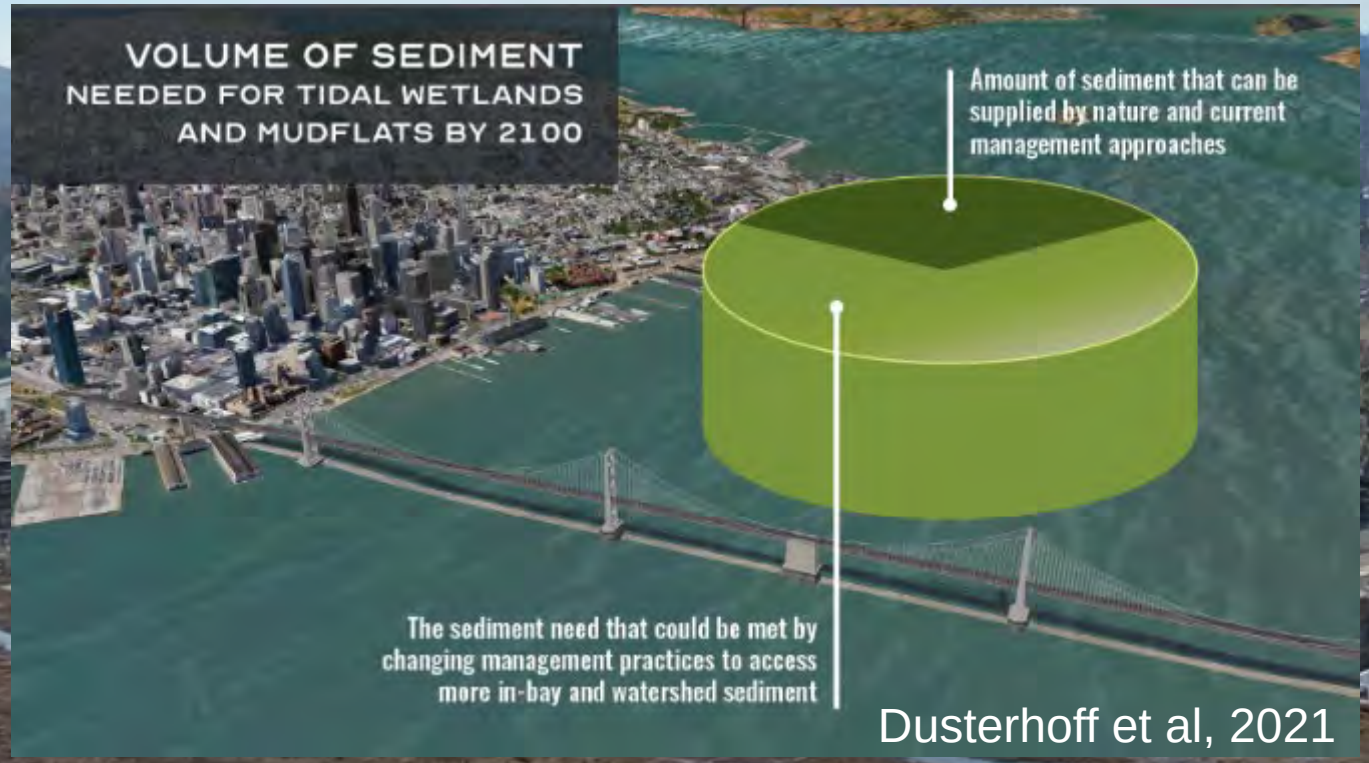
- USACE dredges navigation channels yearly
- Historically “cheaper” to take the material offshore
- We need to reuse the sediment in a smart way, collaboratively if we want to design with nature for climate resilience

The Mercury News | San Francisco Bay: Protection from costly…

NEWS › ENVIRONMENT

San Francisco Bay: Protection from costly disasters is being thrown away, scientists say

Sea level rise threatens billions in flood damage, but dredged mud to raise shoreline isn’t being used



Problems

- Limited **sediment supply** regionally + **sea-level rise**
  - Marsh drowning and erosion
  - **Habitat loss** for endangered and threatened species
  - Increased **flood risk** for low-lying communities

SCIENCE

Got Mud? For Coastal Cities, Humble Dirt Has Become A Hot Commodity

May 1, 2021 · 7:28 AM ET

Heard on Weekend Edition Saturday

LAUREN SOMMER

The simple local solution to sea level rise? Mud from the bottom of San Francisco Bay

US Army Corps of Engineers
San Francisco District

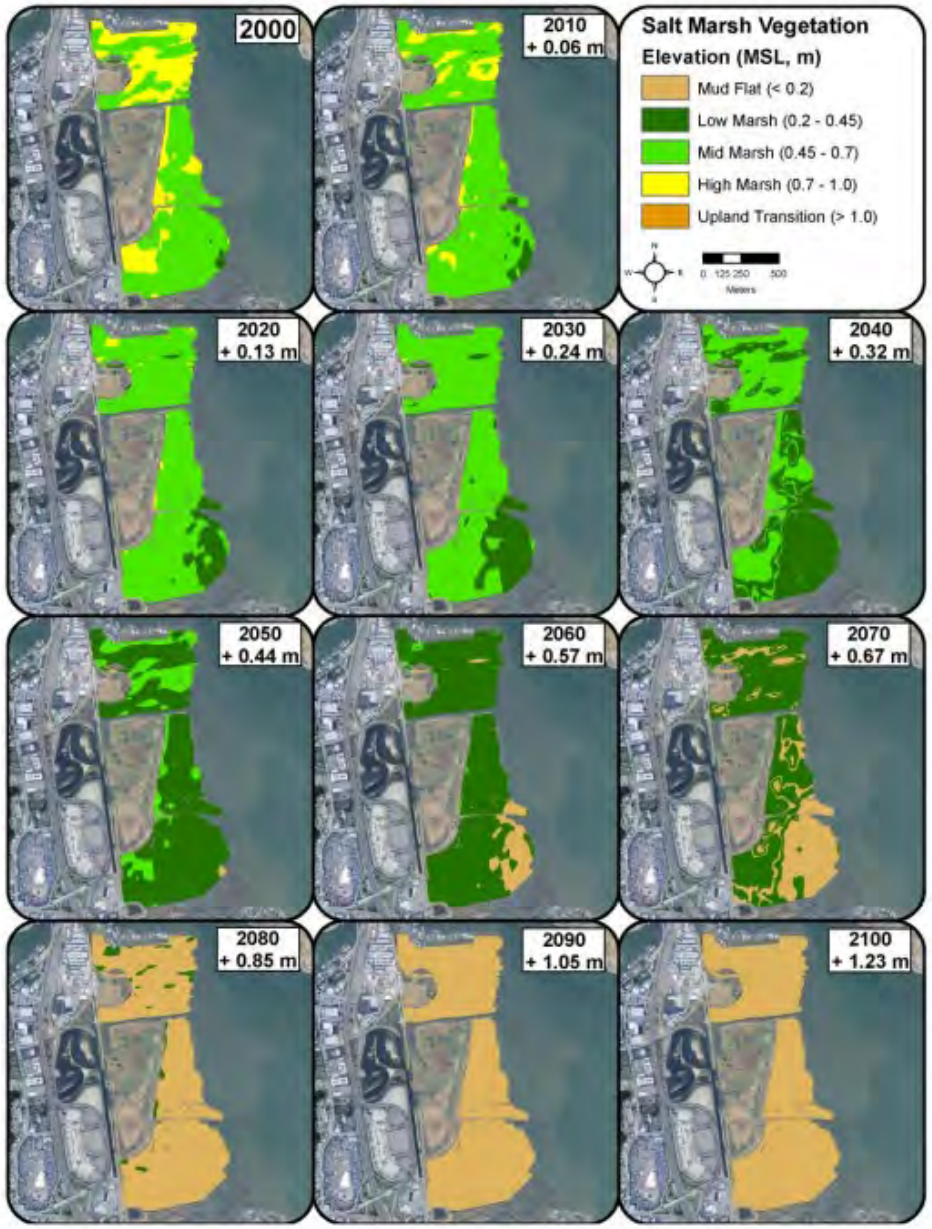


Figure G-9. Corte Madera WARMER results in terms of vegetation category: mudflat, low, mid, or high marsh, or upland transition.

Karen Thorne, USGS

Problems

- Limited **sediment supply** regionally + **sea-level rise**
  - Marsh drowning and erosion
  - **Habitat loss** for endangered and threatened species
  - Increased **flood risk** for low-lying communities

US Army Corps of Engineers
San Francisco District

(SFEI and Baye 2020)

Habitat availability of Ridgways rails over time

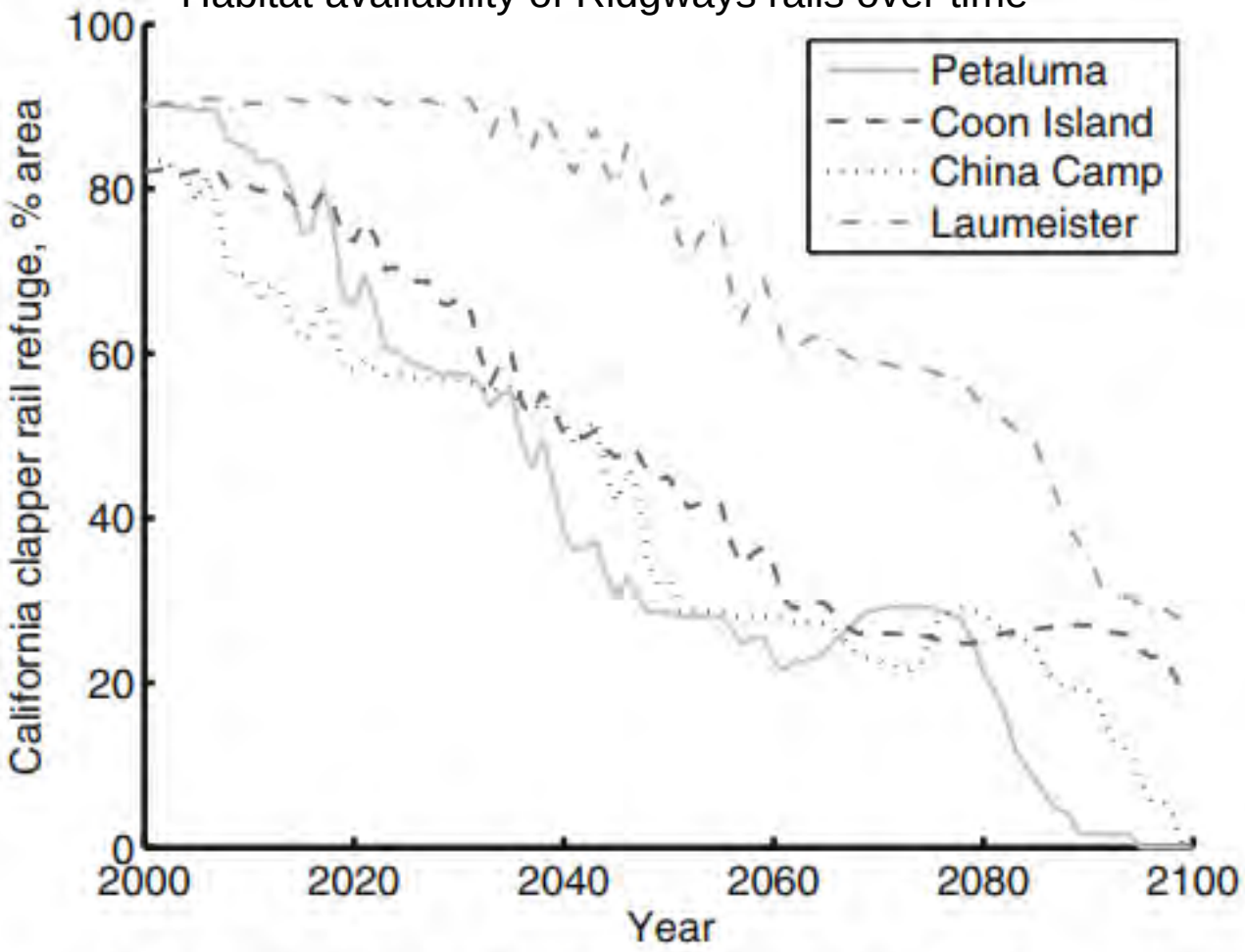


Fig. 9 *R. longirostris obsoletus* habitat availability at MHHW. Projected marsh area (%) where elevation plus maximum vegetation height exceeds MHHW by at least 20 cm

Swanson et al. 2013

Problems

- Limited **sediment supply** regionally + **sea-level rise**
  - Marsh drowning and erosion
  - **Habitat loss** for endangered and threatened species
  - Increased **flood risk** for low-lying communities

Opportunities/Solutions

- **Leverage dredged material** from navigation channels
  - Beneficial Use: Direct Placement
  - **Novel EWN Methods (e.g., Strategic Placement**)

US Army Corps of Engineers
San Francisco District

USACE NAVIGATION – CHALLENGES & OPPORTUNITIES

Challenges

- Equipment challenges
  - Hard to get material to other sites (long distance pipelines)
  - Small enough scows to get close to shore for shallow water placement
- Timing of receiving sites coming online
- Federal standard remains, but environmental benefits can be counted, accounting for all the costs
- Quantifying the benefits of strategic placement

CECG 25 January 2023

Beneficial Use of Dredged Material Command Philosophy Notice

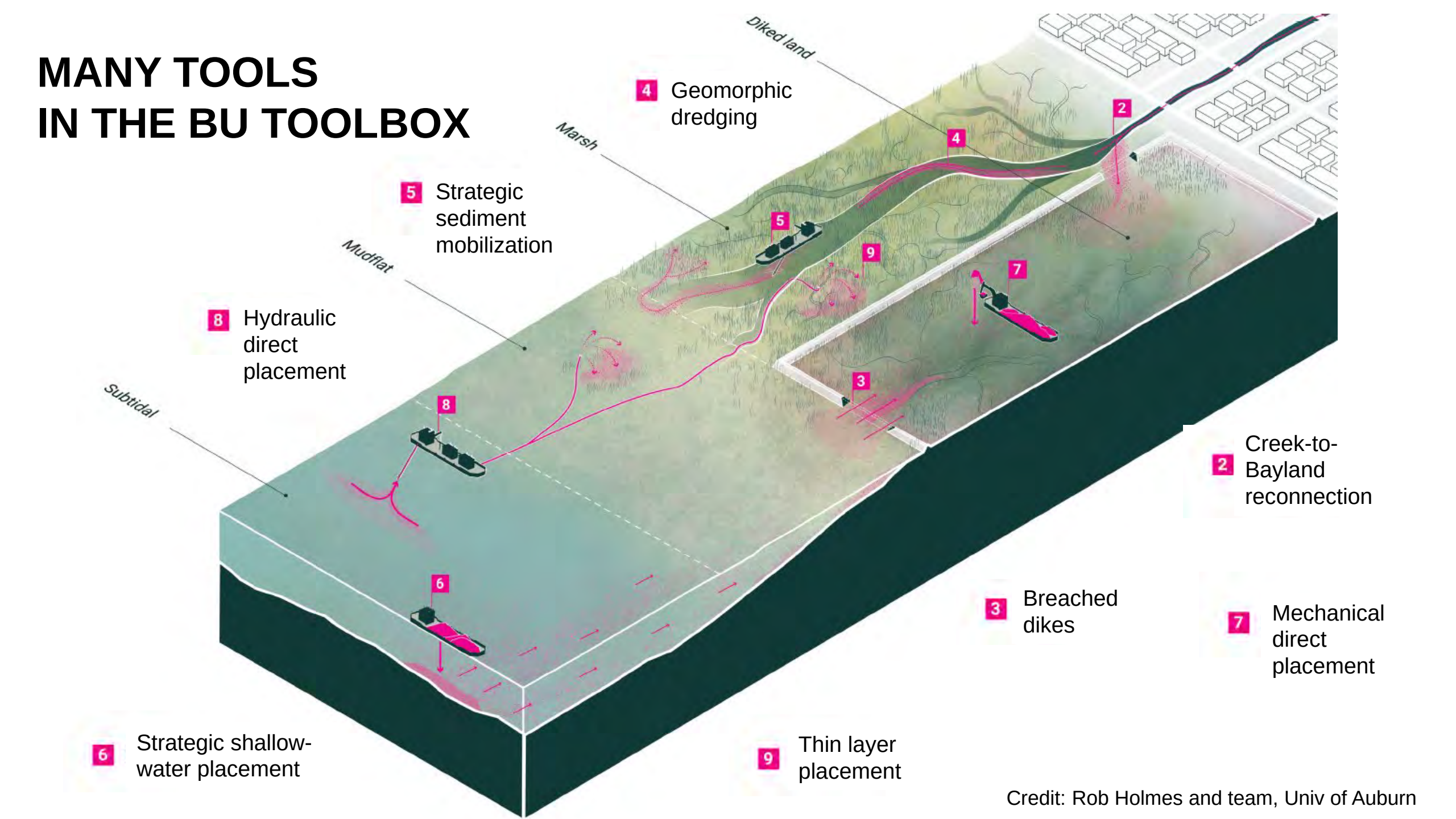
Teammates,

Today I am formally issuing a Beneficial Use of Dredged Material Command Philosophy Notice which outlines my vision for expanding the U.S. Army Corps of Engineers beneficial use of dredged material (BUDM) program. This philosophy notice aligns with two of my four key priorities for the organization, Partnerships and Innovate.

USACE historically uses 30-40% of the sediments derived from the Navigation mission for beneficial purposes. I have established a goal for USACE to advance the practice of BUDM to 70% by the year 2030 ("70/30 Goal").

Achieving our vision will require purposeful documentation and an innovative pursuit both internally and externally with our partners and stakeholders. You will need to leverage available solutions, strategies, and tools to the maximum extent practicable while developing and applying new approaches and technologies to address the associated engineering challenges.

MANY TOOLS IN THE BU TOOLBOX



Credit: Rob Holmes and team, Univ of Auburn

REGIONAL ANALYSIS OF POTENTIAL BENEFICIAL USE LOCATIONS

For each analysis unit...

- Marshes
- Diked baylands (potential future marshes)

...calculating metrics to aid in prioritization:

Wildlife support

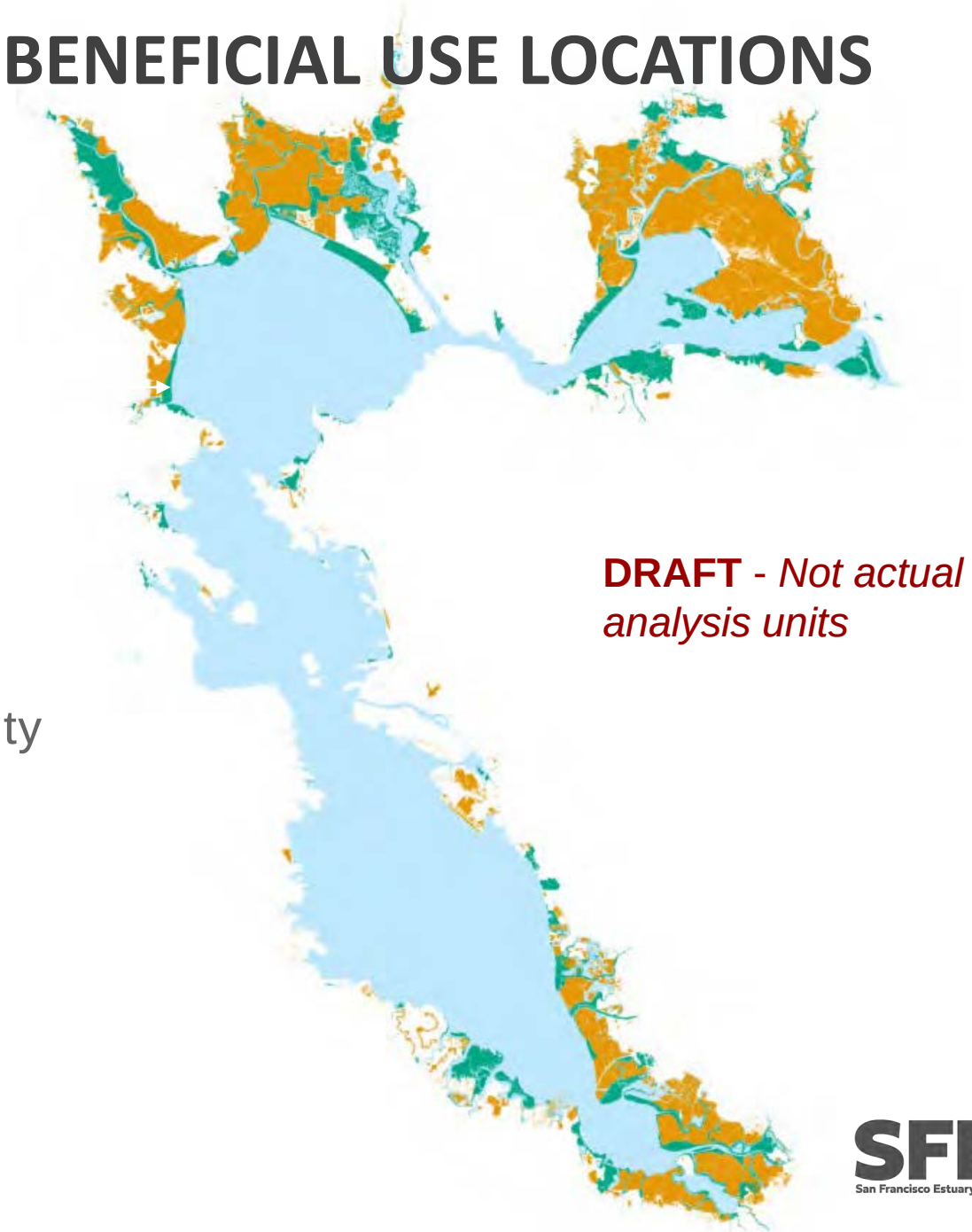
- E.g. patch contribution to habitat connectivity

Flood attenuation

- E.g. wave attenuation benefits of existing marshes and mudflats

Placement feasibility

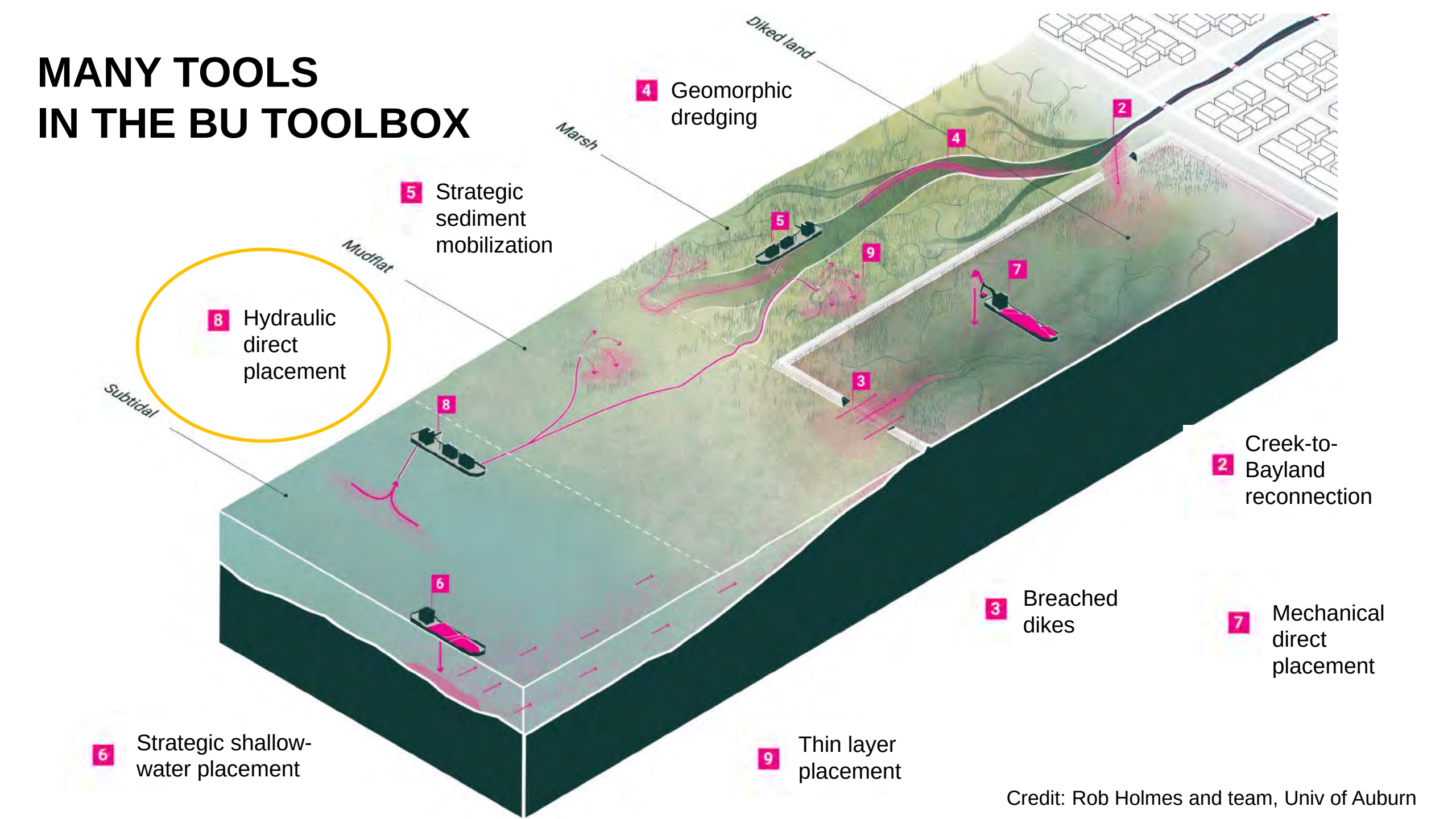
- E.g. proximity to dredging location



DRAFT - *Not actual analysis units*

SFEI
San Francisco Estuary Institute

MANY TOOLS IN THE BU TOOLBOX



Credit: Rob Holmes and team, Univ of Auburn

HYDRAULIC DIRECT PLACEMENT

Big Idea

- Also known as Marsh Spraying or Thin Lift
- Rainbowing material onto existing, drowning marsh to boost elevation

Environmental Benefits

- Elevation gain in short term to downshifting marsh
- Boosts chance of marsh maintaining pace with SLR

Environmental Impacts

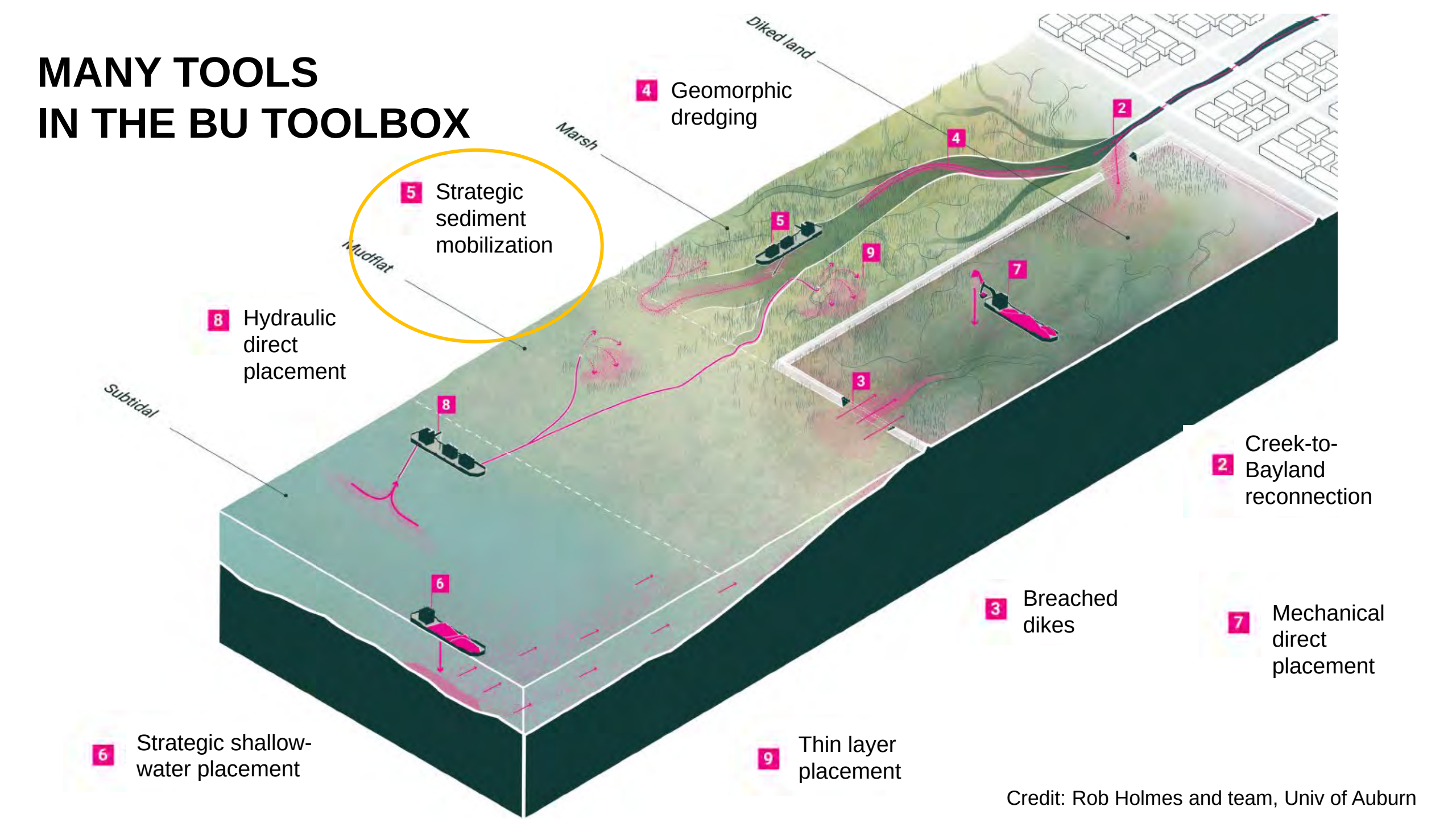
- Risk of compaction
- Risk that marsh doesn't re-vegetation and existing marsh degrades
- Impacts to habitat for species of concern

Seal Beach, CA

Source: USFWS

Source: CSU Long Beach

MANY TOOLS IN THE BU TOOLBOX



Credit: Rob Holmes and team, Univ of Auburn

STRATEGIC SEDIMENT MOBILIZATION

Big Idea

- Also known as Water Injection Dredging
- Remobilize sediment in a tidal channel
- Timed for before storm events
- Uses watershed discharge to move sediment into SF Bay naturally

Environmental Benefits

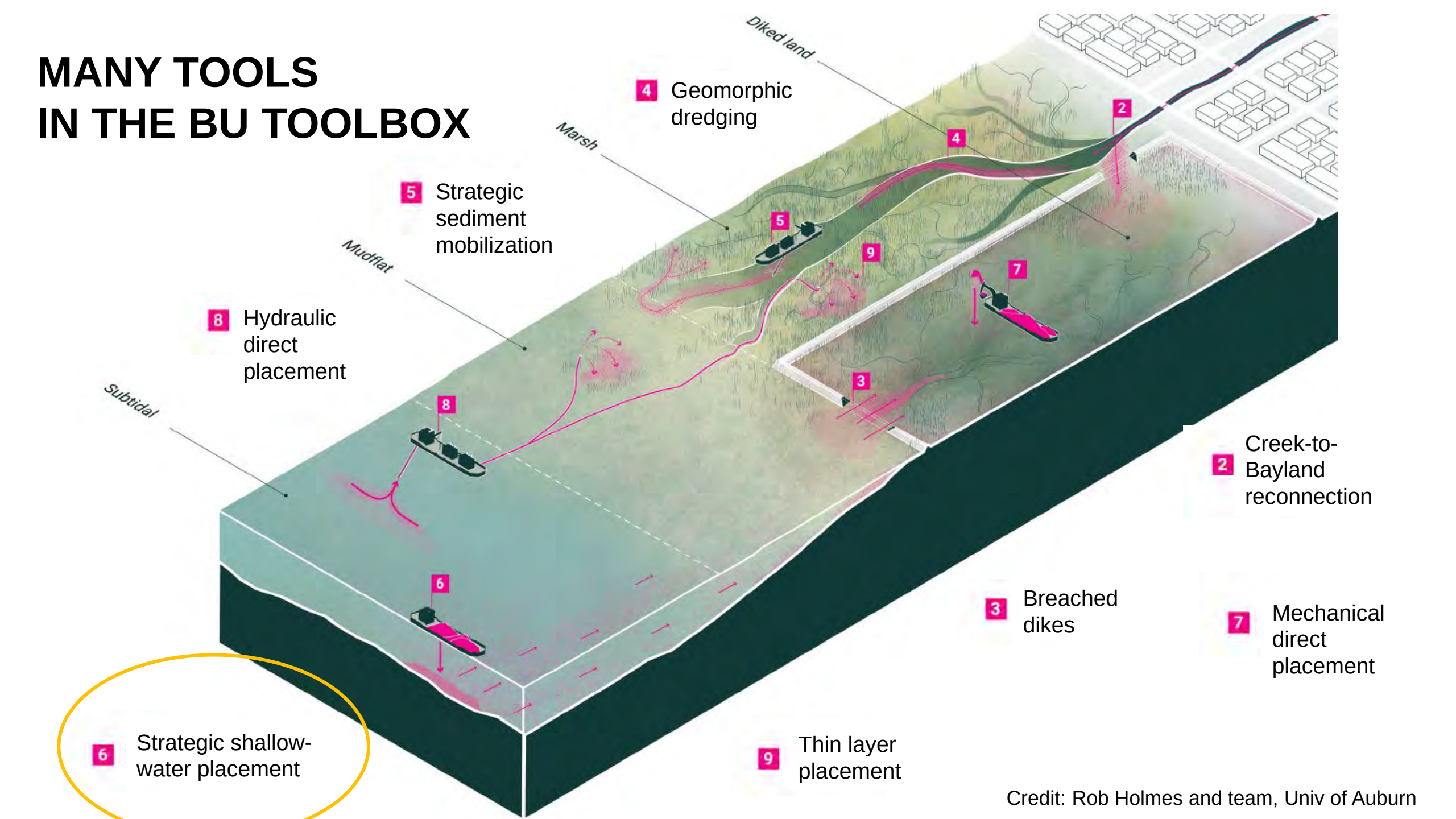
- Sediment stays in system, limits on handling material
- Lower carbon footprint

Environmental Impacts

- Increased turbidity, impacts to benthic communities
- Contaminated material concerns
- Impacts to habitat for species of concern

Source: Van oord Marine Ingenuity
https://www.vanoord.com/en/equipment/water-injection-dredger/

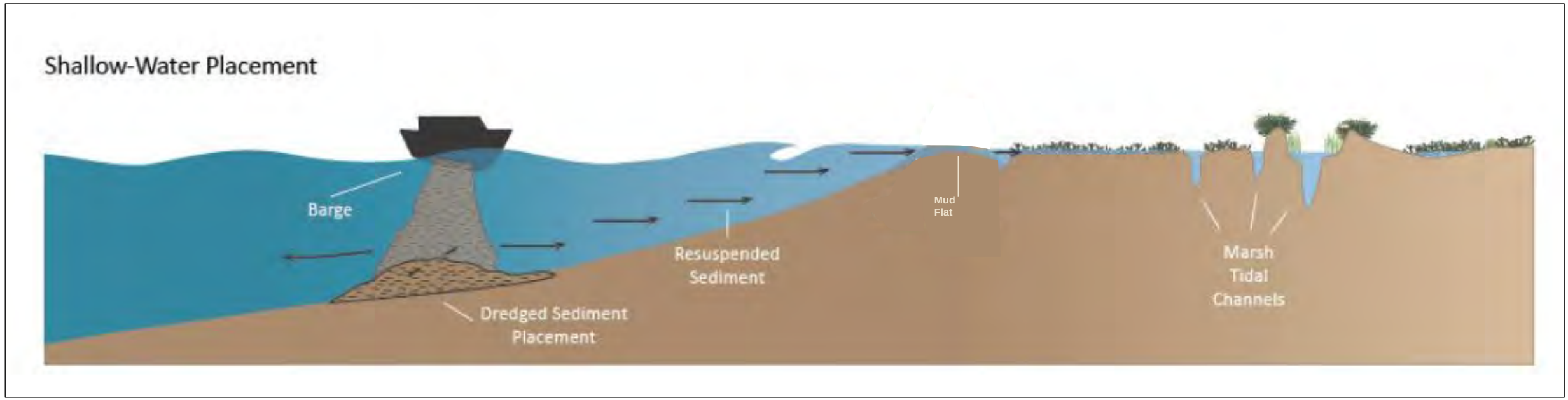
MANY TOOLS IN THE BU TOOLBOX



Credit: Rob Holmes and team, Univ of Auburn

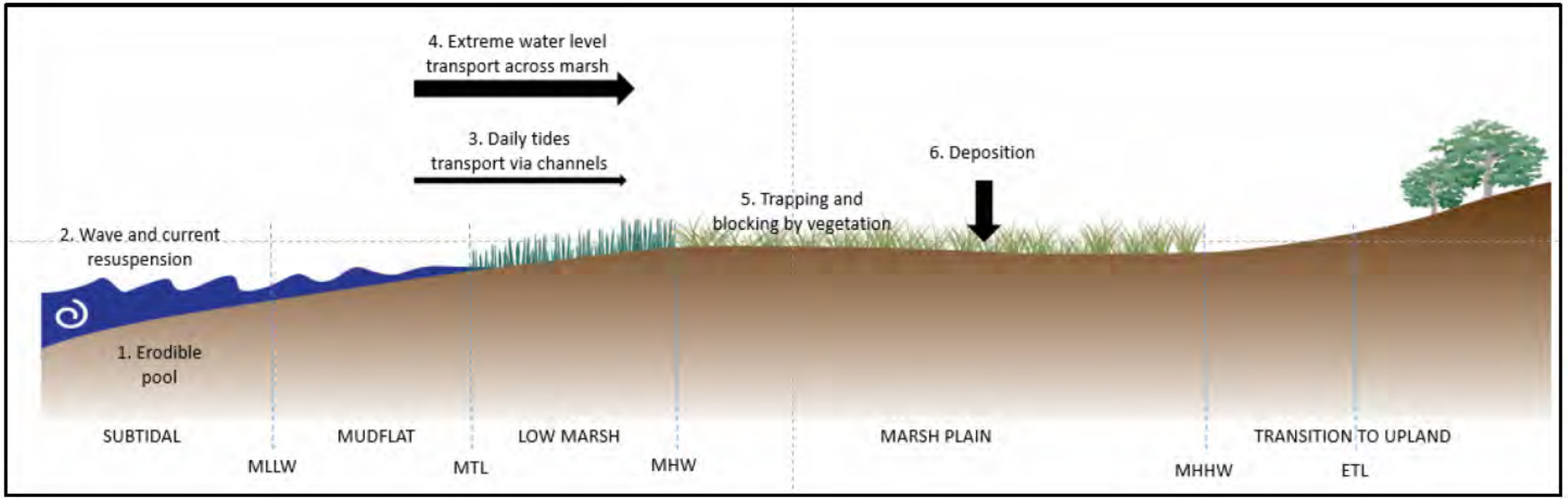
SECTION 1122 SHALLOW WATER PLACEMENT

- Using natural transport processes to move material onshore
- Creates resilience for mudflats and marshes
- Innovative, cost-effective, moves towards regional goals
- Monitoring impacts and effectiveness



SFEI 2017

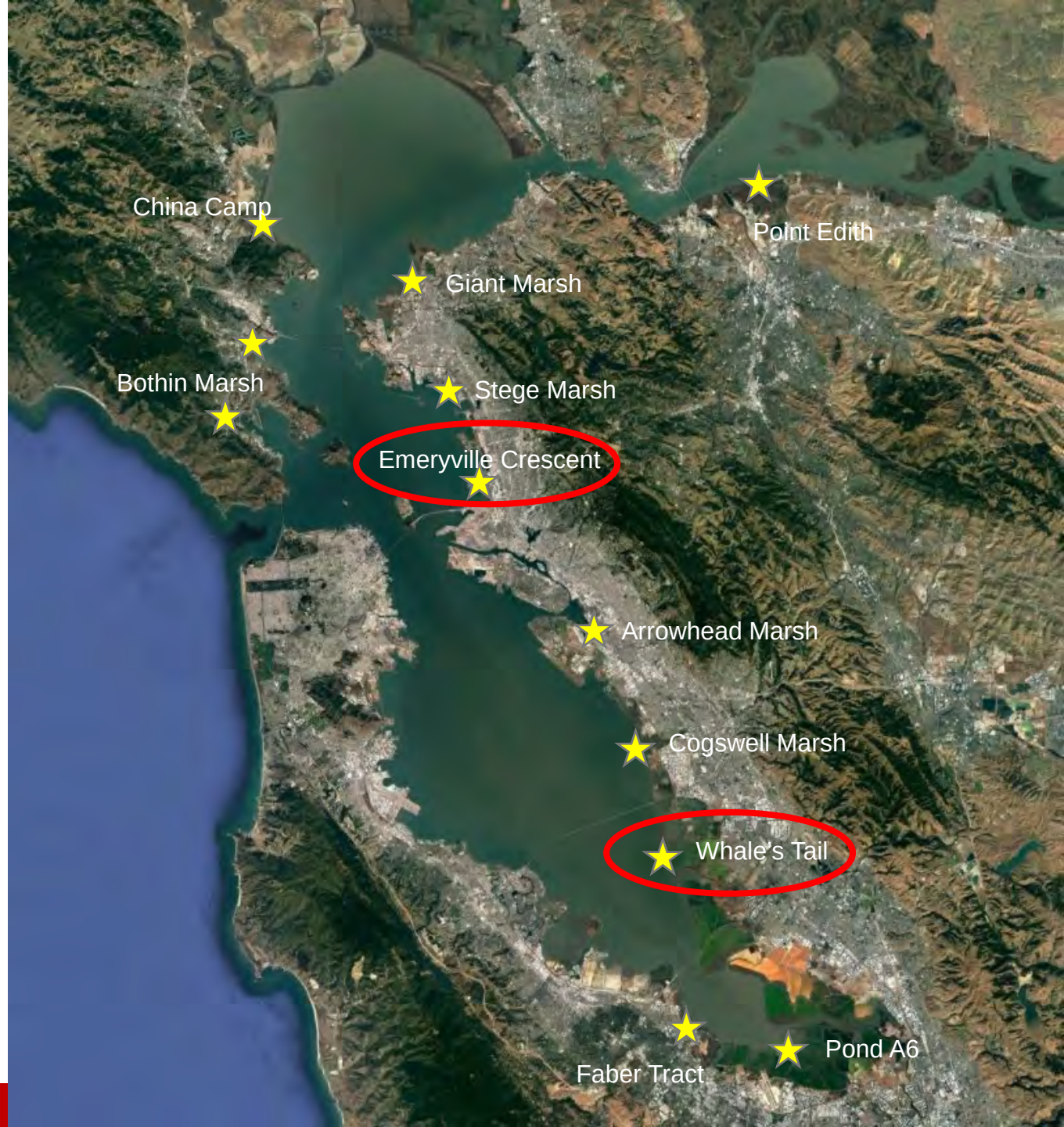
INORGANIC SEDIMENT SUPPLY TO MARSHES (CONCEPTUAL FRAMEWORK)



SFEI 2017

SCREENING OF SITES

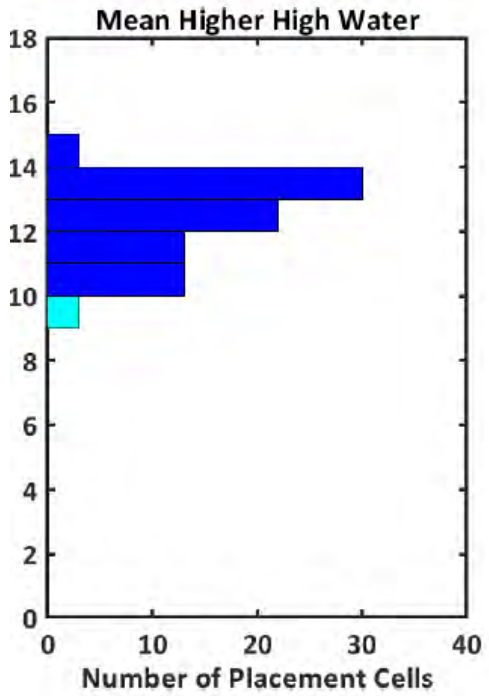
- **Site selection criteria**
  - Eroding or drowning marsh, lack of natural sediment supply
  - Sufficient wind-wave action to resuspend sediment placed
  - Open to tidal exchange
  - Wind-wave shore-normal approach
  - Proximity to a Federal Channel
  - Water deep enough to get scow close to shore
  - Lower populations of critical species
  - Avoiding large eelgrass beds/nearshore reef projects
  - Flood protection for EJ/disadvantaged communities

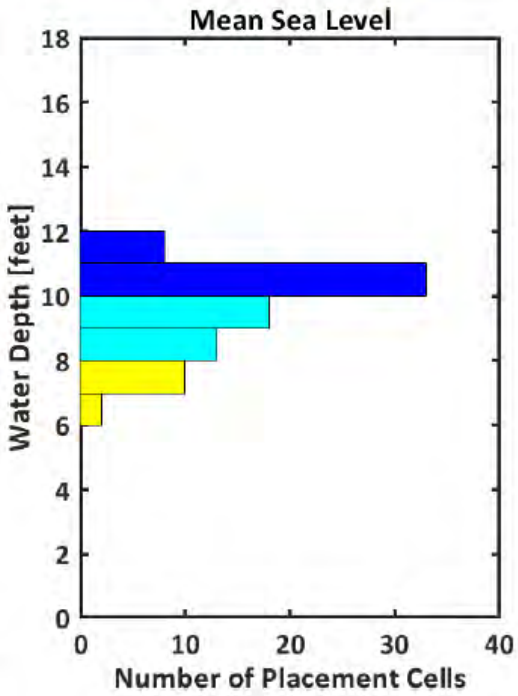


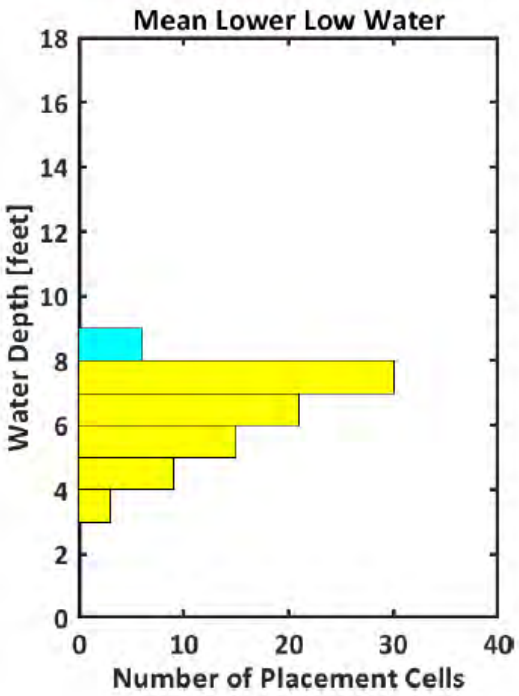
MODELING

- Modeling using UnTRIM Bay-Delta model and sediment transport model to simulate existing conditions and placement alternatives
- **First Round – Site Selection**
  - Determine whether Emeryville or Eden Landing is most suitable for this pilot study
  - Evaluate different placement strategies
    - Testing 100,000 yd^3 total
    - Placement locations
- **Second Round –sensitivity analysis**
  - Different volumes
  - Seasonal differences
  - Size of placement footprint
  - Sediment sources

PLACEMENT STRATEGIES (EMERYVILLE EXAMPLE)

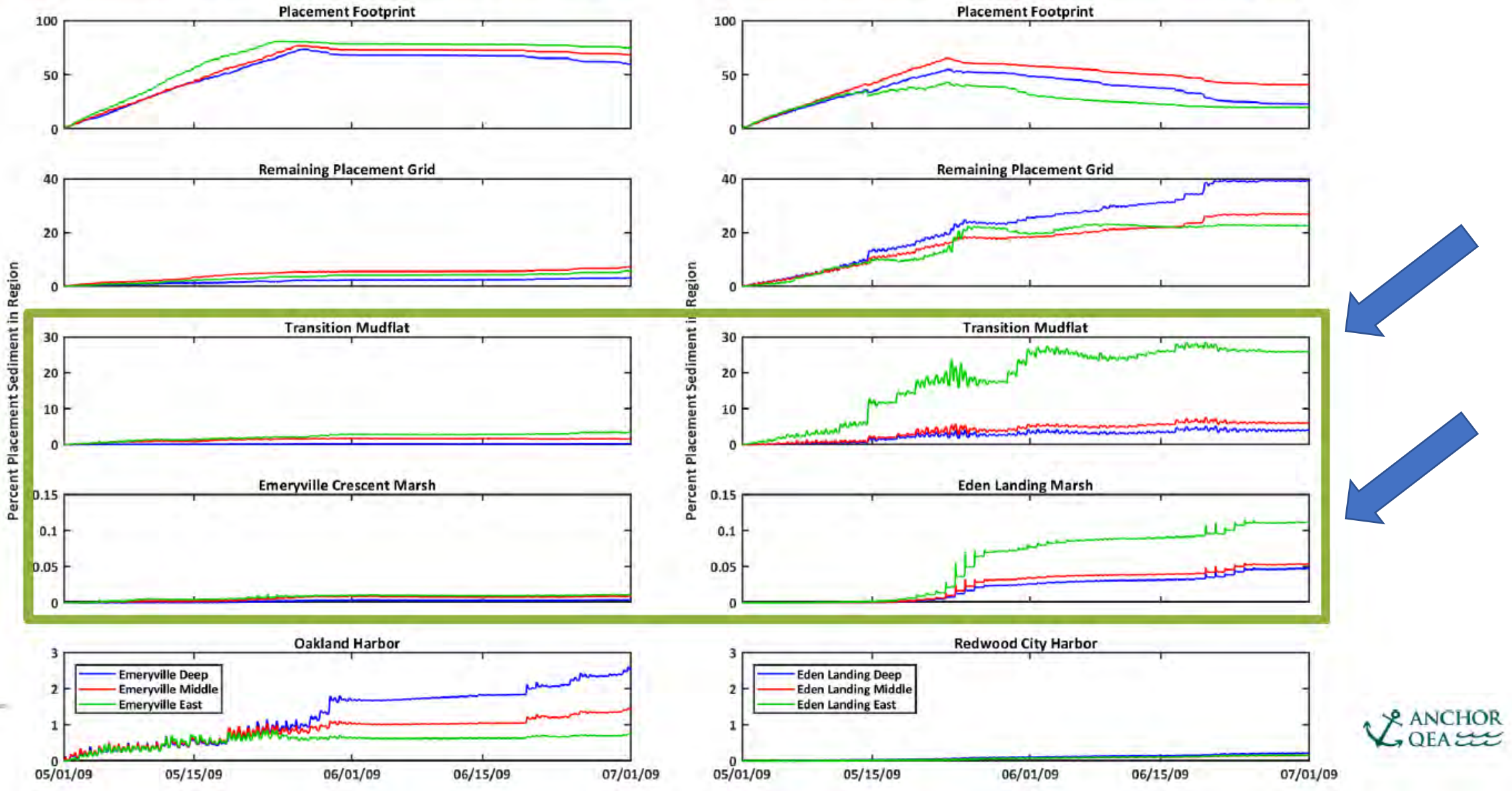




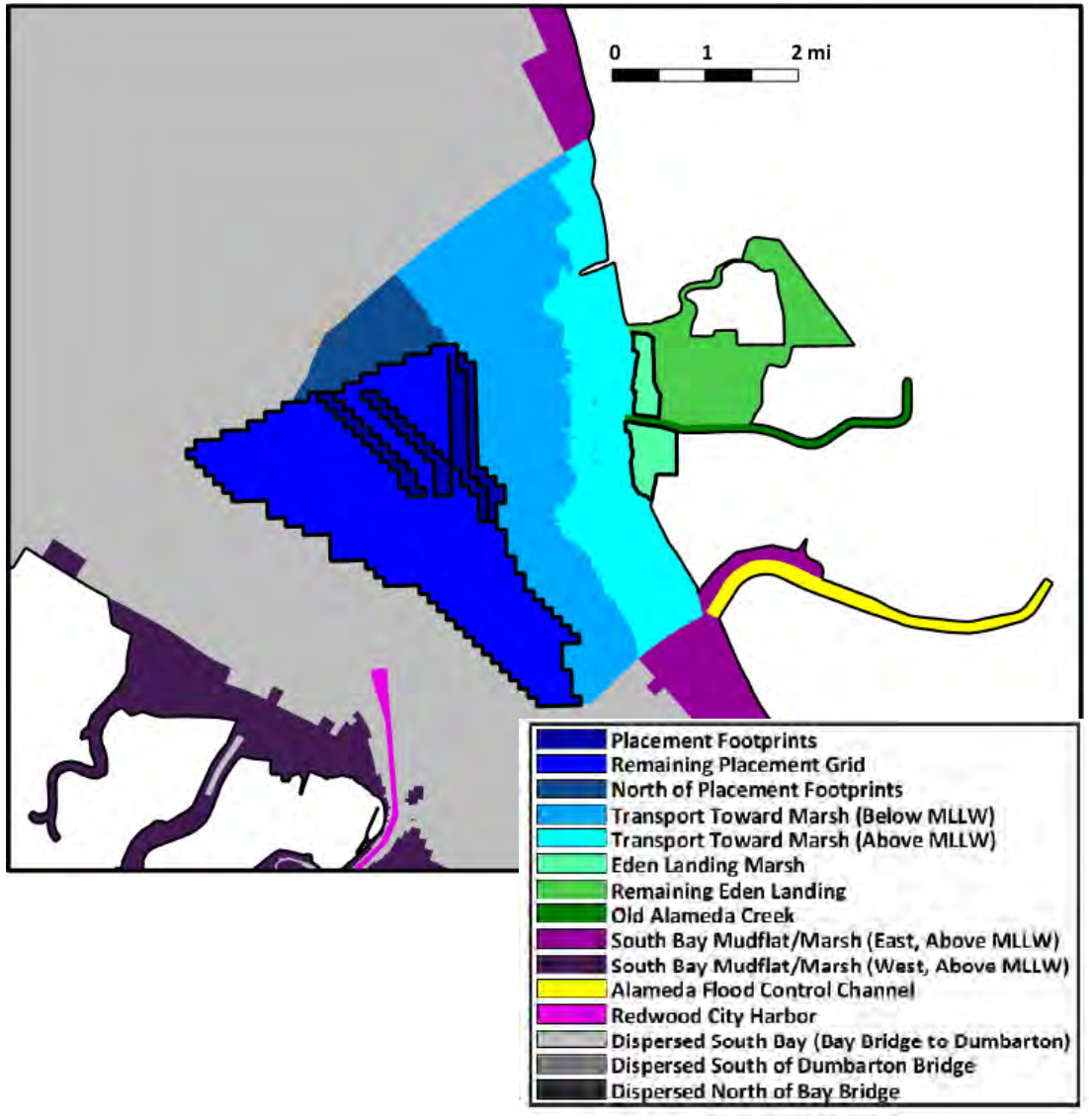


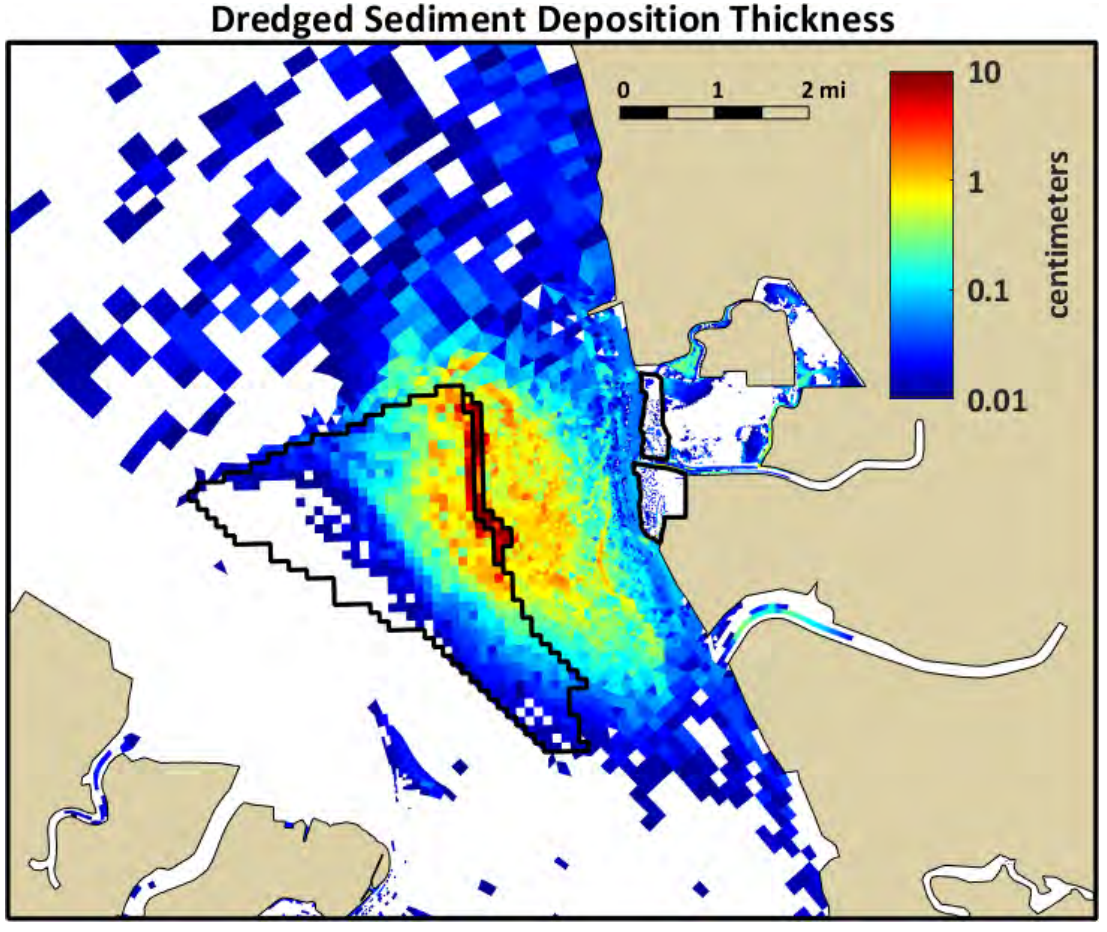
ANCHOR QEA

SCENARIO RESULTS: EMERYVILLE AND EDEN LANDING



EDEN LANDING MODELING RESULTS
SCENARIO: 100K YD^3 PLACEMENT IN SUMMERTIME





SCENARIO RESULTS: EMERYVILLE AND EDEN LANDING

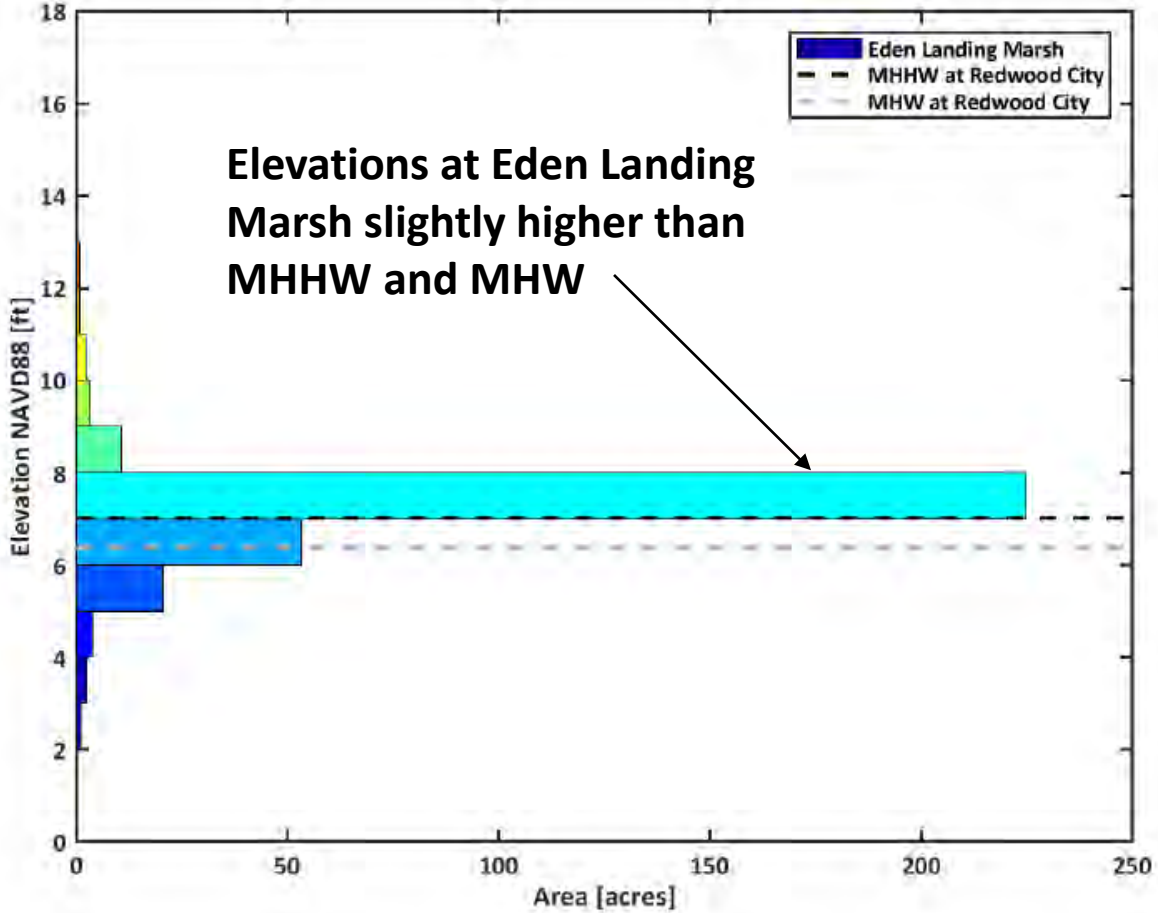
- Percentage of dredged material in various regions at end of simulation

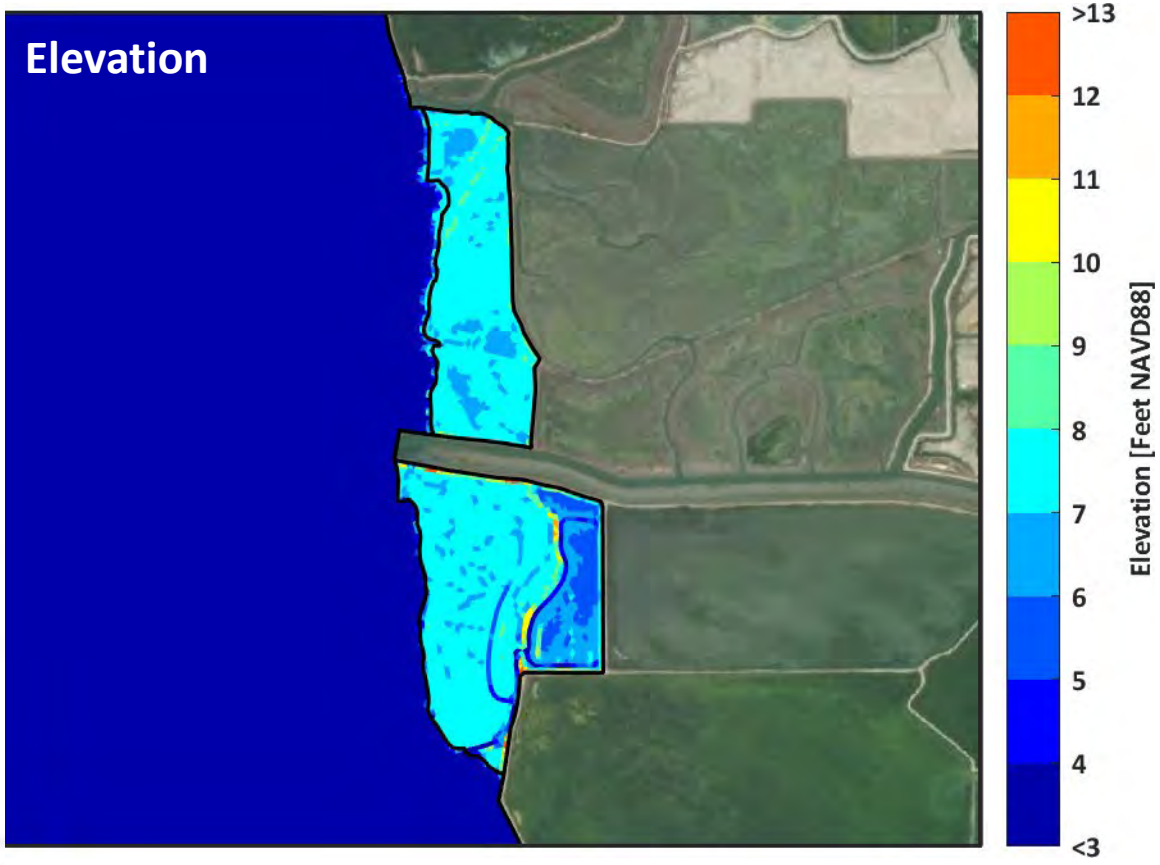
Scenario	Placement Footprint	Remaining Placement Grid	Transition Mudflat	Marsh	Remaining Eden Landing	Ancillary Mudflat (Above MLLW)	Oakland Harbor/ Redwood City Harbor	Dispersed (Below MLLW)
Emeryville Deep	60%	3%	<1%	<1%	NA	<1%	3%	35%
Emeryville Middle	68%	7%	1%	<1%	NA	<1%	1%	22%
Emeryville Shallow/ East	75%	6%	3%	<1%	NA	<1%	<1%	16%
Eden Landing Deep	23%	39%	4%	<1%	<1%	5%	<1%	34%
Eden Landing Middle	41%	27%	6%	<1%	<1%	4%	<1%	26%
Eden Landing Shallow/East	20%	22%	26%	<1%	1%	5%	<1%	32%

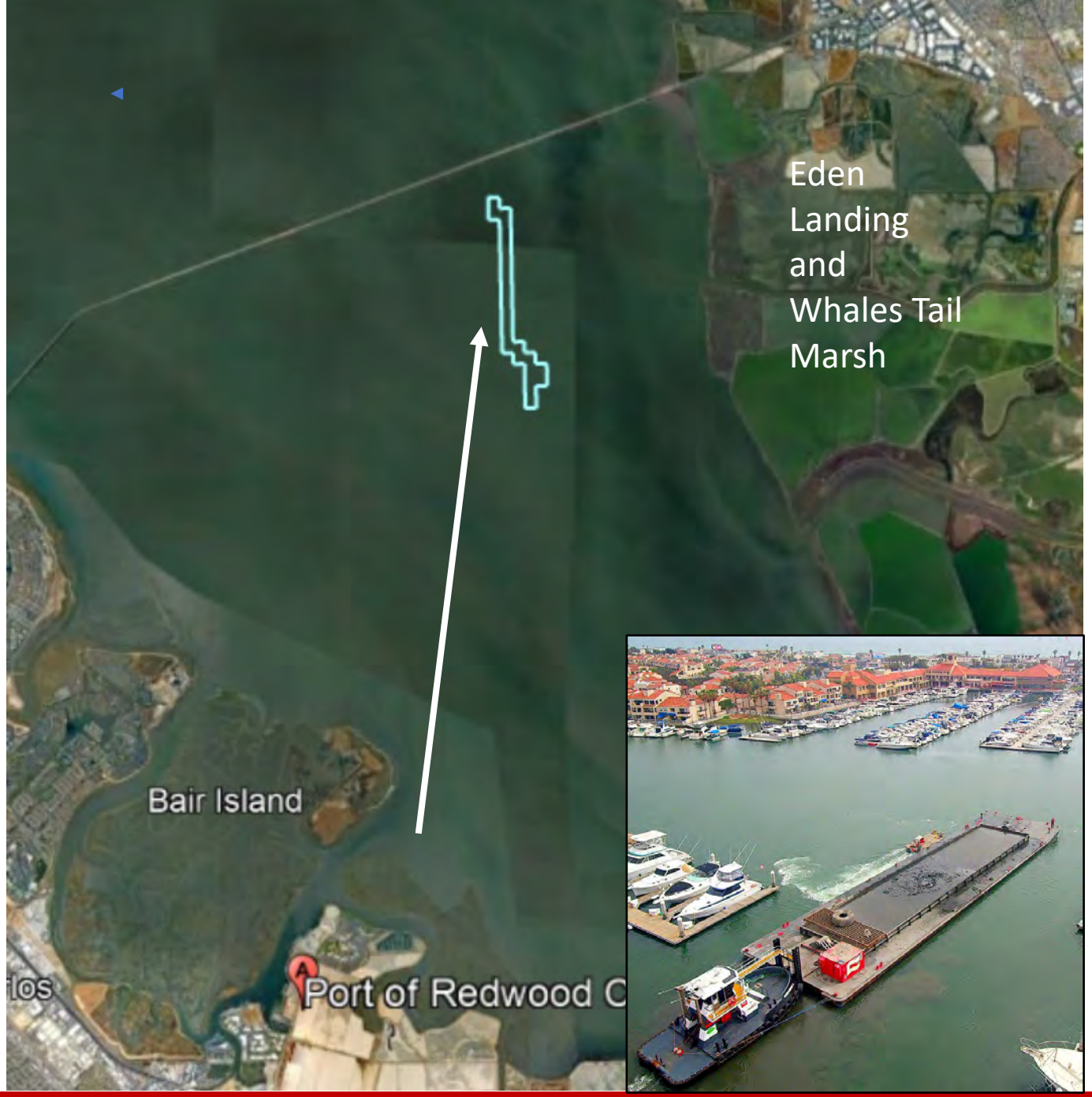
Dispersed is any dredged material not in the other noted regions

ANCHOR QEA

EDEN LANDING: MARSH ELEVATIONS







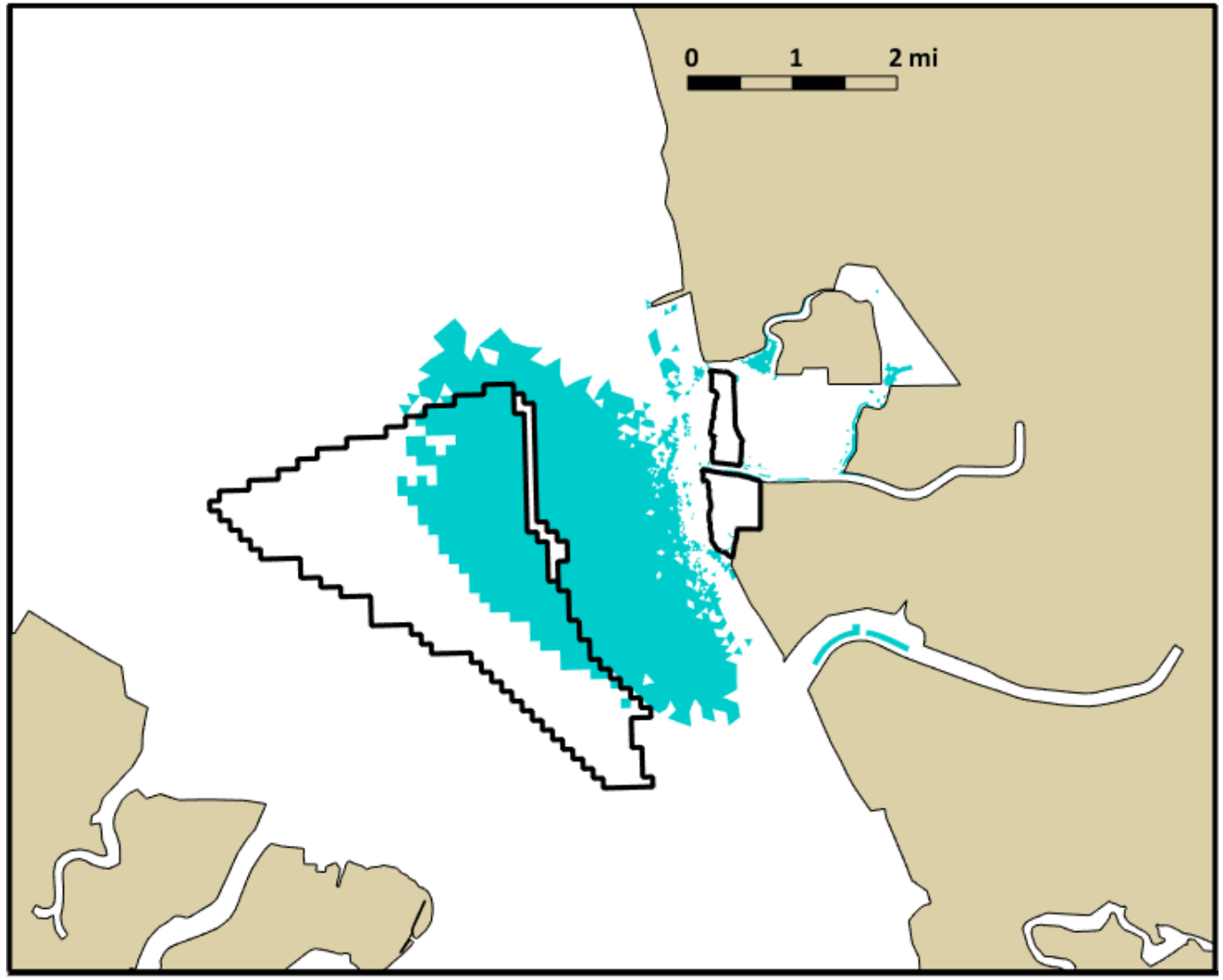
RECOMMENDED PLAN

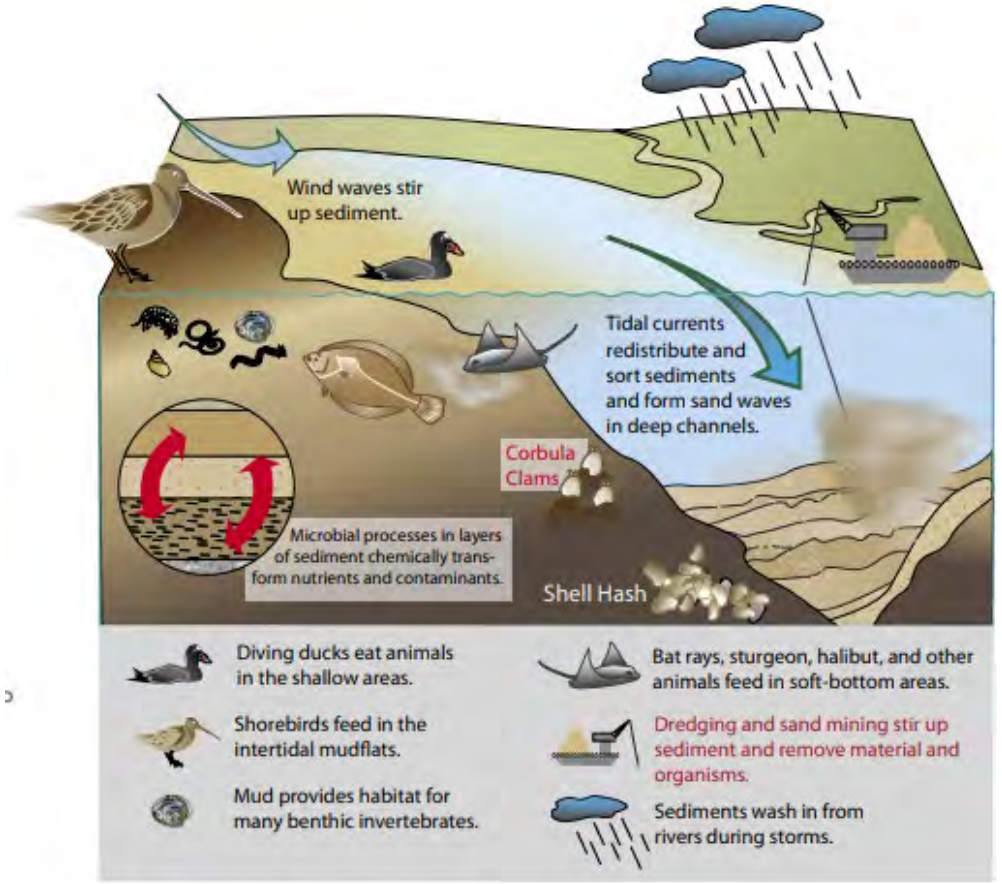
- Placement Site: Eden Landing (shallow)
- Volume: 100,000 yd^3
- Material from Redwood City Harbor Federal Dredging
- ~112 scow trips from RWC dredging diverted to 1.5 miles offshore of Eden Landing
- Placement site is 138 acres, absolute depth is 9-12 ft MLLW
- Sept-Oct 2023

US Army Corps of Engineers: San Francisco District

https://curtinmaritime.com/fleet/arrow-pt-loadlined-split-hulled-dump-scow/

POTENTIAL ENVIRONMENTAL IMPACTS



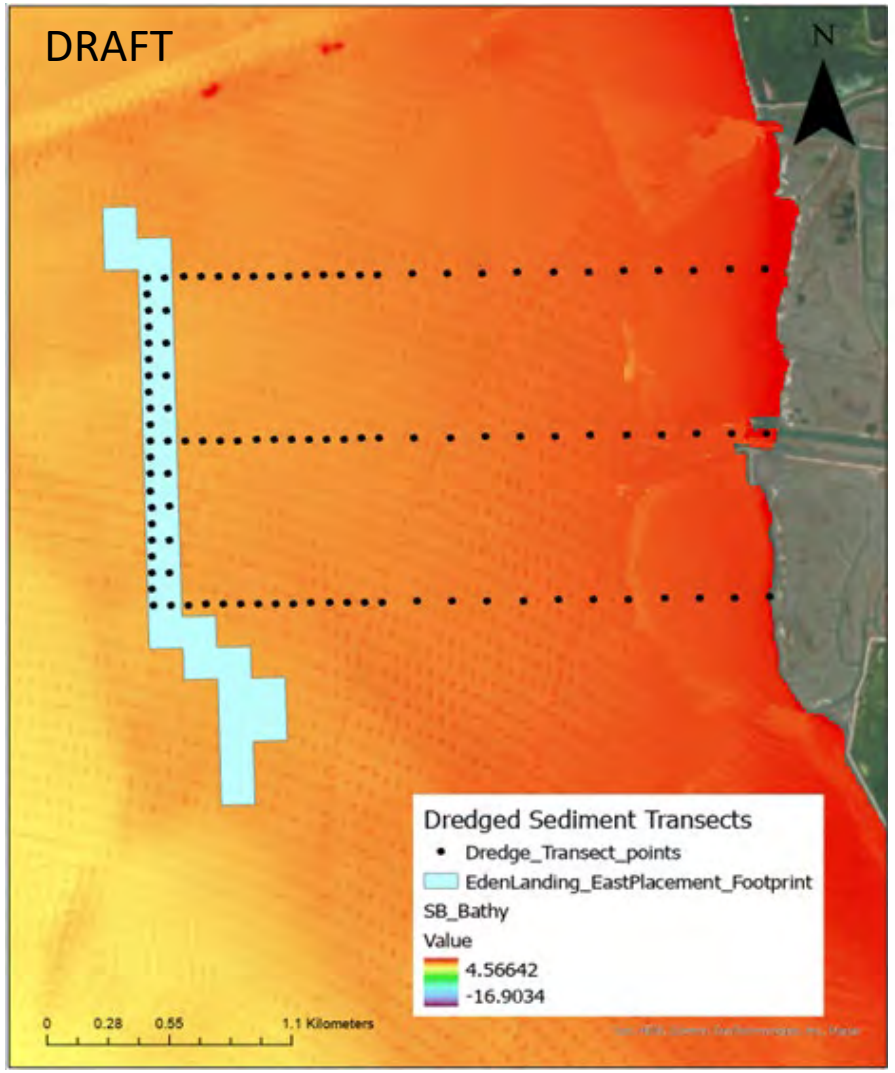


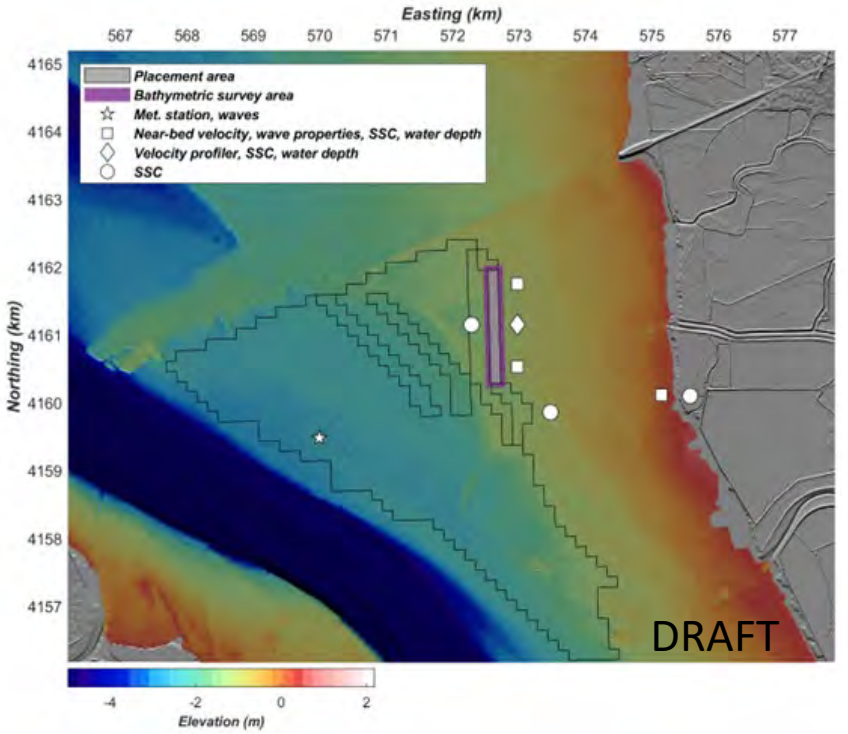
Subtidal goals, 2010

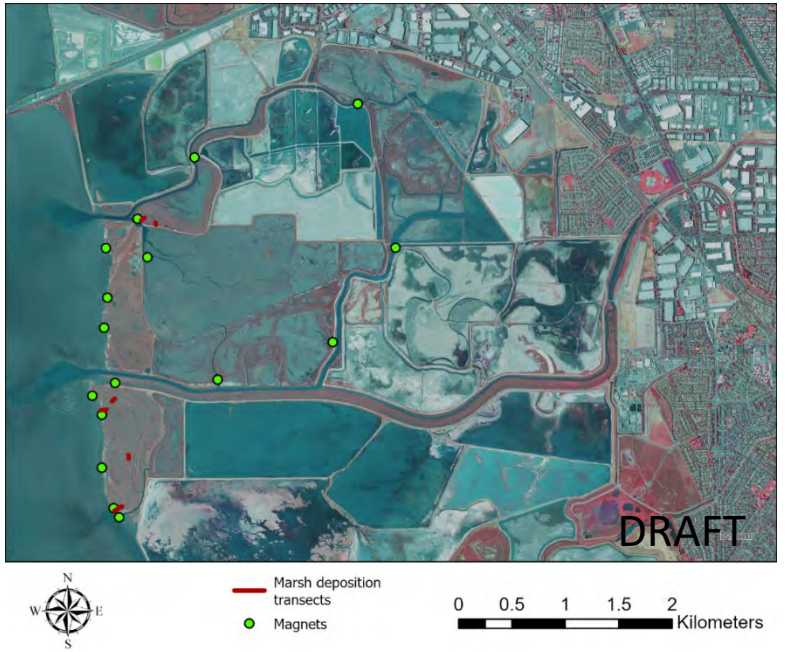
DRAFT MONITORING PLAN

- **Pre-project**
  - Water depth and elevation
  - Suspended sediment, wave conditions
  - Eelgrass surveys
  - Sediment transport rates
  - Background marsh/mudflat gain or loss

- **Post-project**
  - Water depth and elevation
  - Benthos, eelgrass
  - Sediment transport rates
  - Marsh/mudflat gain or loss
  - Magnetic Particle Tracking Study







DEFINING SUCCESS

- What will make this effort successful?
  - Implementation of **novel placement method**
  - Placement without significant impact to ecological function of shallows
  - Material not going to disposal site; **keeping dredged material in the system**
  - **Delivery to mudflats**, and eventually marshes, and restoration ponds
  - Community engagement
  - Development of **monitoring methods** for shallow water placement projects
  - Completion of a **successful contract** with available existing equipment
  - **Testing a tool** useful in maximizing BU for Regional Dredged Material Management Plan and beyond

US Army Corps of Engineers: San Francisco District

THANK YOU

Contact: Julie.R.Beagle@usace.army.mil