Working with Water: Strategic Shallow-Water Placement Pilot Project using Dredged Sediment

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PILOT PROJECTS TAKE TEAMWORK!

USACE

Peter Mull - Project Manager
John Dingler- Planning Mentor
Arye Janoff - Planner
Julie Beagle- Environmental Planner
Eric Joliffe- Environmental Planner
Ellie Covington- Environmental Planner
Tiffany Cheng- Coastal Engineer
Fanny Chan- Civil Engineer
Kelly Boyd – Real Estate
Stephanie Sahinoglu-Cultural Resources

Modeling

Michael MacWilliams, Aaron Bever (AnchorQEA)

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SF Bay Regional Water Quality Control Board (CEQA Lead)

Xavier Fernandez
Kevin Lunde
Jazzy Graham-Davis
Christina Toms

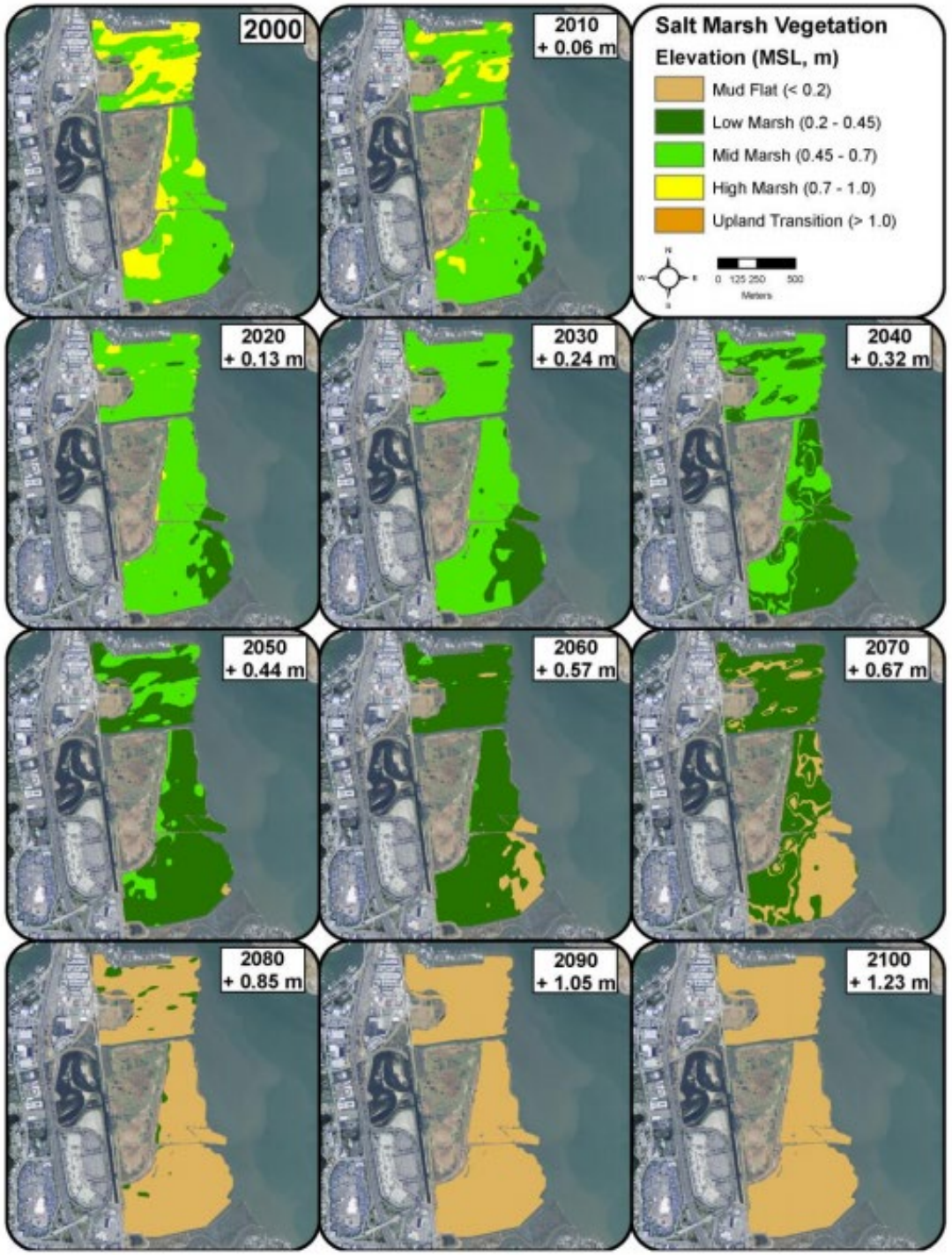
USGS / Monitoring

Jessie Lacy, Andrew Stevens
Karen Thorne, Kevin Buffington
Susan de la Cruz, Isa Woo, Tanya Graham
Keith Merkel

MANY OTHERS

Arrowhead Marsh
Peter Essick/Aurora

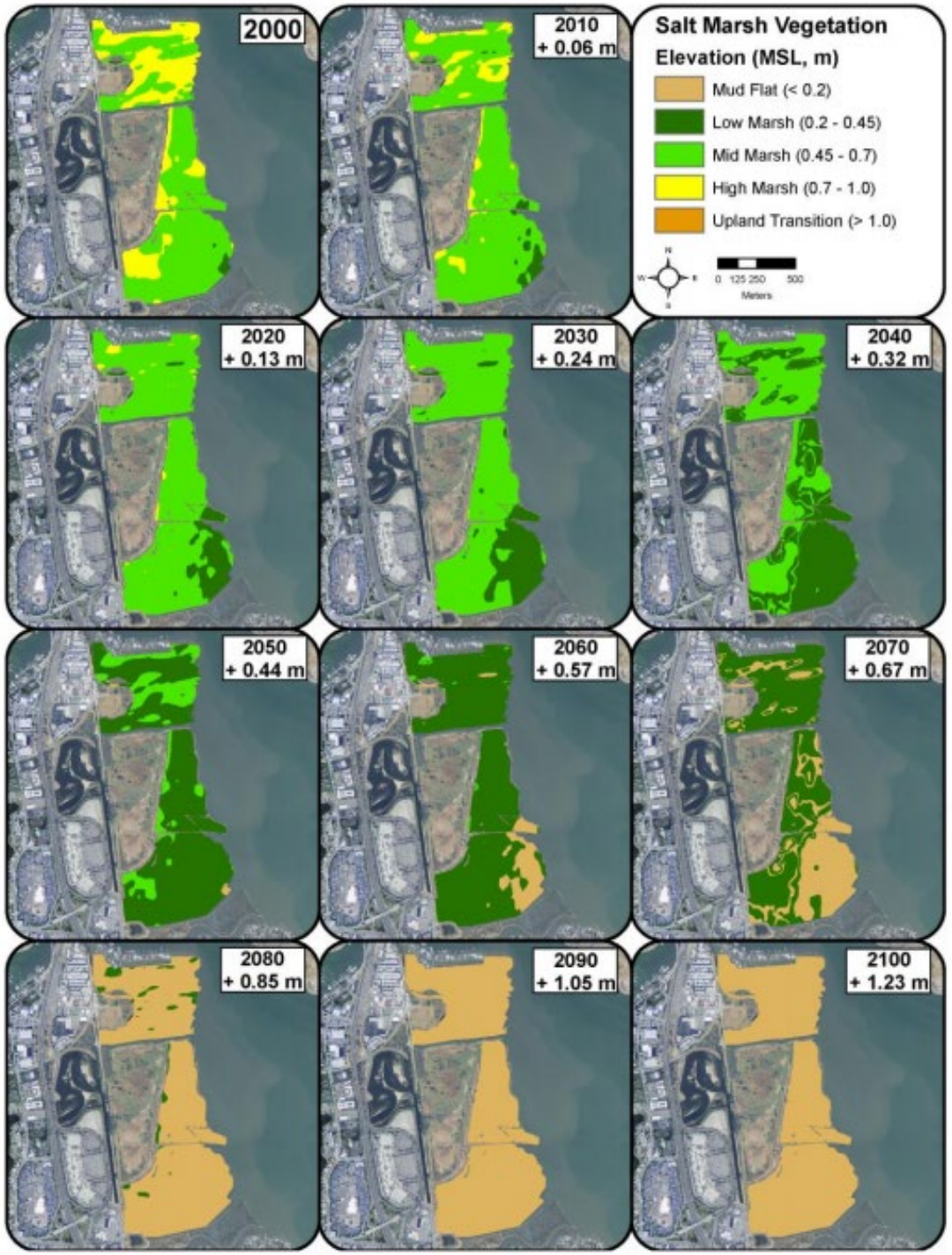
Arrowhead Marsh
Boardwalk During King Tide
1/22/2012
Flikr. KPaulsell



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



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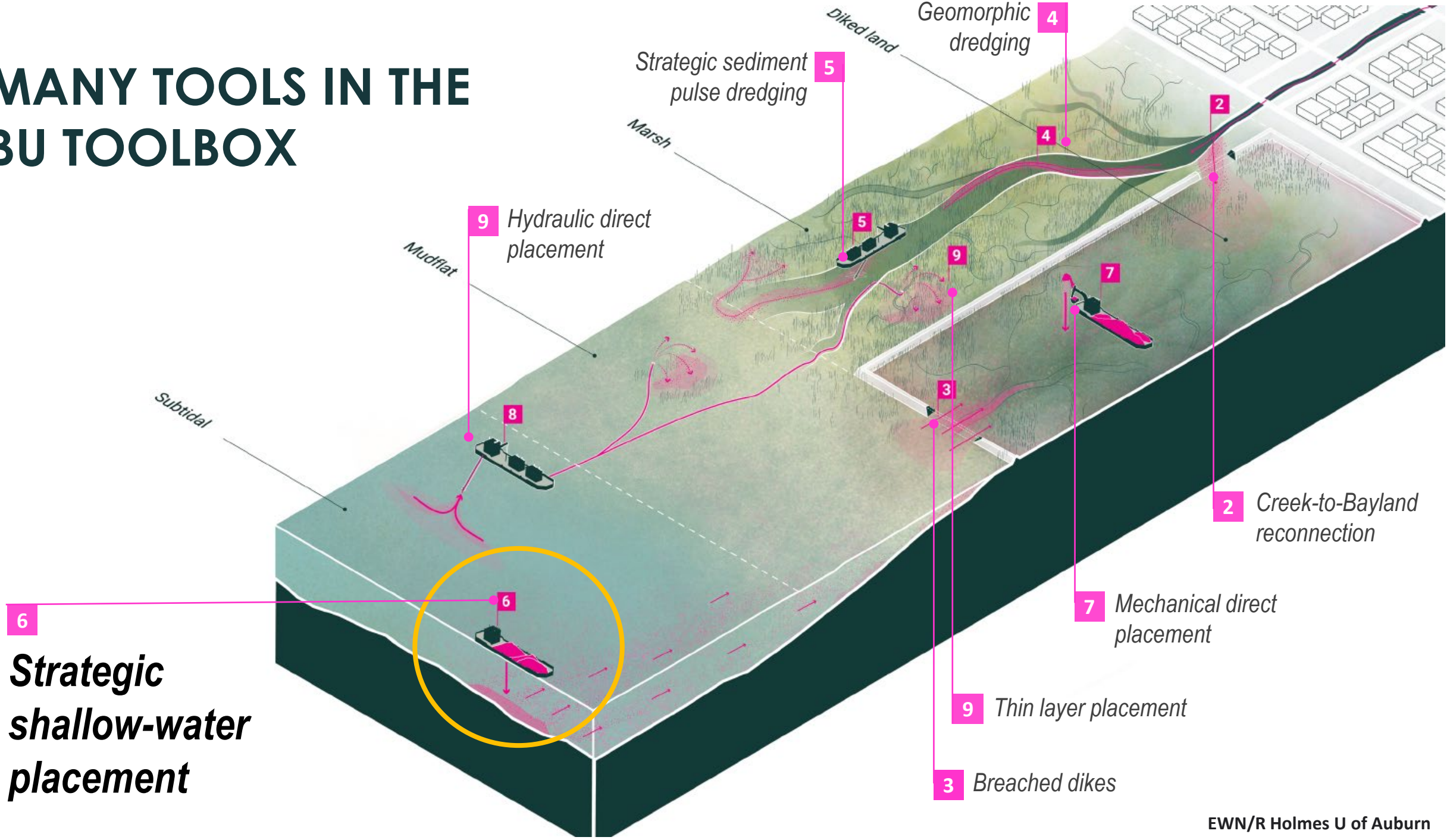
OPPORTUNITY

- Reuse dredged material in innovative ways to support existing bayland ecosystems
- **Leverage dredged material** from navigation channels
  - Beneficial Use: Direct Placement
  - **Novel EWN Methods (e.g., Strategic Placement**)

MANY TOOLS IN THE BU TOOLBOX



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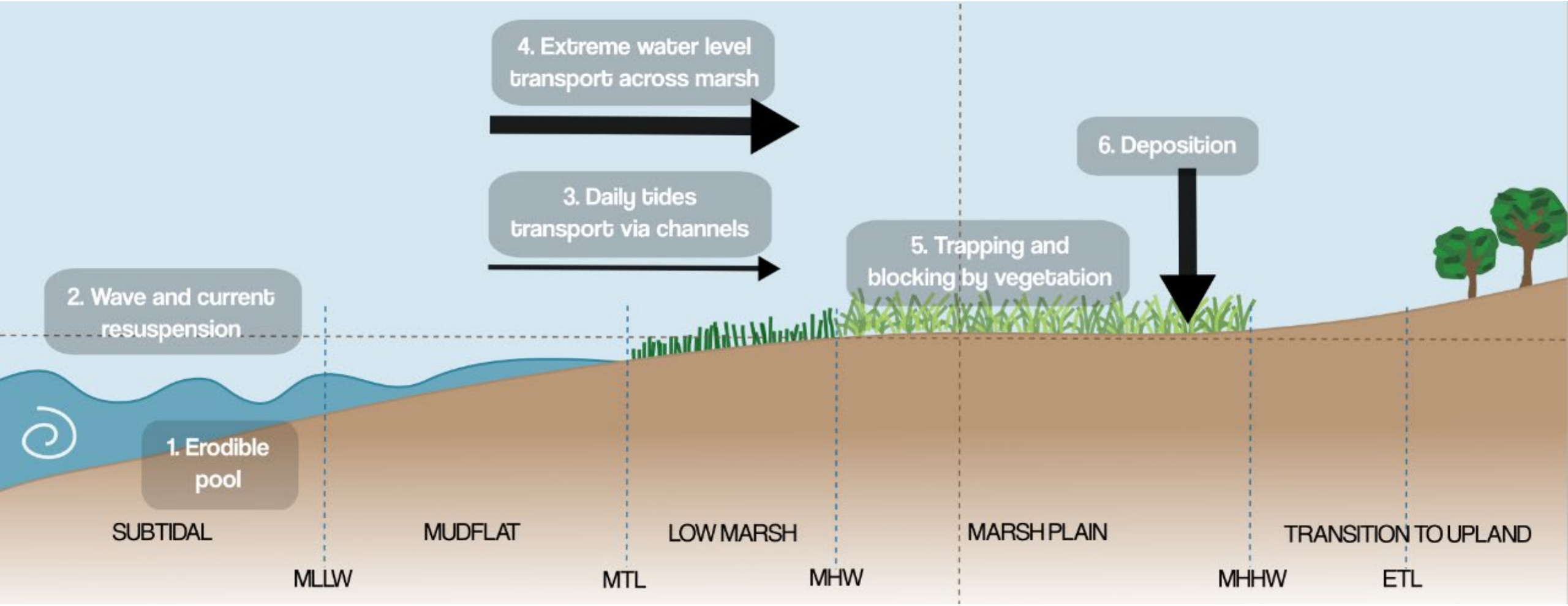
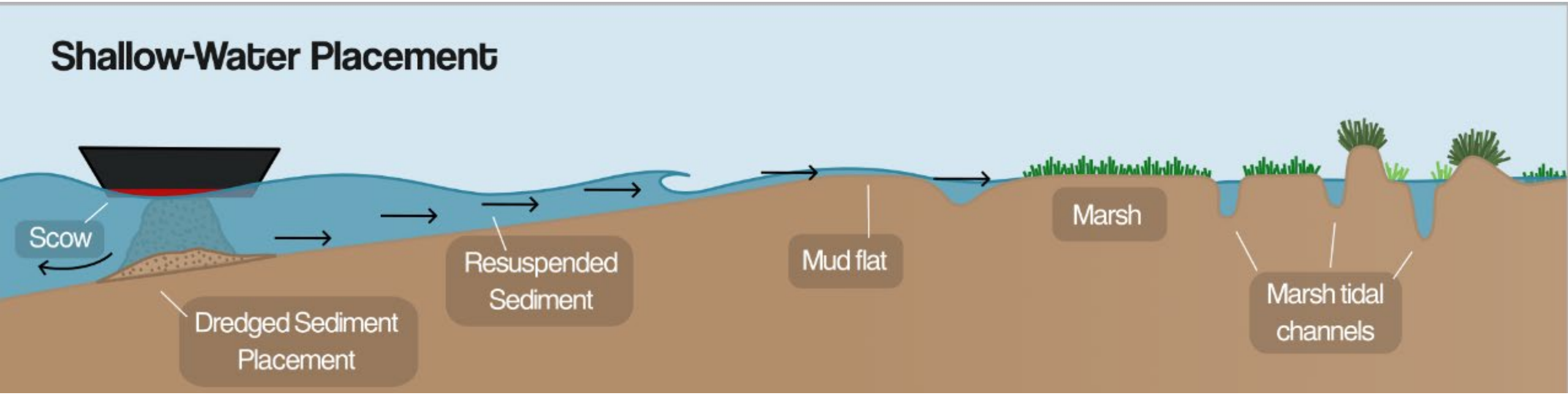
Strategic shallow-water placement

EWN/R Holmes U of Auburn

SEDIMENT TRANSPORT BETWEEN SHALLOWS AND MARSH



MIMICKING/BOOSTING SEDIMENT TRANSPORT PROCESSES



WHERE CAN THIS TOOL BE USED?

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
- Deep water close to shore
- Avoiding large eelgrass beds/nearshore reef projects
- Flood protection for EJ/disadvantaged communities

- **90,000 CY** dredged from the Port of Redwood City, Reach 1 and 2
- Dec 6-Dec 31, 2023

- Loaded **into shallow-draft scows** (1600 CY and 300 CY)

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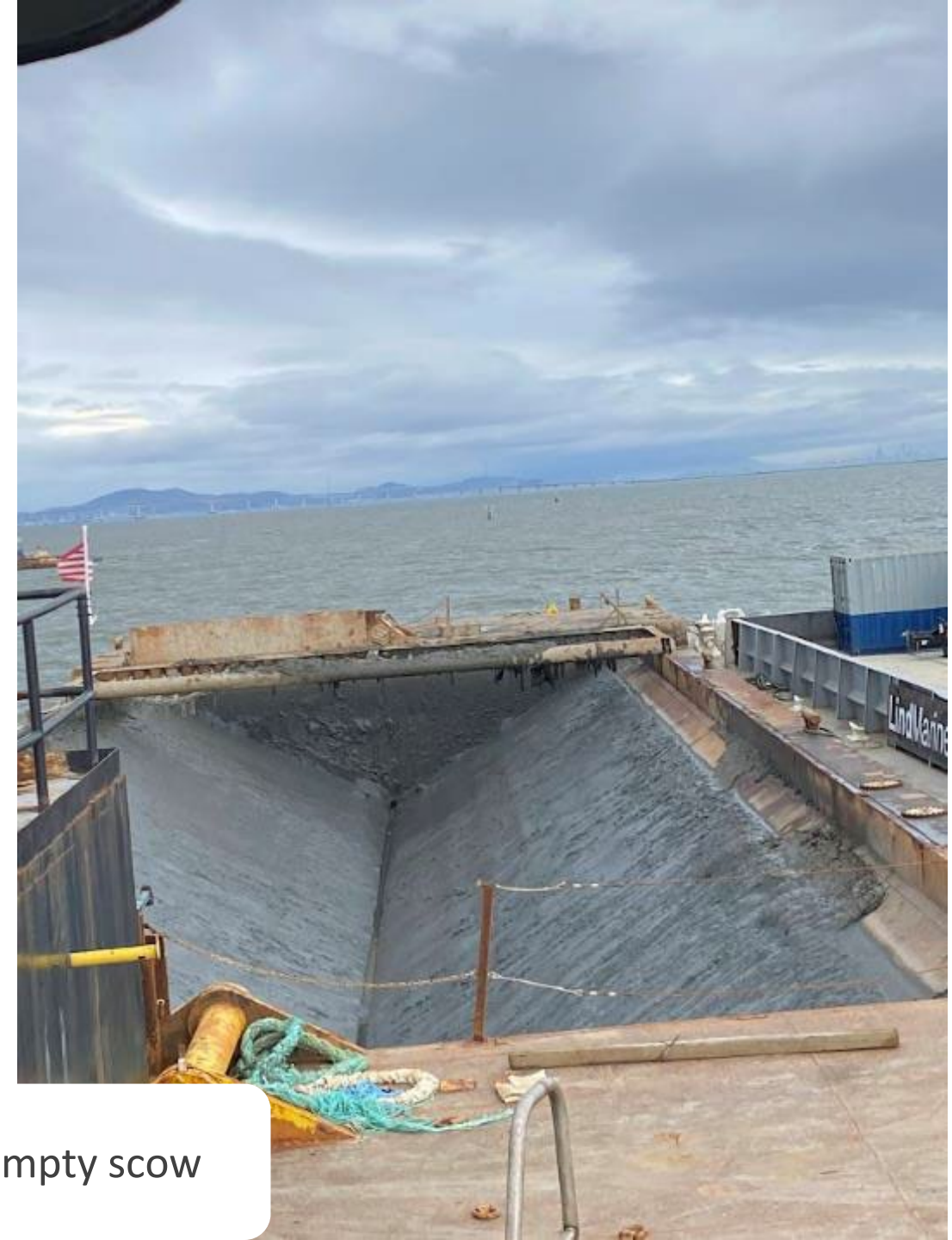
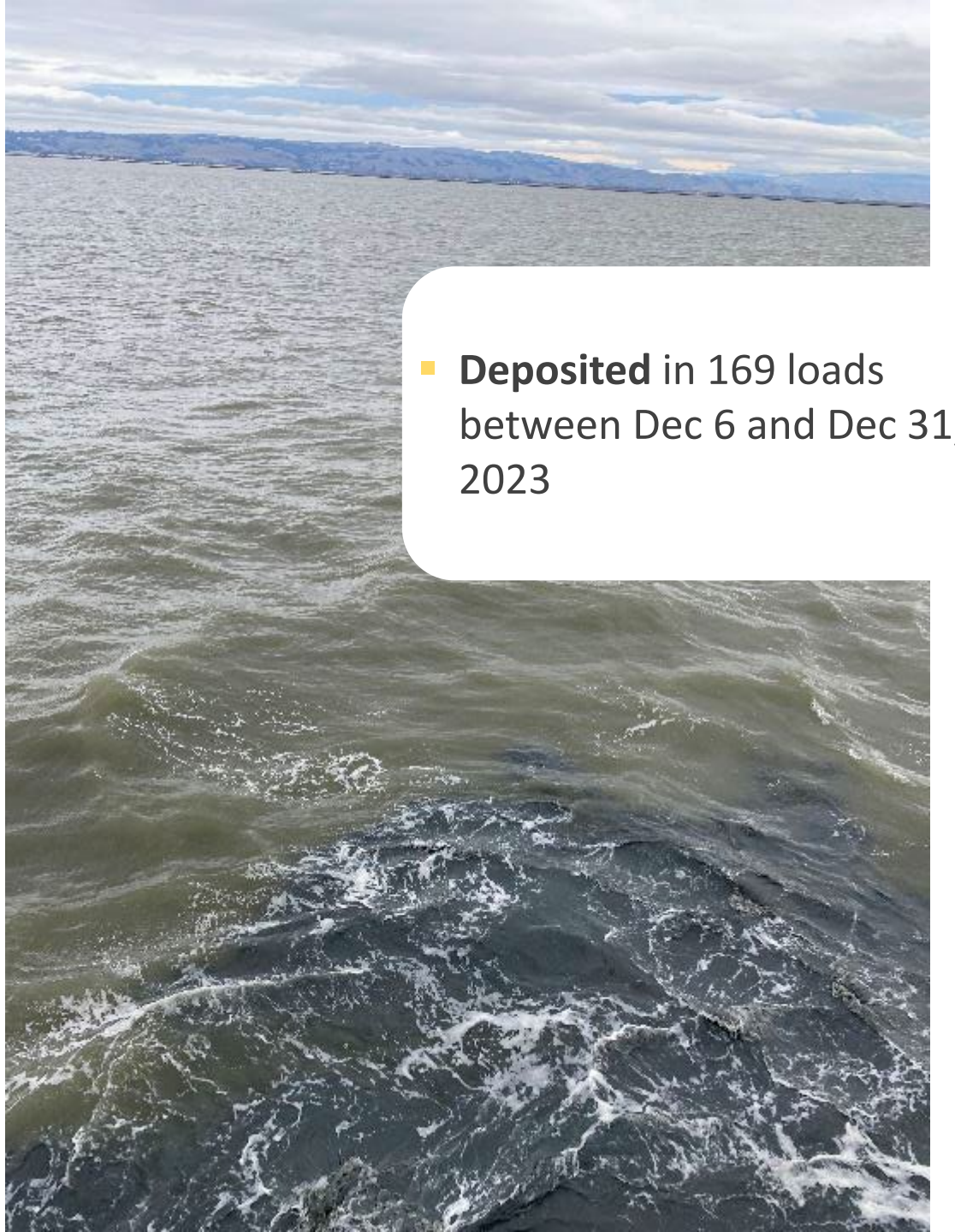
- Pushed across the Bay by Tugboat



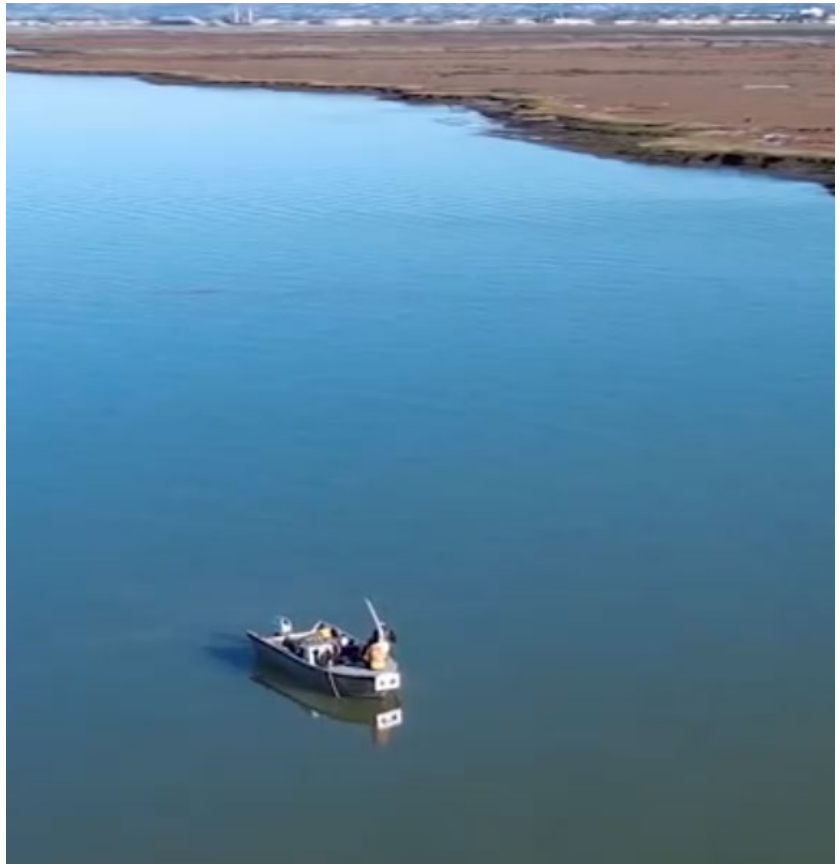
- Empty scow



- **Deposited** in 169 loads between Dec 6 and Dec 31, 2023

MOVING DIRT IS HARD, and we are running out of time!

- Unknown timing of the dredging
- Windows for permits closed or had to be extended
- Government shut down loomed
- Required LOTS of communication, across USACE, dredgers, regulators, monitoring teams, media, and more.
- Sea levels are rising…….



DEFINING SUCCESS

How will we gauge success of this effort?

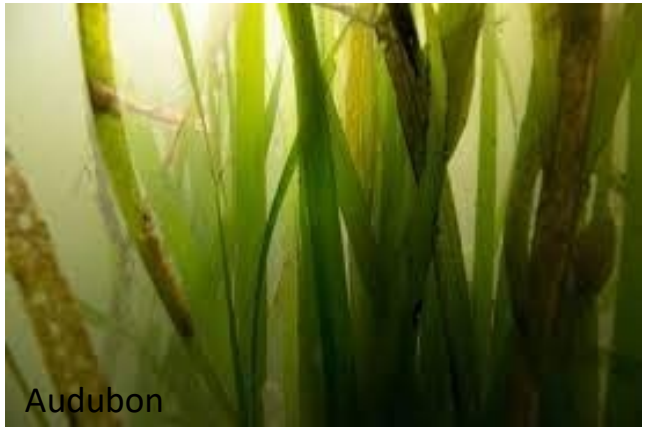
- ✓ Implementation of **novel placement method**
- ✓ Material not going to disposal site; **keeping dredged material in the system**
- **Delivery to mudflats**, and eventually marshes, and restoration ponds
- ✓ Community and Tribal **engagement**
- ✓ Completion of a **successful dredging contract** with available equipment
- ✓ Attracting **new members** of the dredging industry to the region
- Placement minimizing impact to **ecological function of shallows**
- ✓ **Testing a tool** useful in maximizing BU for the future
- Development of **monitoring methods** for future efforts

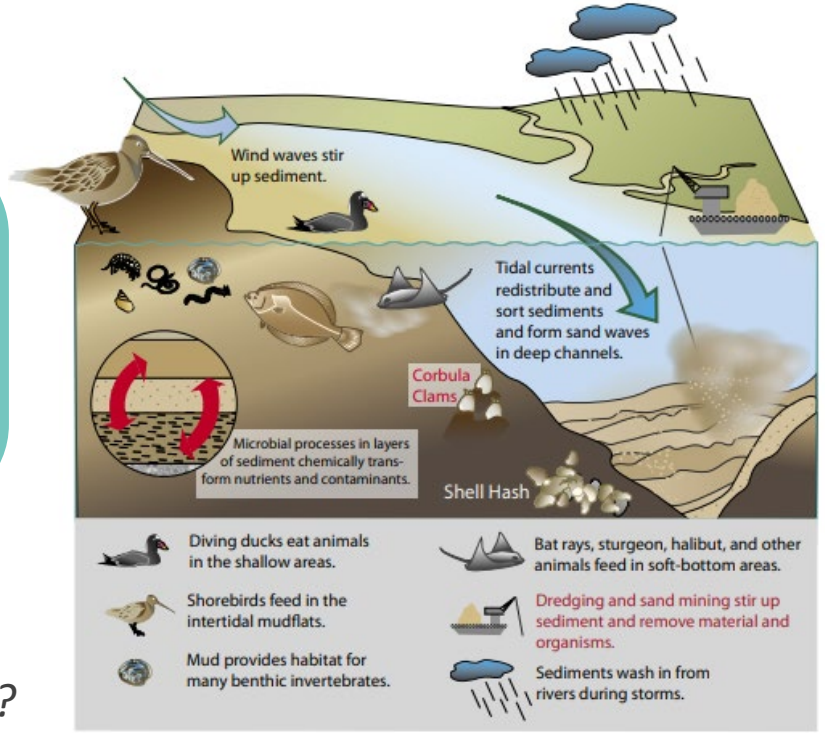
KEY MONITORING QUESTIONS

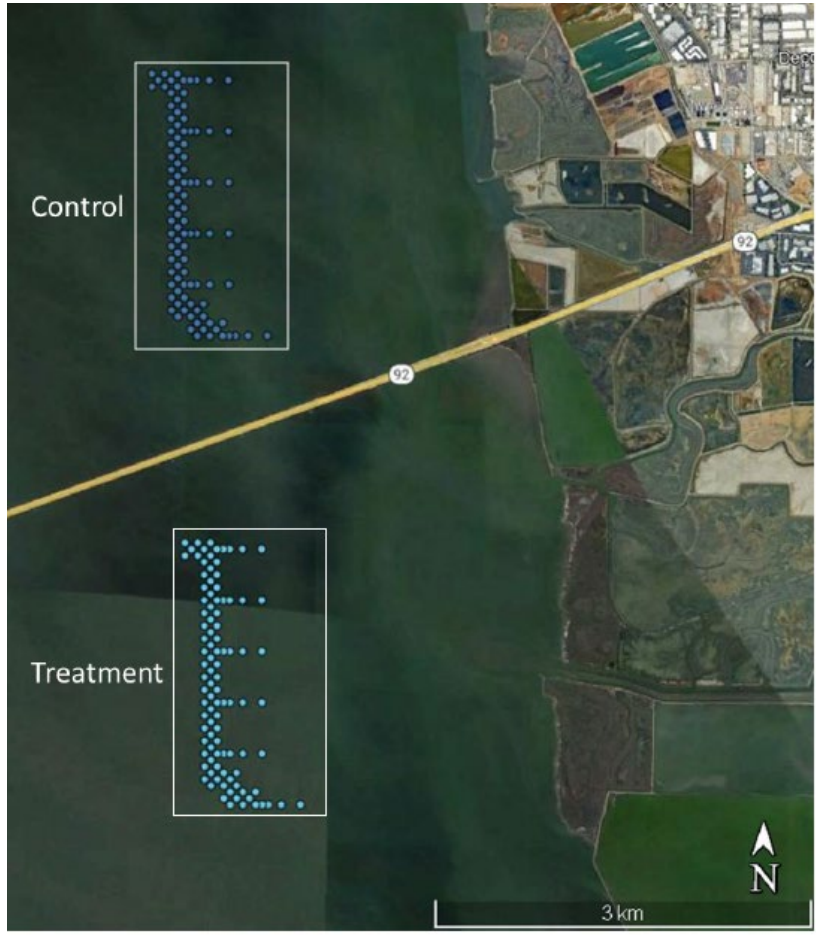
1

What are the potential impacts on the benthos and ecological communities nearby?

- *How long do the effects last?*
- *How far do the effects spread?*
- *What about eelgrass in the area?*







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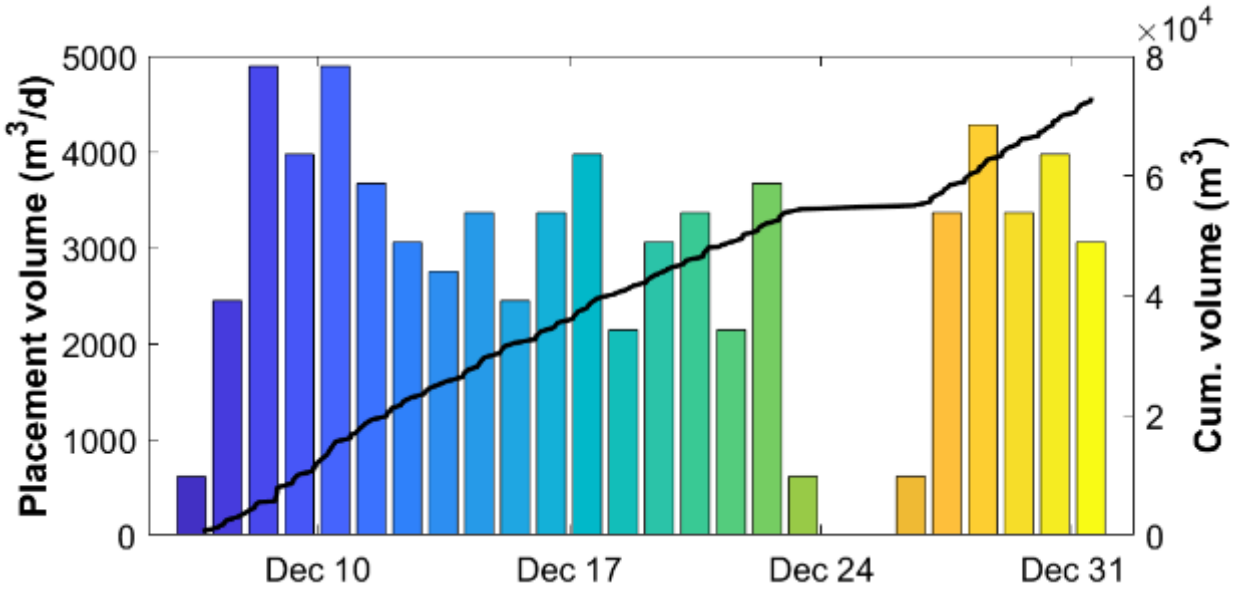
2

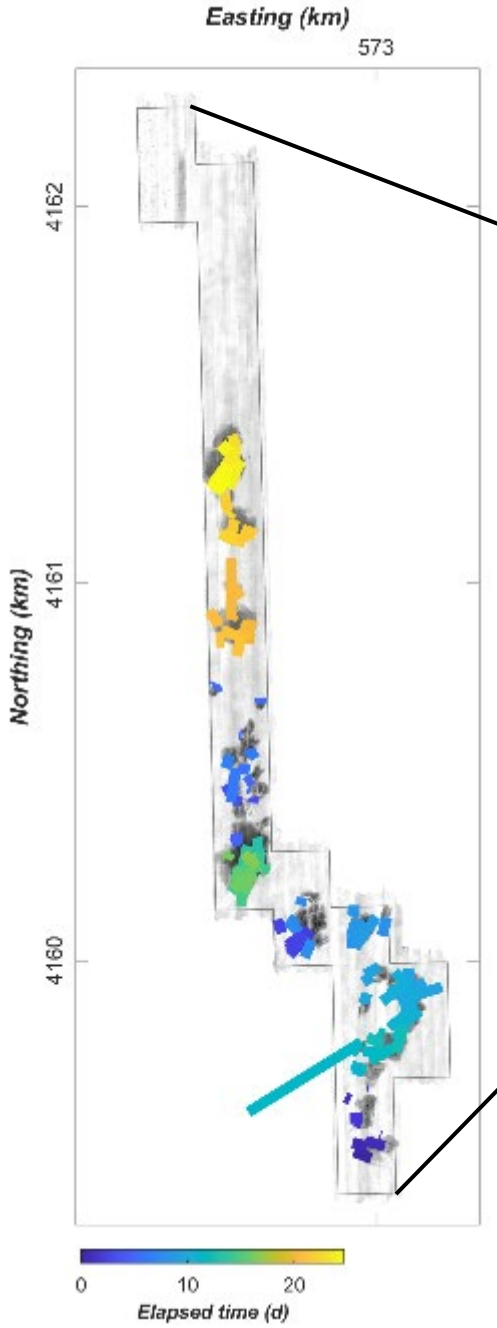
Where does the sediment end up? How do physical processes (tides and waves influence its transport?

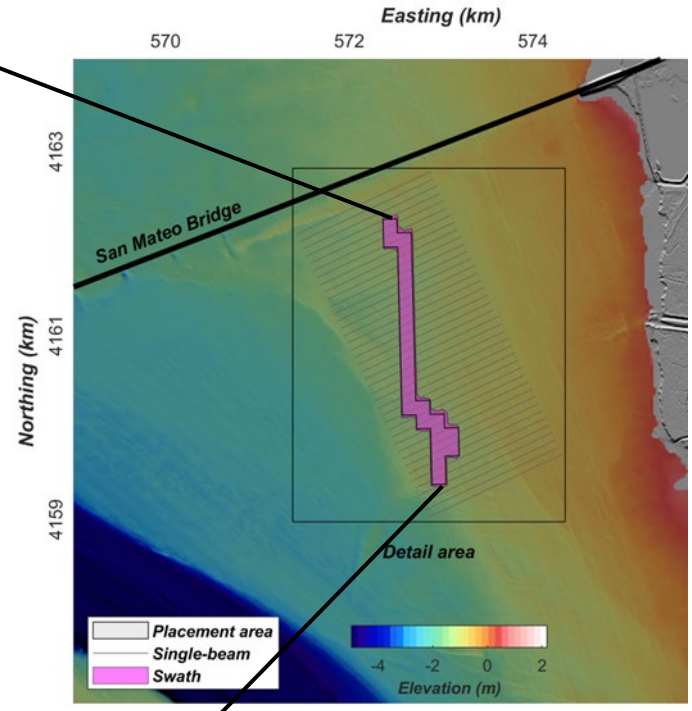
- *Repeat bathymetric surveys*
- *What wave conditions move sediment?*
- *Use of a particle tracking study*
- *Understanding deposition in mudflats, marshes, breached ponds*

Placement Dec 6-31, 2023

Dredgers reported time, location and volume of each placement







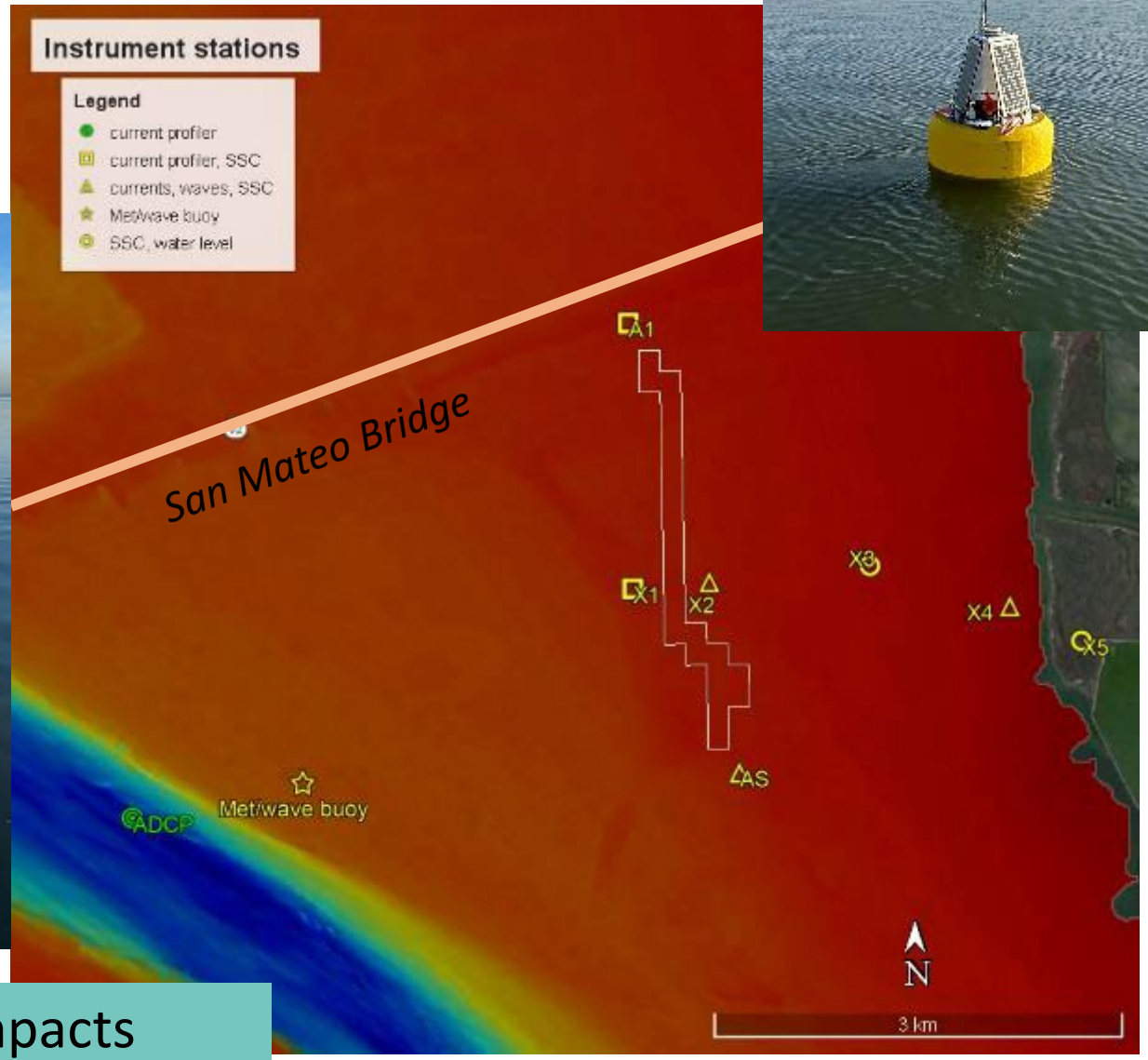
Placement area

Sediment fate and transport

Oceanographic data

Monitoring waves, currents, salinity, suspended-sediment concentration in region of placement area

November 2023-July 2024



Sediment fate and transport

Potential impacts

Effects on Benthic Communities

Benthic community density, diversity and accessibility for predators

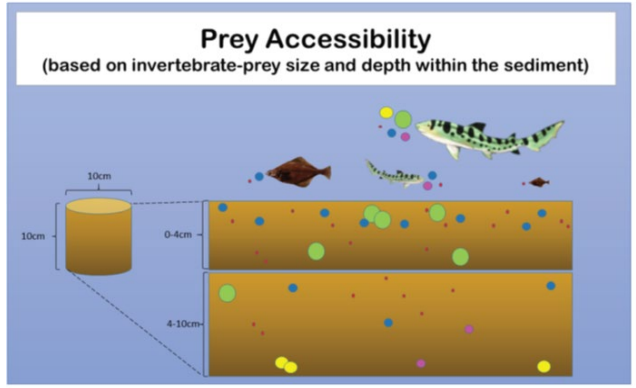
Before After Control Impact (BACI) design to evaluate effects:

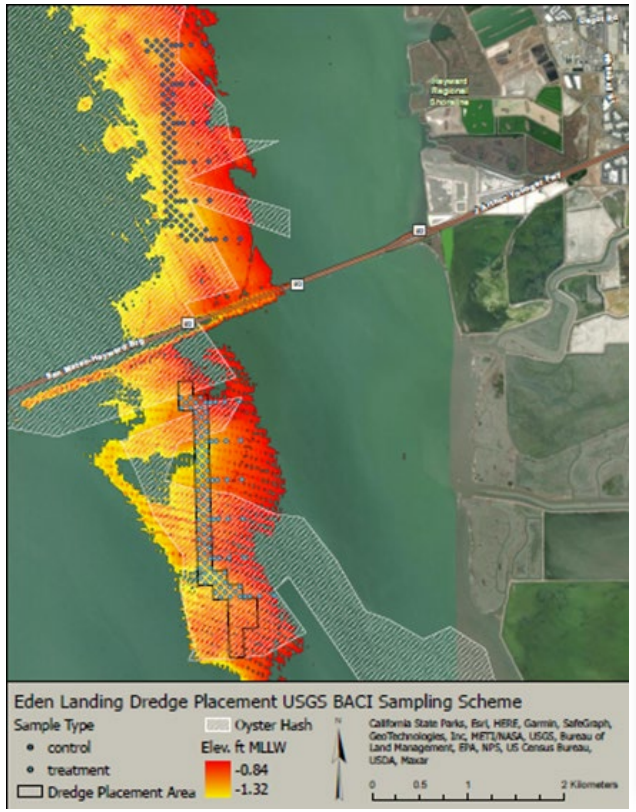
- Distance from placement
- Time since placement

Intensive sampling effort

- immediately pre and post placement
- 6 months later

Potential impacts





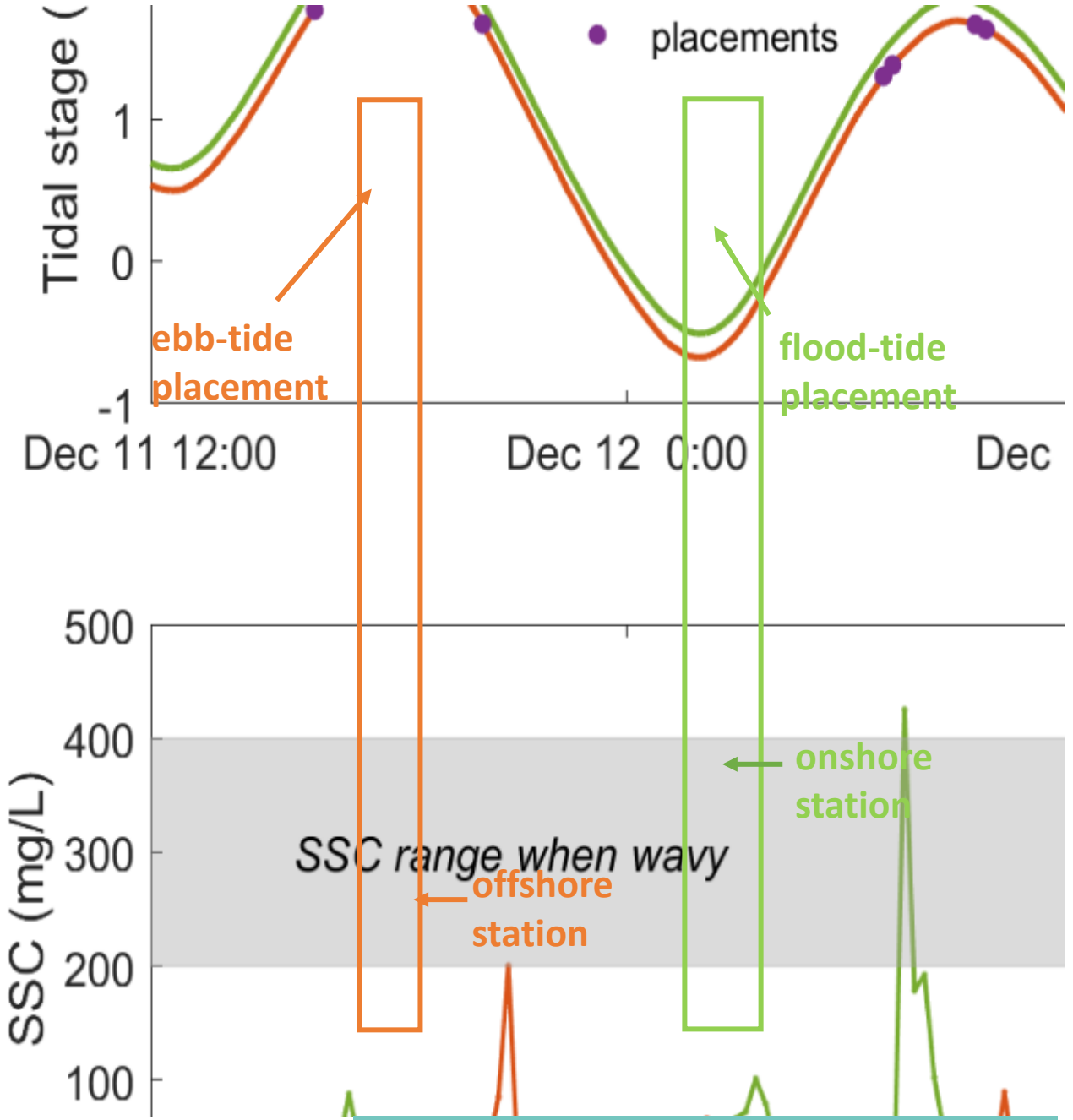
USGS WERC: De La Cruz, Woo, Graham

SSC during placement

Increased SSC reduces light penetration, a concern for eelgrass and phytoplankton

- Spikes in SSC occurred after many placement events
- Spikes typically lasted 1-1.5 hours
- Observed at ‘closest’ station in direction of tidal currents
- During wave events, SSC at all stations reached 200-400 mg/L for >12 hours

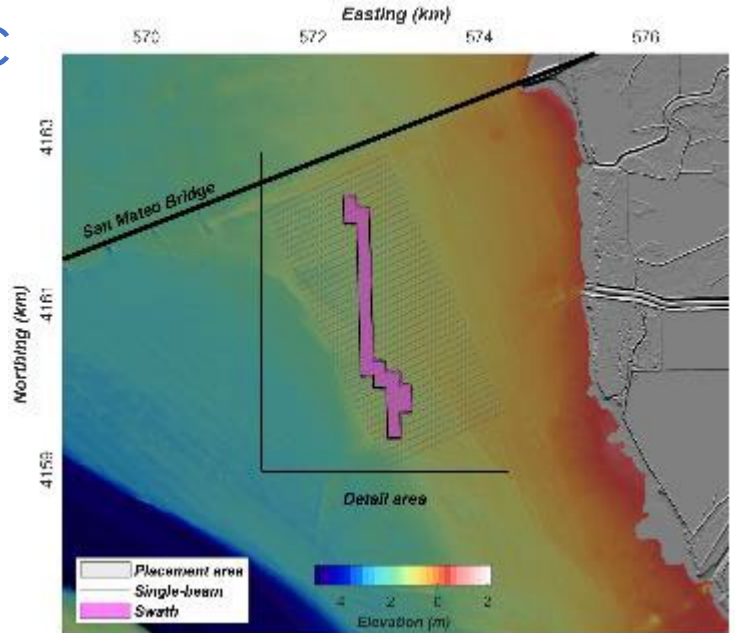
Placement increased SSC for short periods, without exceeding levels that occur naturally

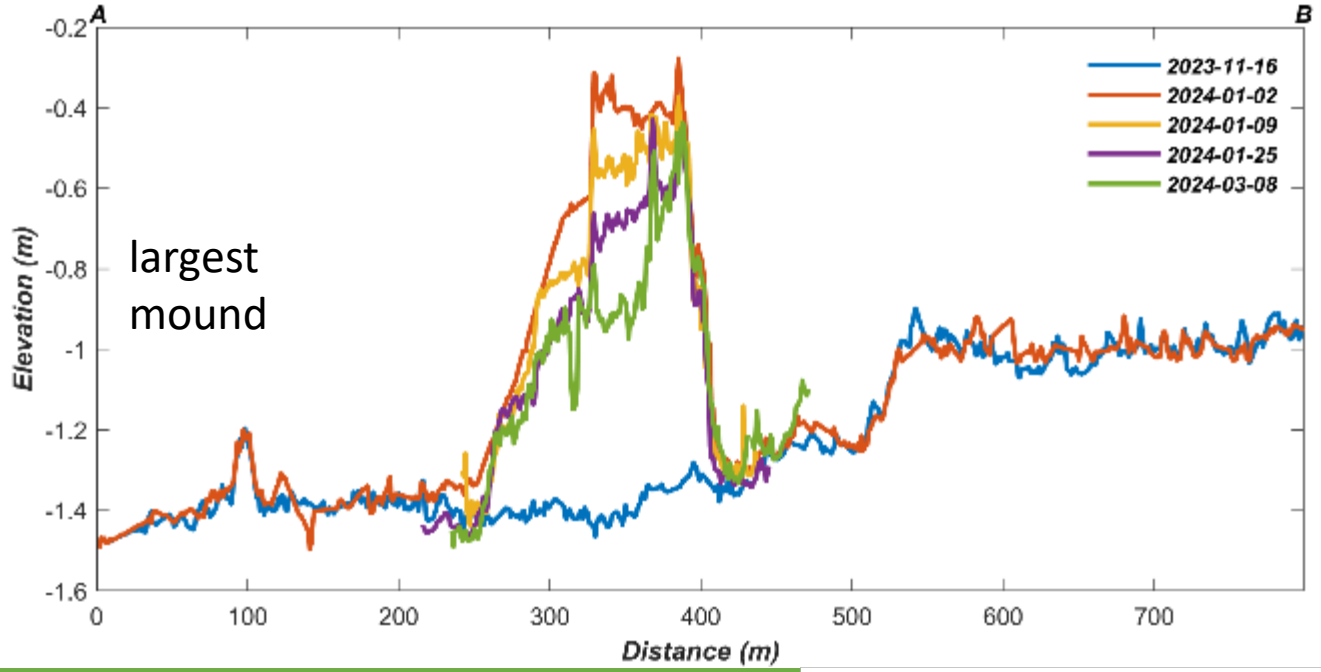


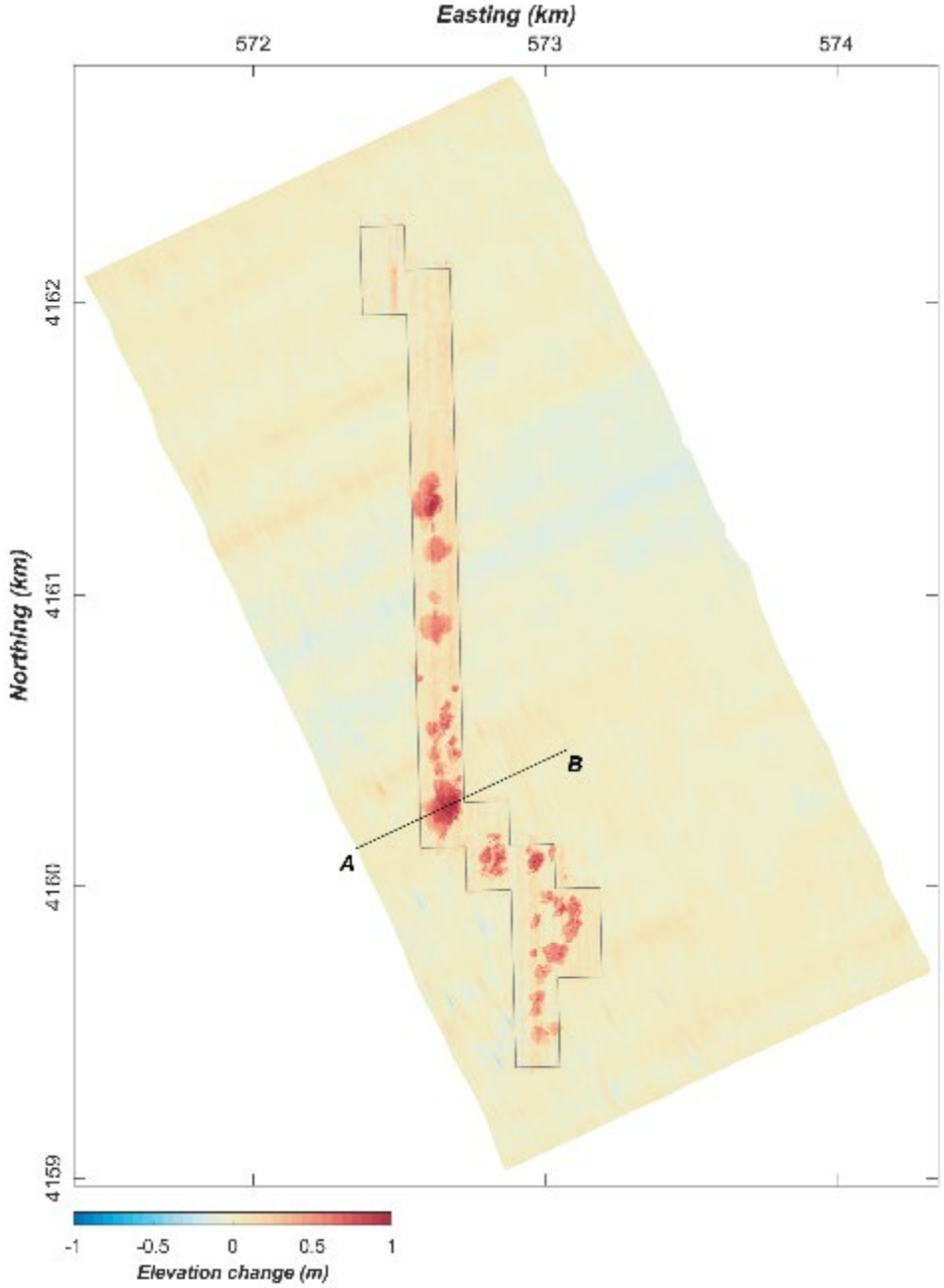
Potential impacts

Repeat bathymetric mapping:

- Multiple mounds
- Varying size
- Height and volume gradually decreasing







Sediment fate and transport

How long does it take for the dredged material to disperse?

Tracer study

- 1,000 kg of fluorescent, magnetic coated silt particles (tracer)
- Deployed January 11, 2024
- One location in the placement area

- What are the primary directions of transport from the placement area?
- Where does sediment from the placement area end up?
- How does that change over time?

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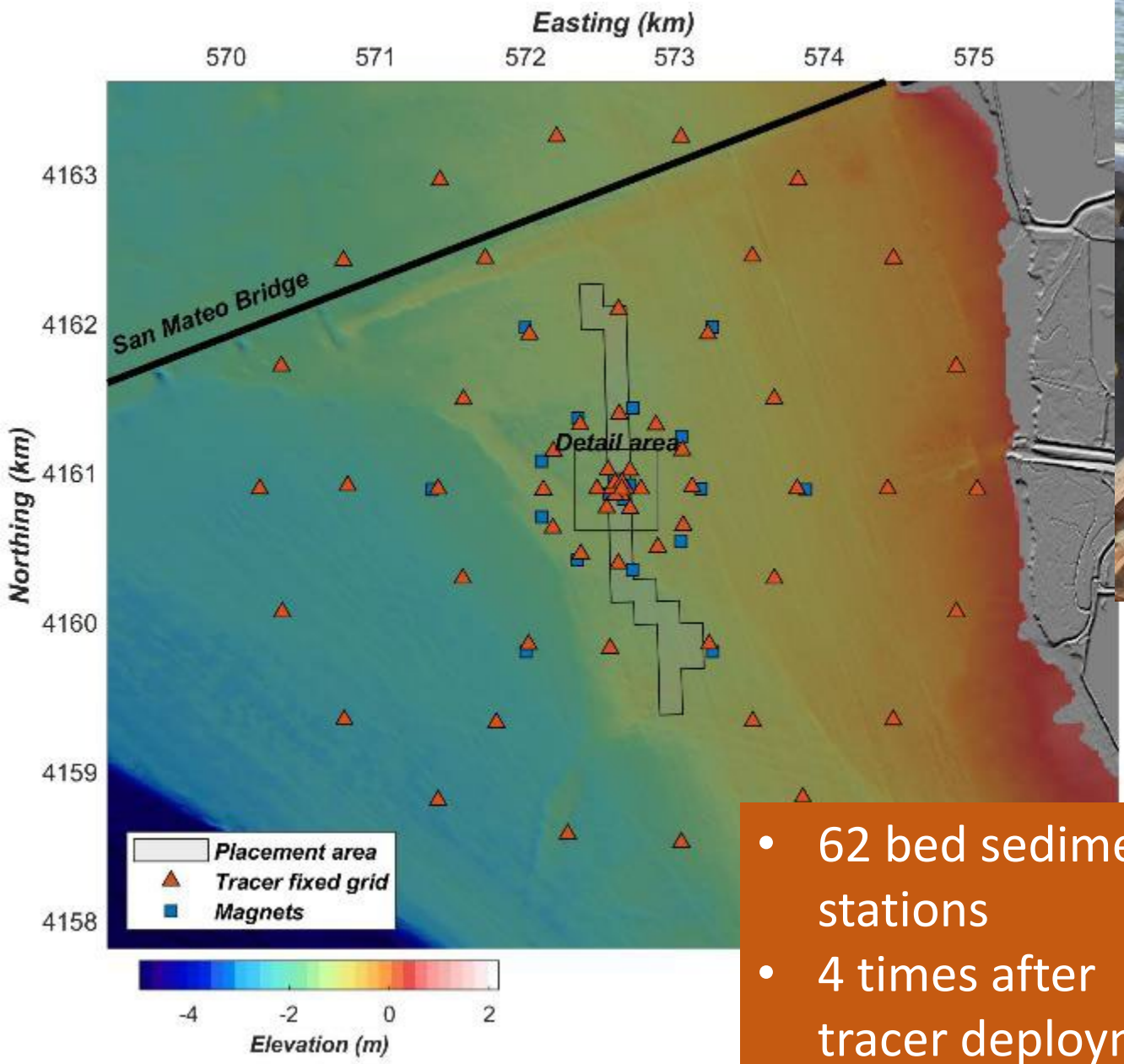
PARTRAC

Sediment fate and transport

Tracer sampling in the shallows



19 magnet stations, one day after tracer deployment

- 62 bed sediment stations
- 4 times after tracer deployment

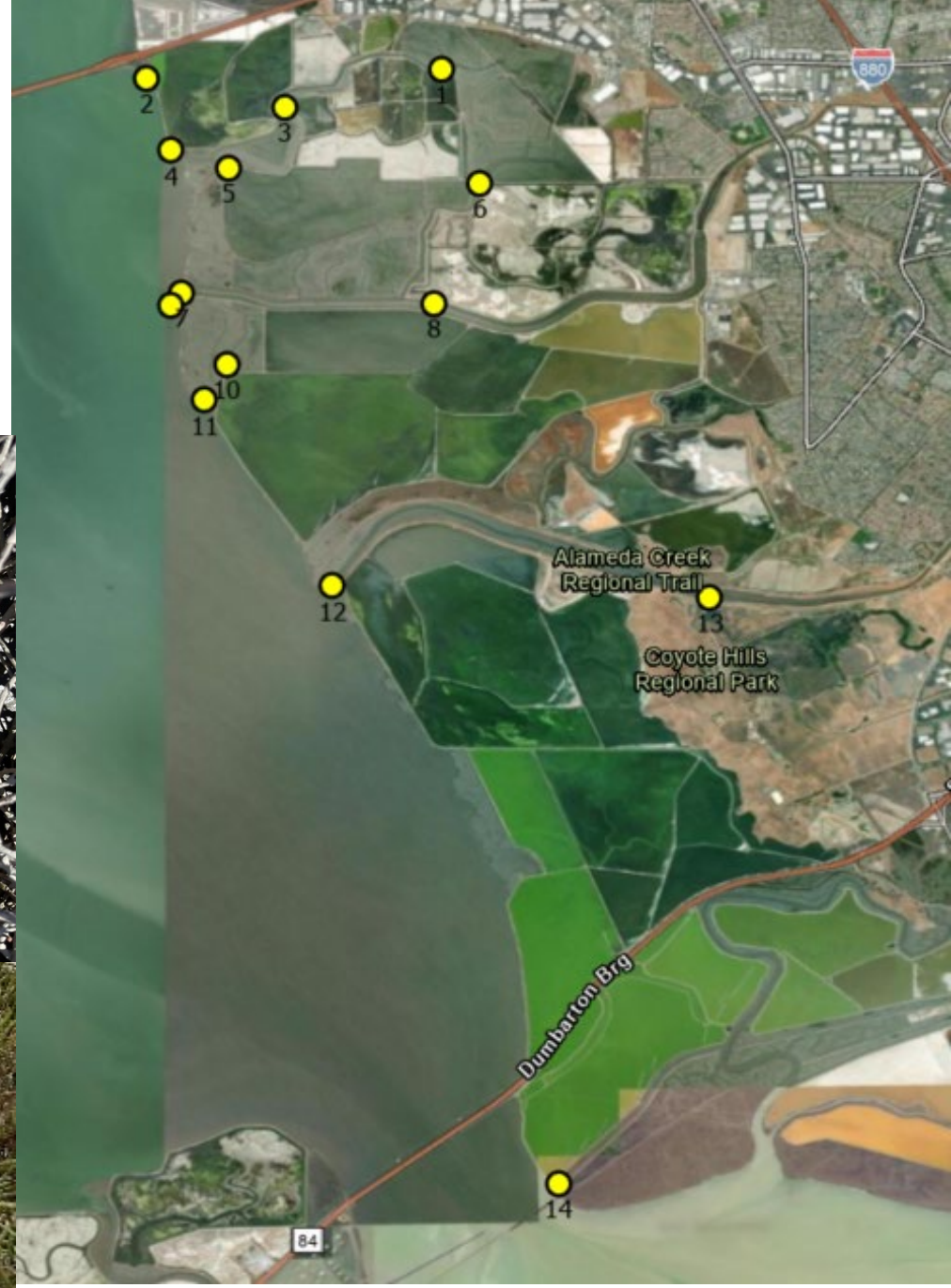
Sediment fate and transport

Marsh and restoration area

Monthly from Nov 2023 to Dec 2024:

- Magnets deployed in tidal creeks to capture tracer
- Transects of sediment pads across marsh (6) and restored areas (6) to measure deposition

USGS WERC: Thorne, Buffington



Magnet stations in tidal creeks

Sediment fate and transport

Conclusions: Monitoring Program

Potential impacts

Sediment fate and transport

- We've successfully implemented an interdisciplinary multi-component monitoring program
- One Team: Information sharing between science teams and dredgers enhances the effort
- Learning from the Pilot: prioritize monitoring components for future projects
- Learning from the Pilot: use results to test and improve models to support future projects
- Monitoring continues until end of 2024

We look forward to sharing future results!

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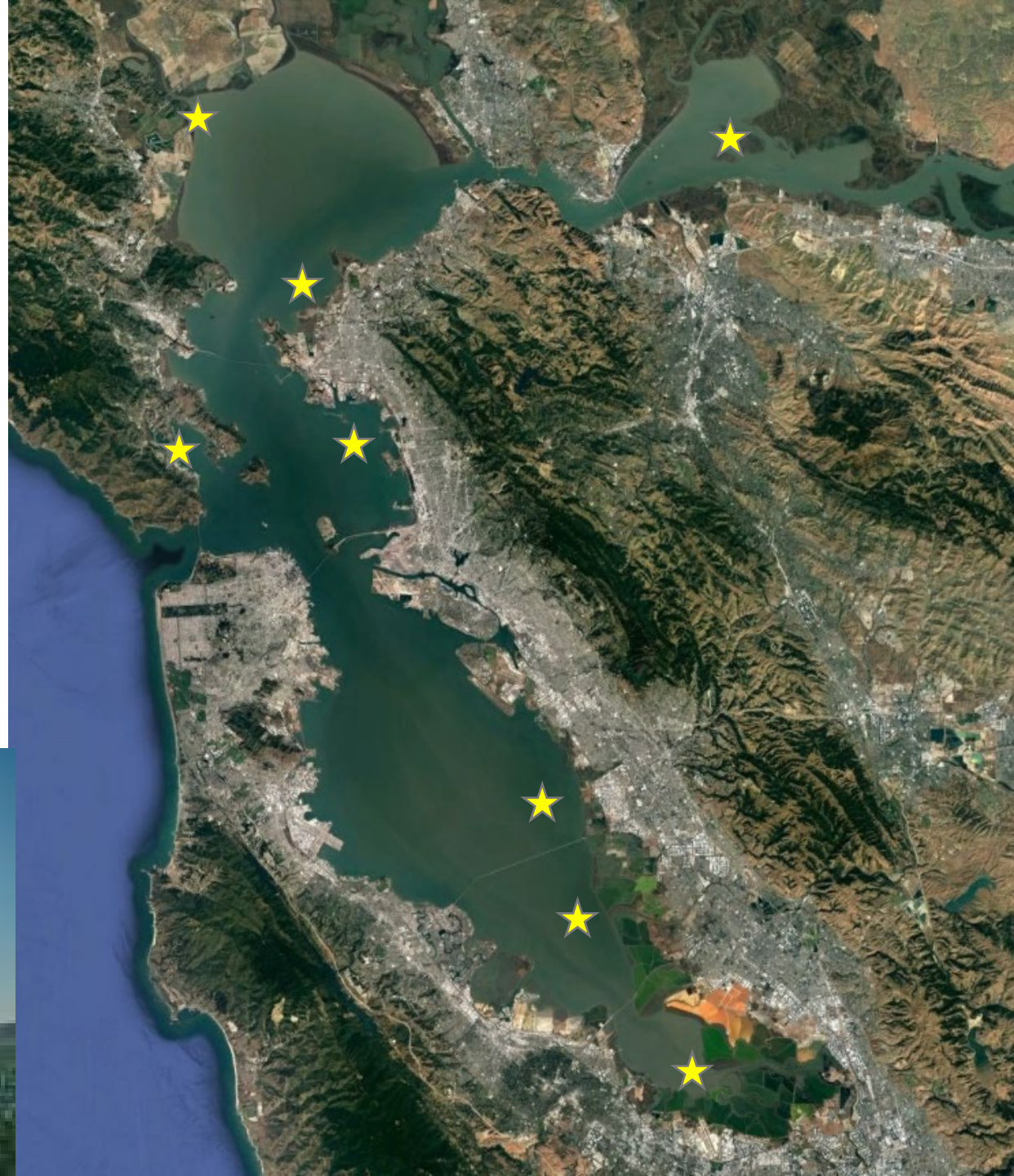
US Army Corps of Engineers: San Francisco District

What's next?

- More pilot projects!
- Scaling up: Toward Marsh Maintenance Plan!
  - Permitting- Programmatic permitting for shallow water placement to support existing marshes
- Beneficial use needs to be a priority across the board
  - Flexibility, interdisciplinary collaboration, and good communication!



THANK YOU

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