Bay Planning Coalition

SEDIMENT IN ACTION: RESTORATION SITES & INNOVATIVE APPROACHES

Jessica Davenport

CA State Coastal Conservancy

SPEAKER

Russ Barnes

Wilshire Consulting

SPEAKER

David O’Connell

EnviroMend Group

SPEAKER

Roger Leventhal

Marin County Flood Control District

SPEAKER

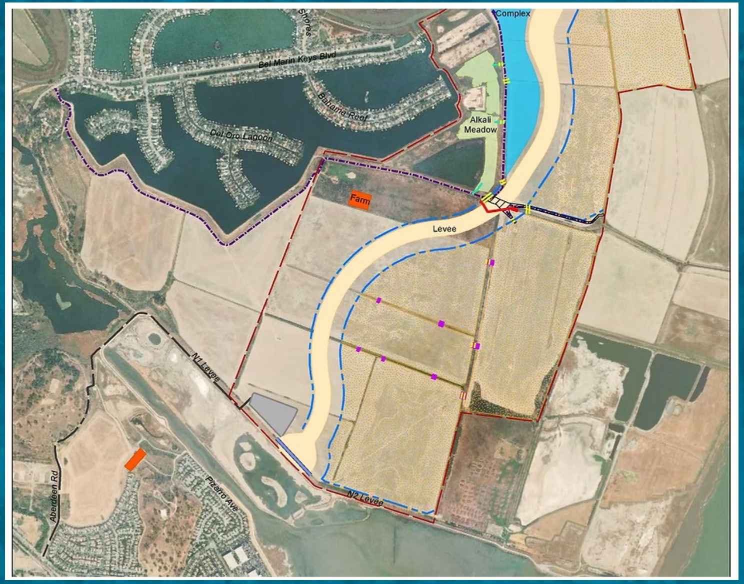
Brenda McConathy

PG&E

MODERATOR

Hamilton/Bel Marin Keys V Wetland Restoration Project

Bay Planning Coalition Dredging and Beneficial Reuse Workshop
October 9, 2025

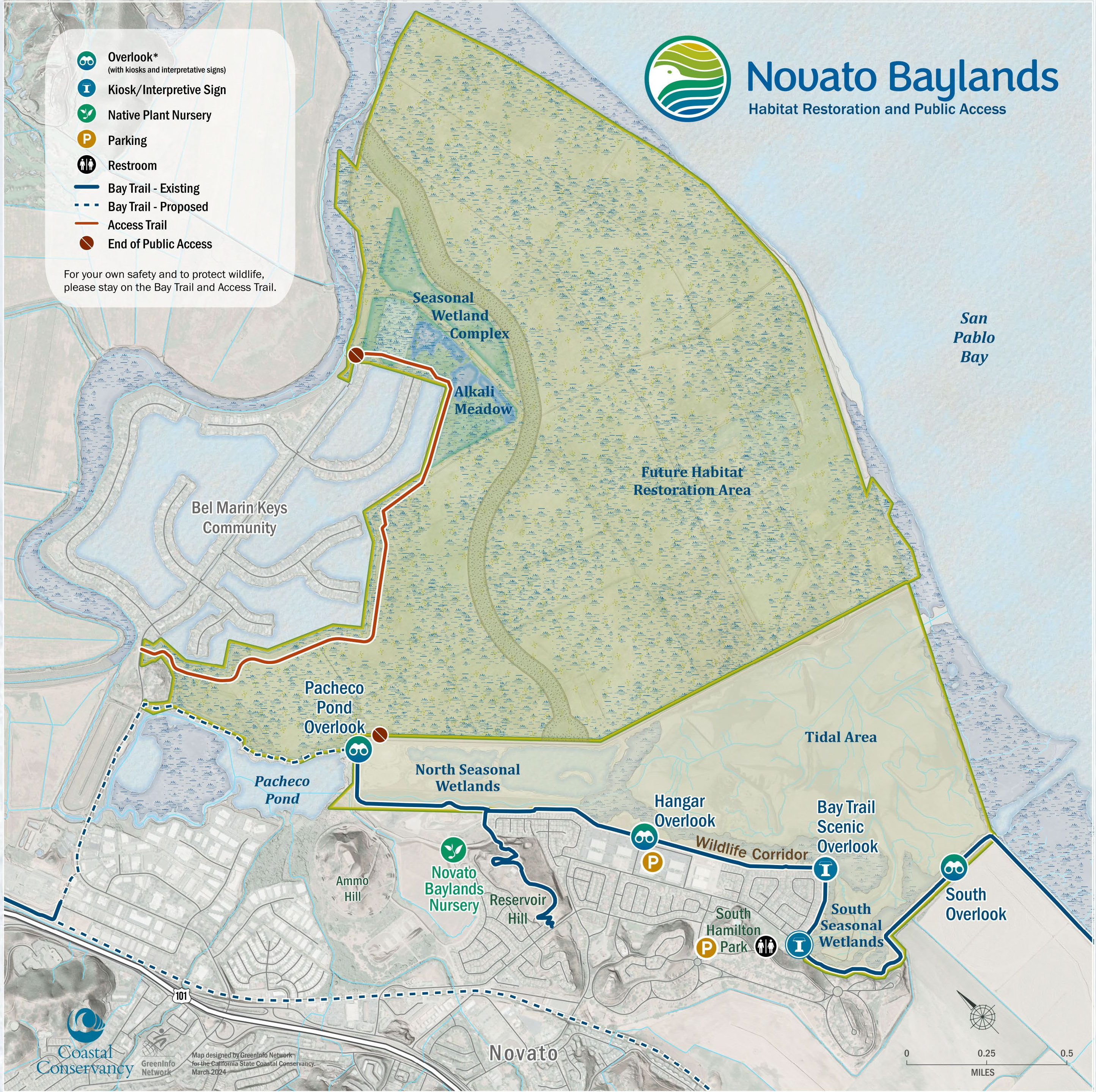


Jessica Davenport
Bay Area Regional Manager

Coastal Conservancy
STATE *of* CALIFORNIA

SCC and SFBRA Roles in Beneficial Reuse

- Resilient San Francisco Bay Pilot Project (Advocacy for Funding)
- Eden Landing: San Francisco Bay Strategic Shallow-Water Placement Pilot Project
- Redwood City Harbor
- Petaluma River Dredging
- Montezuma Wetlands



Novato Baylands
Habitat Restoration and Public Access
Overlook*
(with kiosks and interpretative signs)
Kiosk/Interpretive Sign
Native Plant Nursery
Parking
Restroom
Bay Trail - Existing
Bay Trail - Proposed
Access Trail
End of Public Access
For your own safety and to protect wildlife, please stay on the Bay Trail and Access Trail.
San Pablo Bay
Seasonal Wetland Complex
Alkali Meadow
Future Habitat Restoration Area
Bel Marin Keys Community
Pacheco Pond Overlook
Pacheco Pond
North Seasonal Wetlands
Tidal Area
Hangar Overlook
Wildlife Corridor
Bay Trail Scenic Overlook
South Overlook
South Seasonal Wetlands
South Hamilton Park
Novato Baylands Nursery
Reservoir Hill
Ammo Hill
101
Novato
Coastal Conservancy
GreenInfo Network
Map designed by GreenInfo Network for the California State Coastal Conservancy. March 2024
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MILES


Future Habitat Restoration Area
Bel Marin Keys Community
Pacheco Pond Overlook
Tidal Area
North Seasonal Wetlands
Pacheco Pond
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101
Novato
Coastal Conservancy
GreenInfo Network
Map designed by GreenInfo Network for the California State Coastal Conservancy. March 2024
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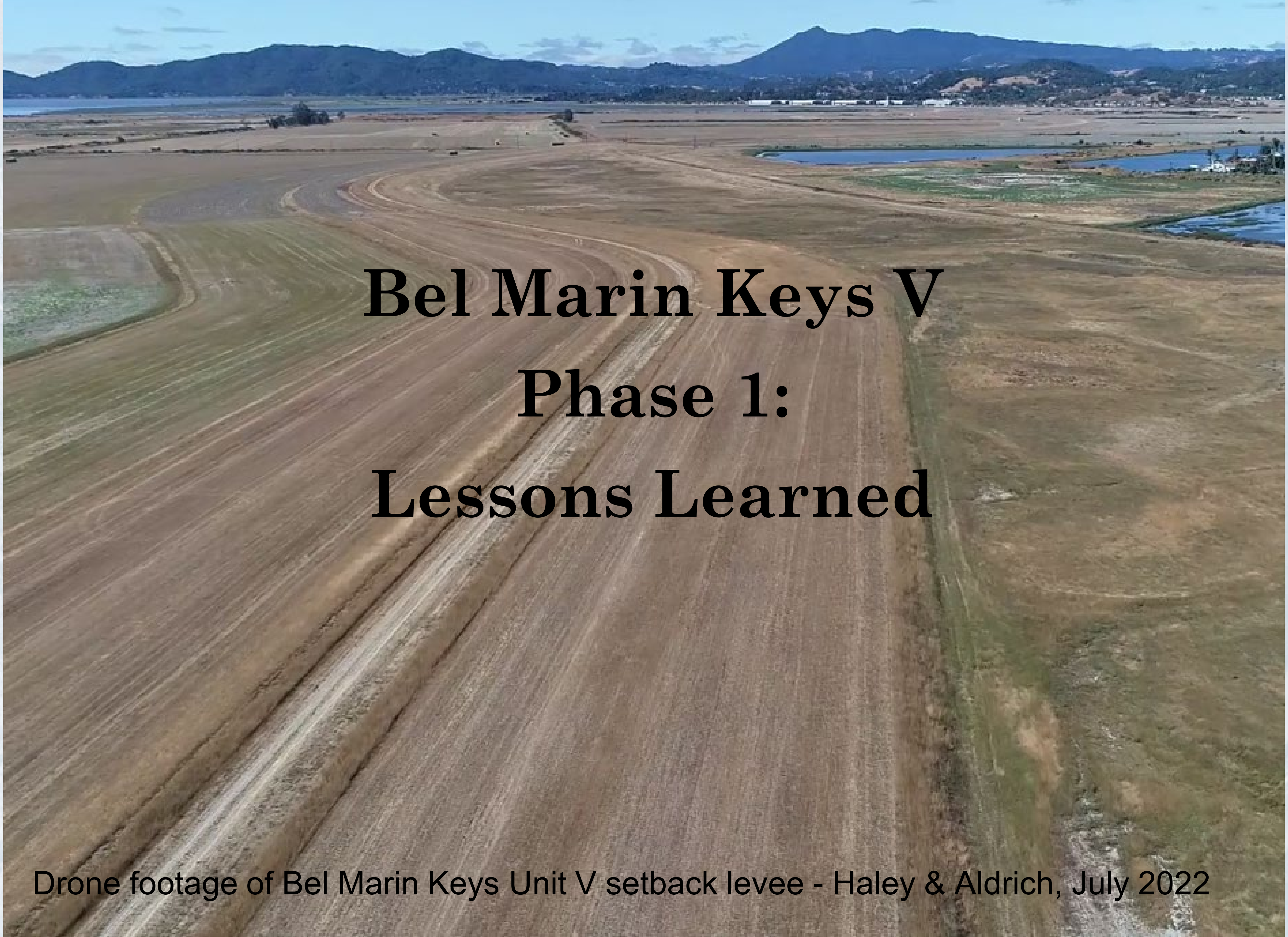
Hamilton Wetlands: Lessons Learned

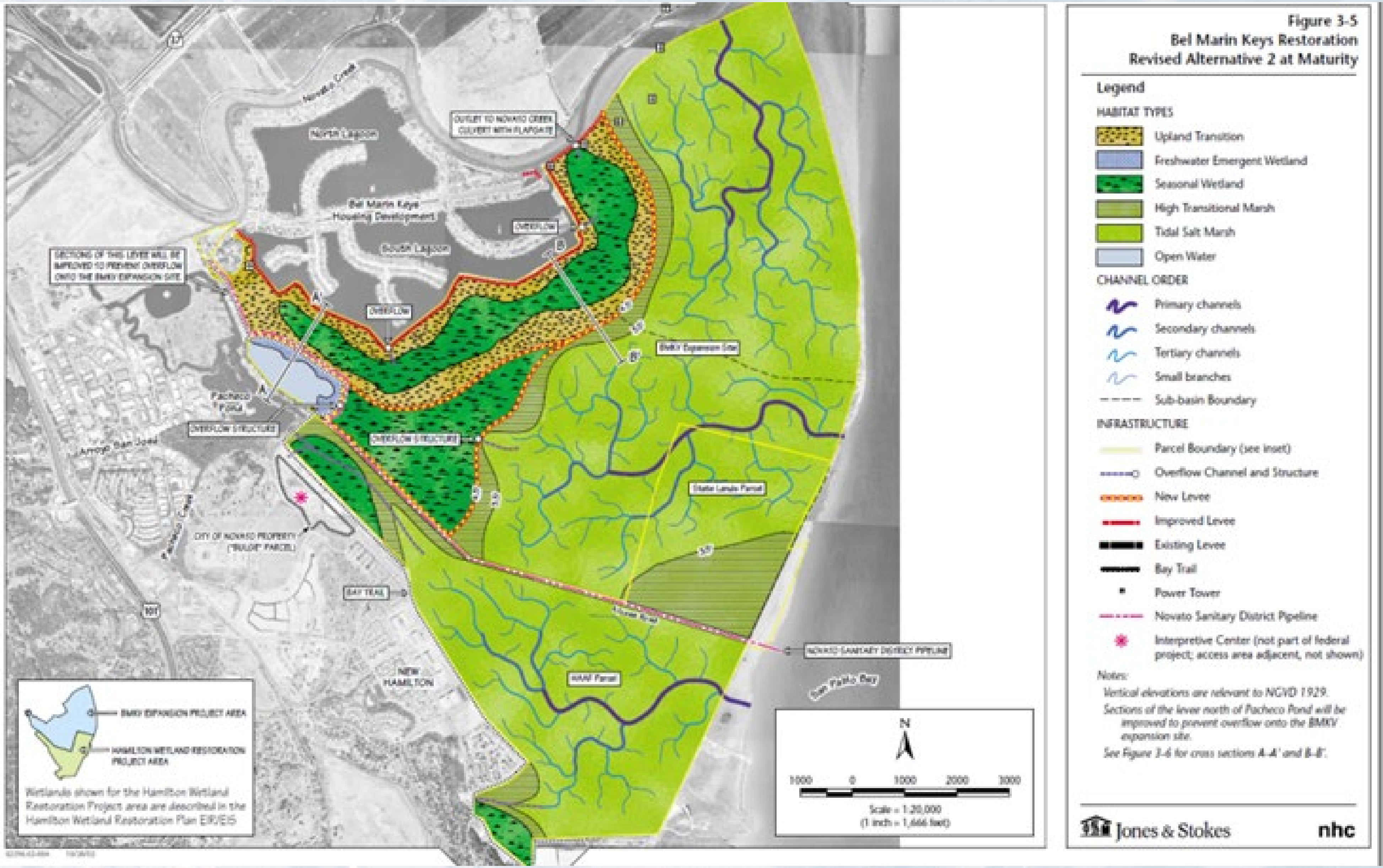
Shorebirds + waterfowl in Pond 6 10-9-24 by Rick Krueger

Bel Marin Keys V Phase 1: Lessons Learned



Drone footage of Bel Marin Keys Unit V setback levee - Haley & Aldrich, July 2022

H/BMK Conceptual Design, Preferred Alternative, USACE, 2003



Bel Marin Keys V Restoration Phase 2 Challenges

- Contaminants on Formerly Used Defense Site (FUDS)
- High cost of bringing dredged material to the site
- High cost of earth work

View of Hamilton Wetlands and Bel Marin Keys Unit V from Reservoir Hill

FUDS Problem and Possible Solutions

Bel Marin Keys Unit V
(~1,600 acres)

FUDS Site: North Antennae Field

State Lands Commission (~300 acres)

Hamilton Wetlands
(Restored Airfield)
(~650 acres)

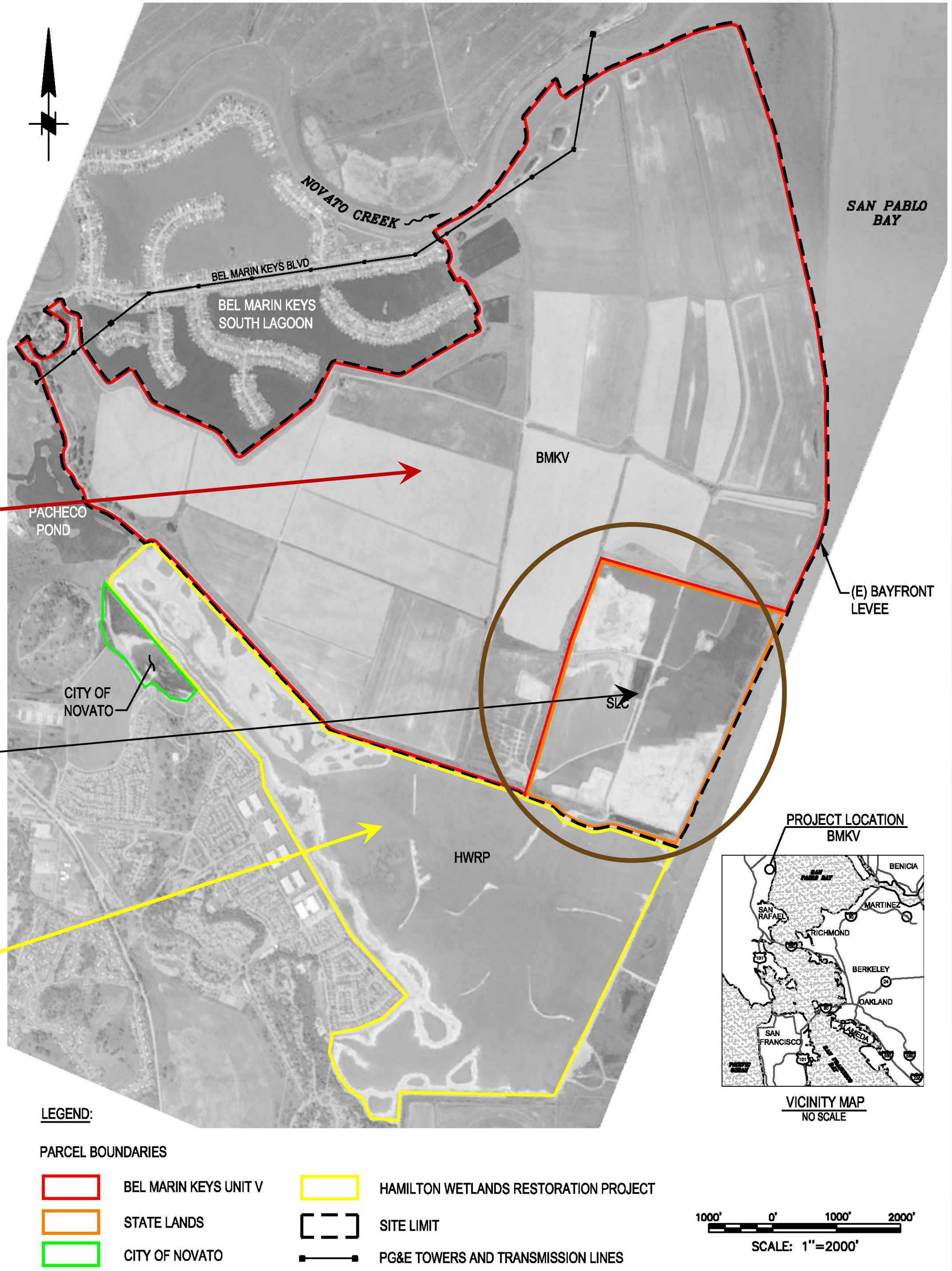


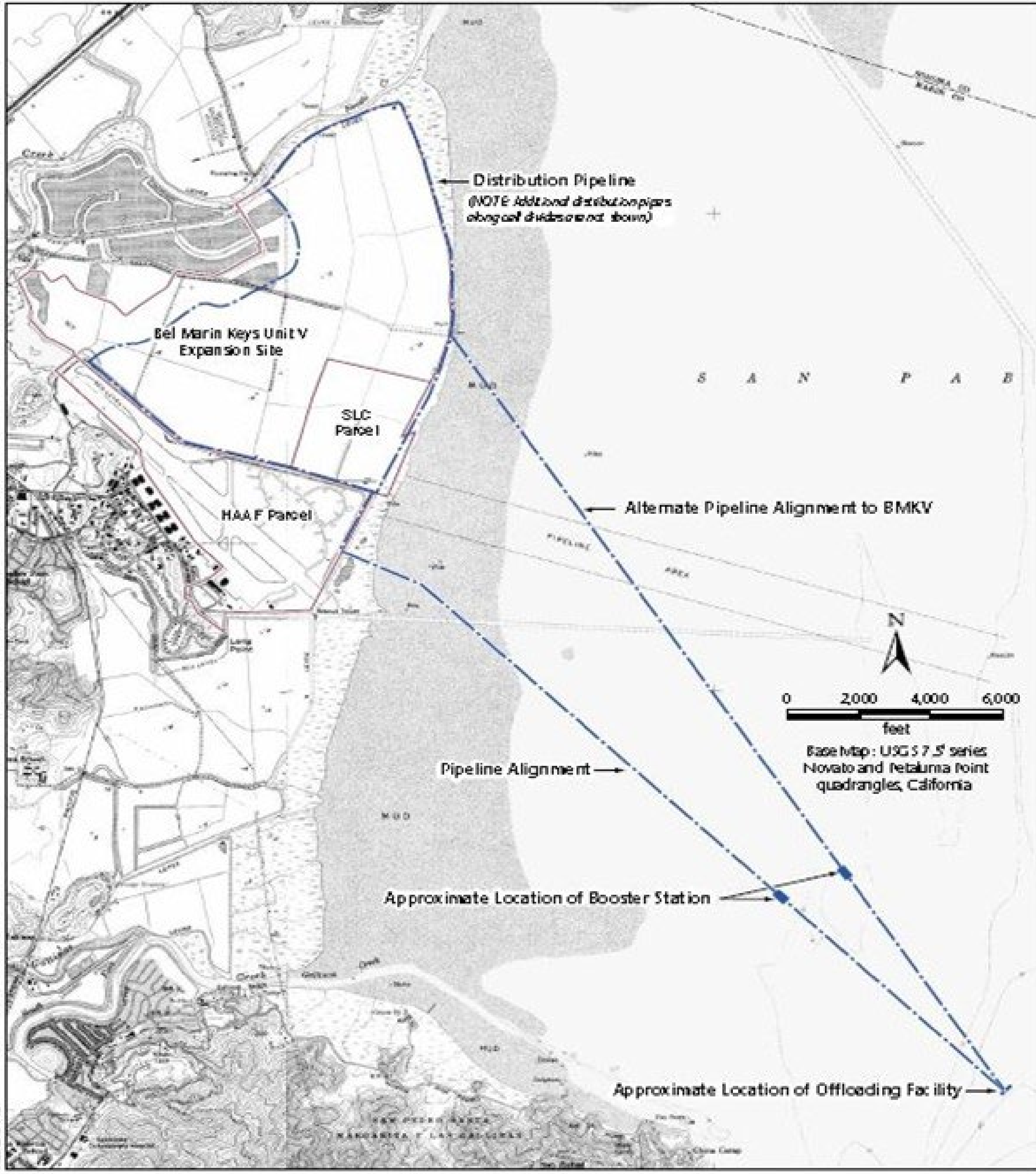
TABLE 14
EVALUATION OF TIDAL WETLAND CONCEPTS

Evaluation Criteria	Concept 1A. Minimal Intervention	Concept 1B. Natural Sedimentation Emphasis	Concept 1C. Natural Sedimentation Plus	Concept 2. Beneficial Use of 4 MCY of Dredged Material	Concept 3 Beneficial Use of 8 MCY of Dredged Material
Habitats and Benefits to Special Status Species	Medium	Medium	Medium-High	High	Very High
	Small extent of initial marsh habitat. Large initial subtidal habitats with benefits for fish. Large mudflats by 2050, though development of mudflats may be slower than modeled (no wave sheltering). 2050 wetland habitat acres: High marsh: 85 Low marsh: 32 Mudflat: 931 Subtidal: 87	Small extent of initial marsh habitat, though more than 1A. Additional marsh will develop over time (more quickly than 1A). 2050 wetland habitat acres: High marsh: 103 Low marsh: 80 Mudflat: 715 Subtidal: 232	Small to moderate extent of initial marsh habitat. Additional marsh will develop over time. 2050 wetland habitat acres: High marsh: 155 Low marsh: 129 Mudflat: 174 Subtidal: 616	Moderate to high extent of initial marsh habitat. Additional marsh will develop over time 2050 wetland habitat acres: High marsh: 370 Low marsh: 59 Mudflat: 135 Subtidal: 571	High extent of initial marsh habitat. Additional marsh will develop over time. 2050 wetland habitat acres: High marsh: 602 Low marsh: 47 Mudflat: 94 Subtidal: 387
Beneficial Use of Imported Dredged Material	Low	Low	Low	Medium-High	High
	No use of imported dredged material. Beneficial use of 1 MCY of local dredge material.	No use of imported dredged material. Beneficial use of 1 MCY of local dredge material.	No use of imported dredged material. Beneficial use of 1 MCY of local dredge material.	4 MCY of imported dredged material. Beneficial use of 1 MCY of local dredge material.	8 MCY of imported dredged material. Beneficial use of 1 MCY of local dredge material.
Compatibility with Adjacent Land Uses / Habitats	High	High	Medium-high	Medium-low	Low
	Disturbance during short construction period.	Disturbance during short construction period.	Disturbance during moderate-length construction period.	Disturbance during moderate to long construction period.	Disturbance during long construction period.
Maintenance and Management Feasibility	Medium	Medium-high	Medium-high	High	High
	Maintenance associated with erosion of the ecotone and levees. Most wave energy.	Maintenance associated with erosion of the ecotone and levees.	Maintenance associated with erosion of the ecotone and levees.	Maintenance associated with erosion of the ecotone and levees. Large fringing marsh will absorb wave energy.	Maintenance associated with erosion of the ecotone and levees. Large fringing marsh will absorb wave energy.
Cost Feasibility	High	Medium-high	Medium	Low-medium	Low
	$62 million	$98 million	$192 million	$296 million	$476 million

ESA, 2024

Hamilton Wetland Restoration: Offloader

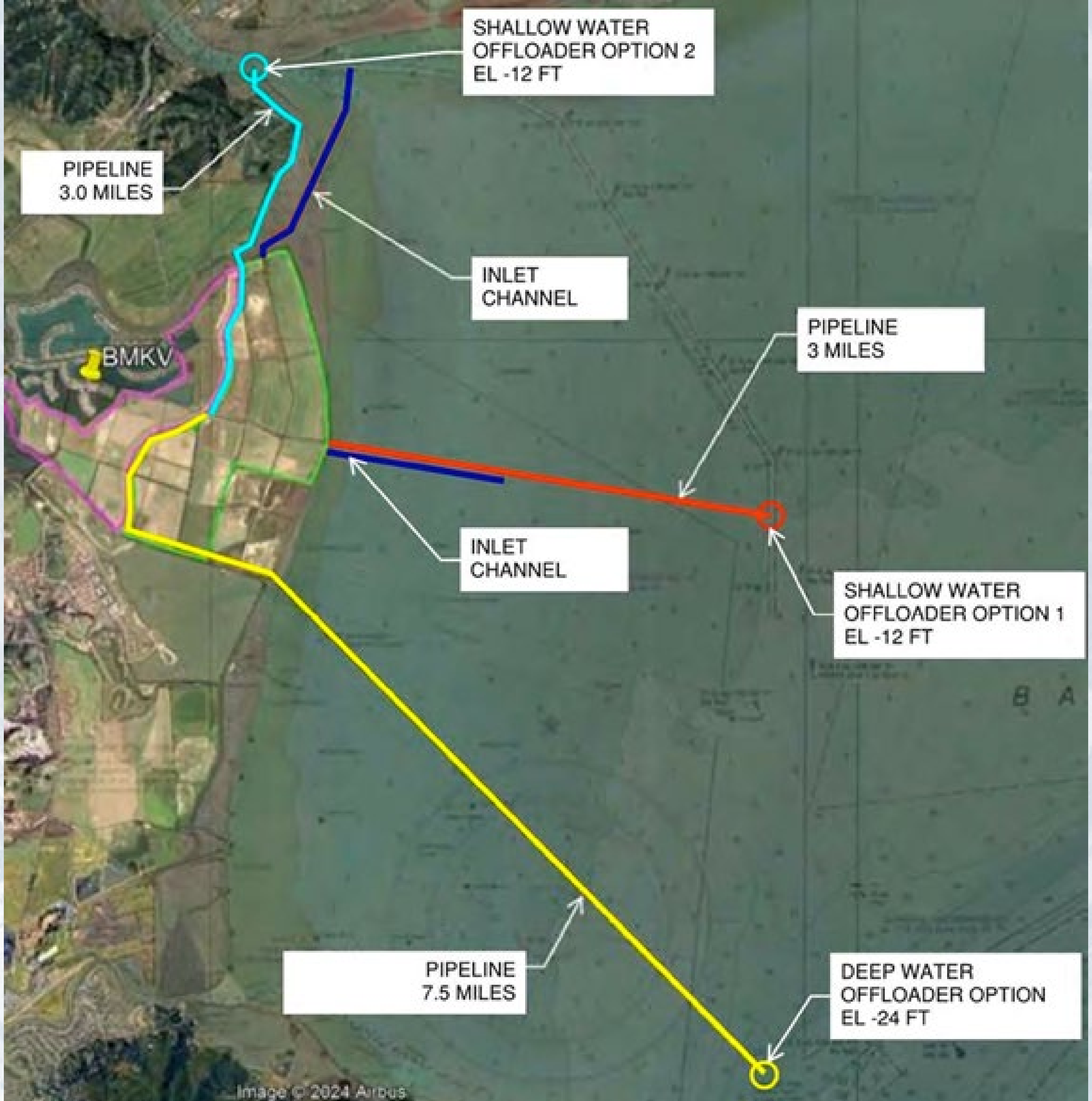
- 5 miles offshore - deep water
- Electrically driven - power line from BMKV
- Sediment slurried with Bay water pumped via submerged pipe



Jones & Stokes
nhc northwest hydraulic consultants

Figure 3-4
Approximate Location of Offloading Facility

Alternative Methods of Dredged Material Delivery



ESA, 2024

Earthwork and Possible Cost-Cutting Measures

- Construct levee across future tidal area to create North and South Cells
- Import 4 mcy of dredged material into 460-acre North Cell
- Construct ecotone around the internal edges of the North Cell
- No construction of containment berms, wind wave berms, or channels

Hamilton Wetlands Restoration

Tentative Schedule for BMKV Restoration Phase 2

- 2024-2028: Design and permitting
- 2029-2031: Construction of earthwork and dredged material delivery infrastructure
- 2032-2034: Dredged material placement
- 2035: Levee breach for tidal wetland restoration
- 13 years of monitoring and adaptive management

Hamilton Wetlands Restoration

Thank you

Coastal Conservancy
STATE *of* CALIFORNIA

EnviroMend Group

POWERED BY GOODFELLOW BROS.

Talking Points

- EnviroMend Group – what and why?
- Upland Soils and Dredged Sediments – what's the difference?
- How can Upland Soils help my project?
- Questions for the Group

EnviroMend Group – What and Why?

What is EnviroMend Group?

EMG is an environmental and remediation contractor, part of the **Goodfellow Bros** family of companies

Why start EMG?

1) Soil management across heavy civil projects, specifically in CA

2) Dedicated team for hazardous remediation and wetland-oriented work

Soil Management

Remediation

Wetland Restoration

Talking Points

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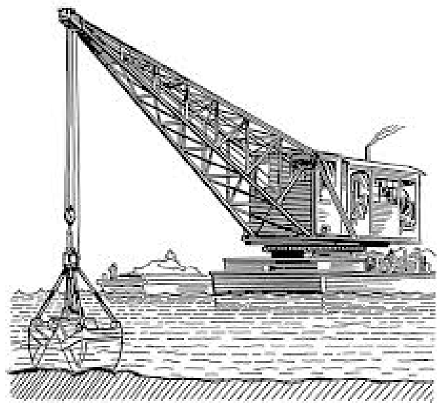
The Difference – Sources

Dredged Sediments

- Navigable Waterways
  - USACE
  - Ports
- Public Funding
- Season-driven



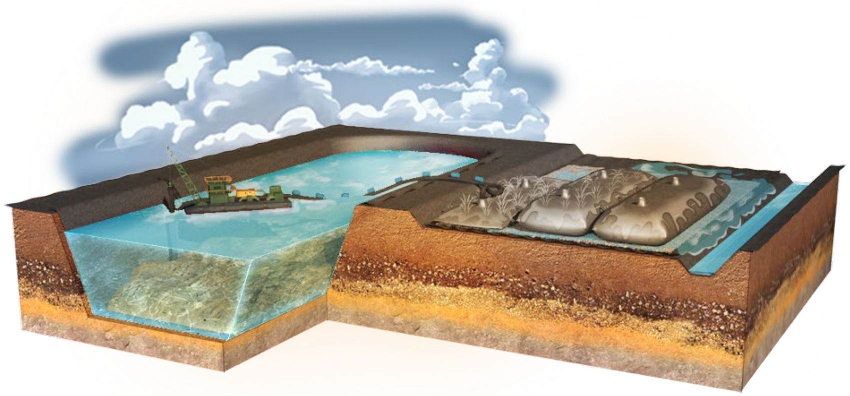
Upland Soils

- Private Developers
  - Mixed Use Residential
  - Tech Campuses
  - Data Centers…?
- Private Funding
- Economy-driven

The Difference – Sediment / Soil Properties

Dredged Sediments

- High water content
- Finer grained silts, low strength
- Rich in organics



Upland Soils

- Low water content
- Various clays, silts, sands and gravels
- Low organic content
- Potential high strength, levee grade material

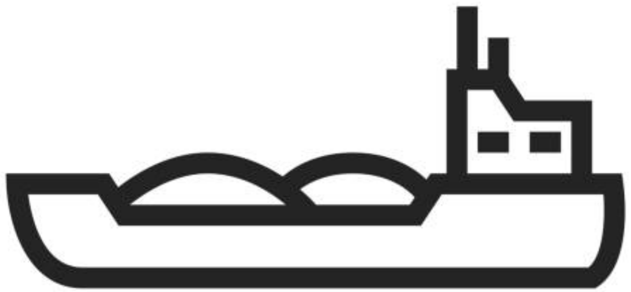
The Difference – Generating the soil/sediment

Dredged Sediments

- Clamshell bucket / cutter head
- 3,500 CY Scow

Upland Soils

- Excavator and trucks
- 10 CY per truck
- 5,000 CY to 500,000 CY projects



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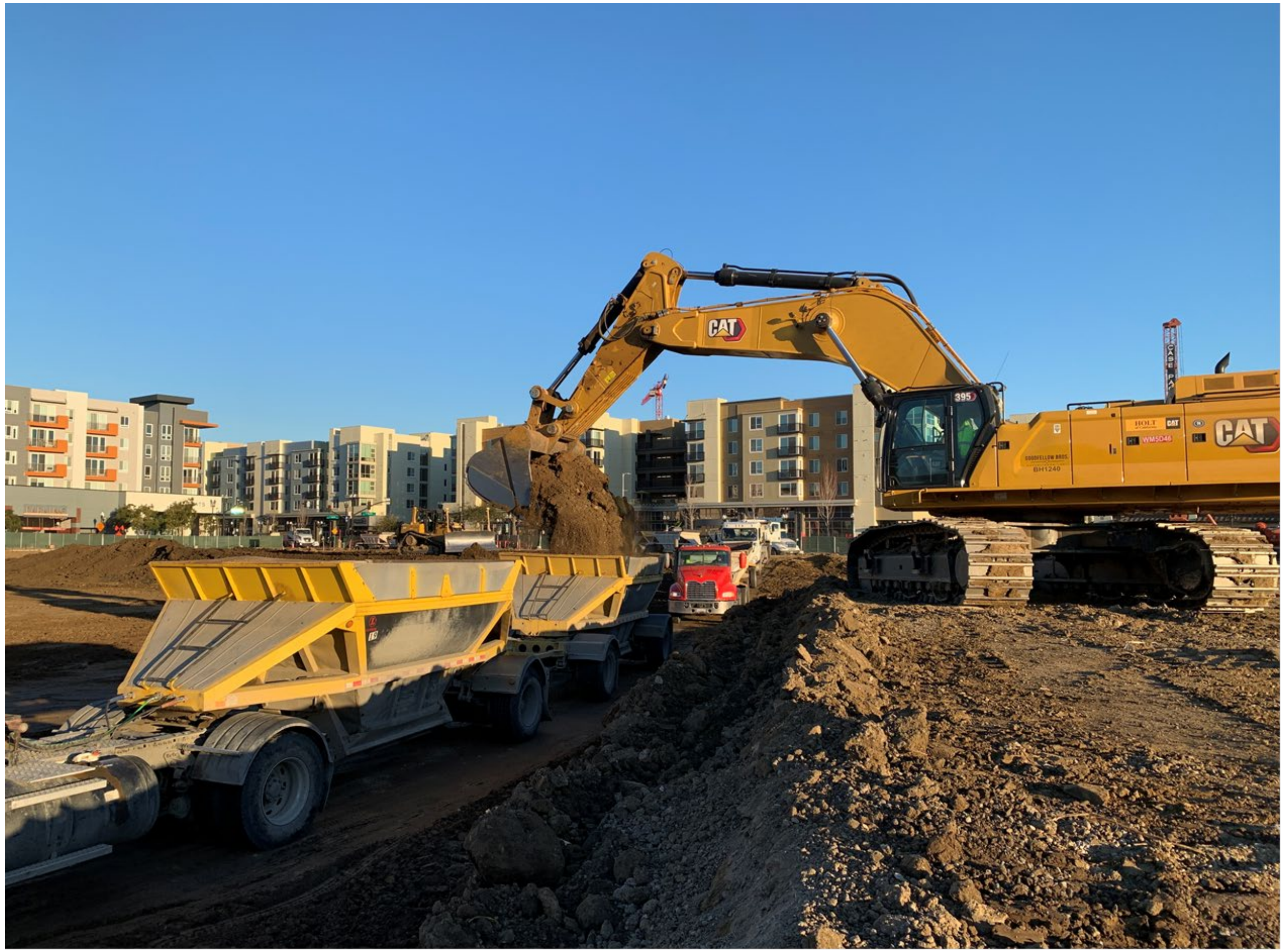
Talking Points

- EnviroMend Group – what and why?
- Upland Soils and Dredged Sediments – what's the difference?
- How can Upland Soils help my project?
- Questions for the Group

How Can Upland Soil Benefit my Project?

- Geotechnical Properties
- Low Water Content and Organic Content
- Site Access
- Little to no contamination*



Talking Points

- EnviroMend Group – what and why?
- Upland Soils and Dredged Sediments – what’s the difference?
- How can Upland Soils help my project?
- Questions for the Group

Questions for the Group

1) Where can Upland Soils benefit Dredged Sediment sites?
   - ✓Barge vs Trucking access
   - ✓Geotechnical, WC and organic differences

2) Are we missing out on blending opportunities between Upland Soil and Sediment?
   - ✓Level of contamination
   - ✓Distance between sources
   - ✓Blending & mixing areas

3) Have any projects been overlooked due to the lack of Upland Soils? Could they be re-visited?

EnviroMend Group

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THANK YOU

Dredging with Nature: The Strategic Sediment Pulse Dredging Approach to Marsh Nourishment Applied to Tidal Flood Control Channels in San Francisco Bay

BPC Dredge Workshop
October 9, 2025

Roger Leventhal, P.E.
Senior Engineer
Marin DPW Flood Control

roger.leventhal@marincounty.gov

**All slides and opinions are my own and may not represent official Marin County or Flood District Policies*

Historically, the Army Corps Turns Over Flood Control Channels to the Local Sponsor to Maintain

- ✓“Congratulations on your new flood control channel designed assuming no siltation”

- ✓Few years later as it silts in and DPW can’t afford to dredge – “You are out of compliance and out of the program”

And What Our Residents Say…

Petaluma River dredge protest (above)

San Rafael Canal dredge protest (right)

Gallinas Creek, Marin County

Flooding Up Tidal Channels is Major SLR Impact

- Direct flooding up tidal creeks is a major SLR impact
- Many home and business are located adjacent to these tidal channel
- Backwater prevents drainage = backwater flooding

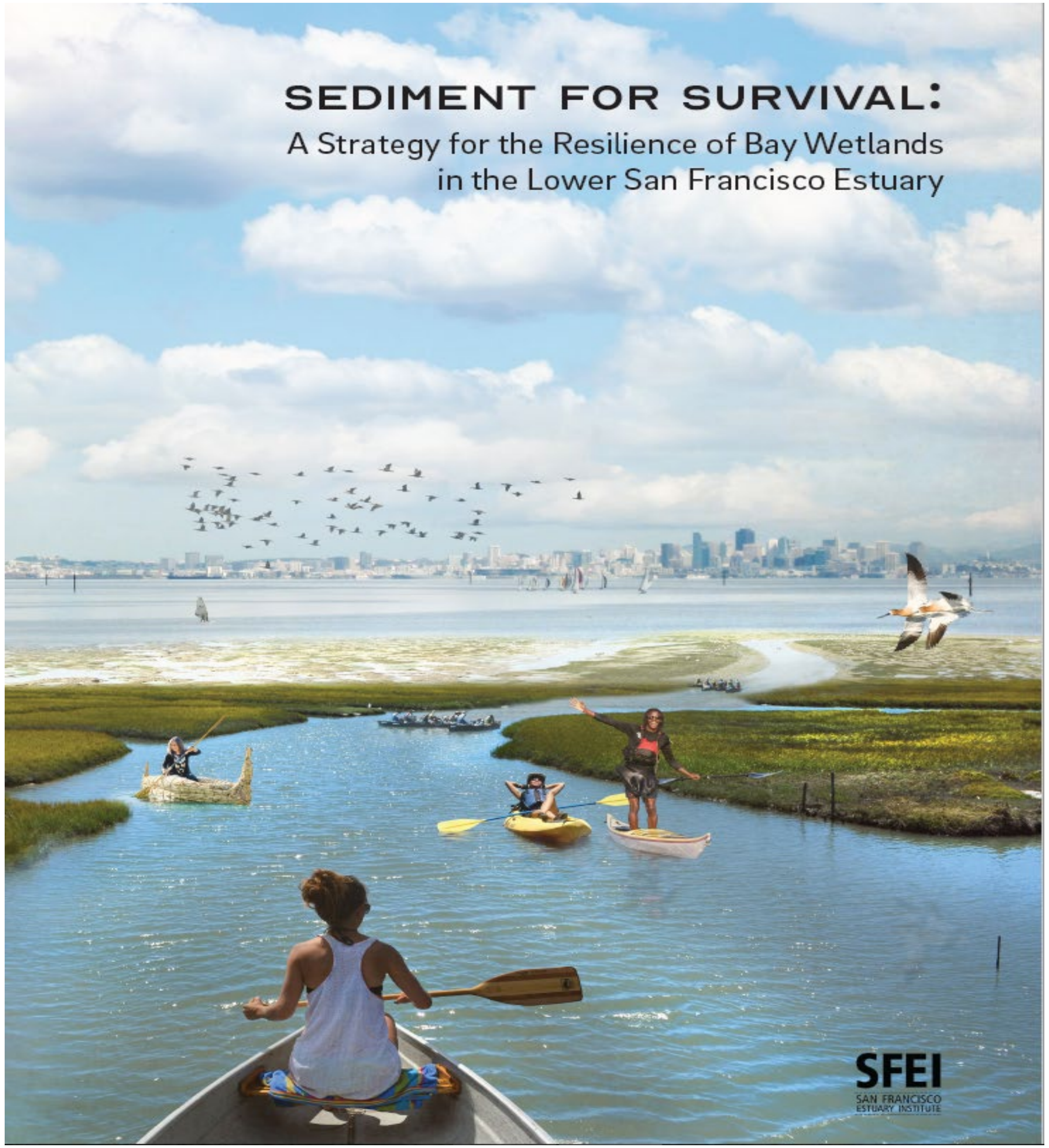
Why Do We Need a New Dredge Approach for Tidal Flood Control Channels?

- ✓Dredging tidal channels is impactful and difficult to permit
- ✓Major SLR flooding impact
- ✓It is expensive so that typical DPW flood agencies cannot afford to dredge
- ✓Generates huge amounts of GHGs
- ✓Marshes need the sediment

2020 Novato standard dredge – dewatered creek at downstream end

Bay Wide Awareness of Sediment Needs

- Estimate 5 to 10% of sediment tied up in tidal channels – not being beneficially reused (*estimate is low IMO*)
- Channels are located closest to marshes and mudflats
- Thorne et al (2022) confirmed research from Europe that episodic events such as ARs results in sediment deposition onto marshes and does the most to sustain marsh elevations – **critical finding!**
  - Pannozo et al (2023) - *"Majority of sediment supplied to marsh platform by storms likely generated by an increase in … resuspension of mudflat and tidal creek sediments."*

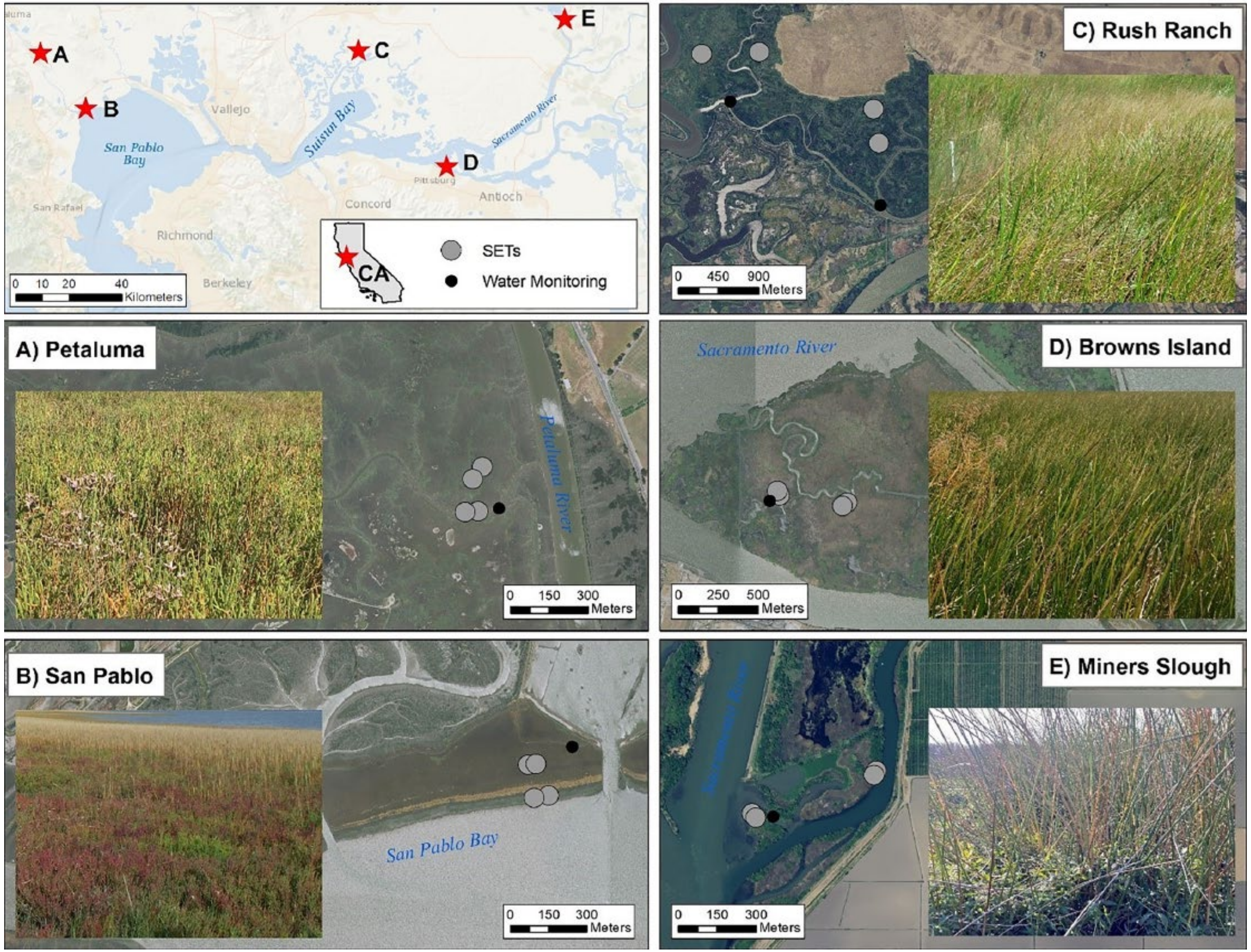


Storm Driven Depositions on Tidal Marshes

Recent studies document the importance of episodic storm driven deposition on tidal marshes (Thorne 2023 & Tognin 2021)

Thorne studies deposition due to an Atmospheric River (AR) event (2017)

ERDC staff used this same event for modeling in this project



The Science Shows the Way Sediment Moves

RESEARCH

Marsh Sediment in Translation: A Review of Sediment Transport Across a Natural Tidal Salt Marsh in Northern San Francisco Bay

Madeline R. Foster-Martinez*[1‡], Matthew C. Ferner[2‡], John C. Callaway[3‡], Brenda Goeden[4‡], Jessica R. Lacy[5‡]

the physical processes that we characterized there, key scientific conclusions, and proposed management implications. Key conclusions include (1) bay shallows are an important but variable source of marsh sediment, (2) flood tides and waves move sediment across the bay–marsh edge, (3) tidal creeks may not always import sediment to the marsh platform, and (4) protective effects of marsh vegetation depend on species and season. China Camp marsh is one of

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Geomorphology

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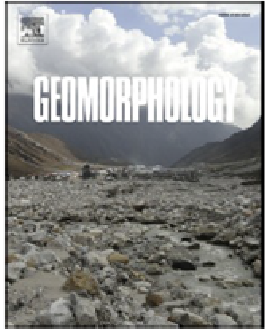

Storm sediment contribution to salt marsh accretion and expansion

Natascia Pannozzo [a,*], Nicoletta Leonardi [a], Iacopo Carnacina [b], Rachel K. Smedley [a]

[a] Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, Chatham Street, Liverpool L69 7ZT, UK
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A R T I C L E I N F O

Keywords:
Salt marshes
Storms
Suspended sediments
Sediment provenance

A B S T R A C T

Salt marshes are ecosystems with significant economic and environmental value. However, the accelerating rate of sea-level rise is a significant threat to these ecosystems. Storms significantly contribute to the sediment budget of salt marshes, playing a critical role in salt marsh survival to sea-level rise. There are, however, uncertainties on the extent to which storms contribute sediments to different areas of marsh platforms (e.g., outer marsh vs marsh interior) and on the sediment sources that storms draw on (e.g., offshore vs nearshore). This study uses field analyses from an eight-month field campaign in the Ribble Estuary, North-West England, to understand storms' influence on the sediment supply to different marsh areas and whether storms can deliver new material onto the salt marsh platform which would otherwise not be sourced in fair-weather conditions. Field data from sediment traps indicate that storm activity caused an increase in inorganic sediment supply to the whole salt marsh platform, especially benefitting the marsh interior. Geochemistry and particle size distribution analysis indicate

Estuaries and Coasts (2025) 48:104
https://doi.org/10.1007/s12237-025-01524-1

Check for updates

Estuarine Sediment Dynamics and the Importance of Storms in Moving (and Removing) Mud

Molly E. Keogh[1,2] · David A. Sutherland[1] · Emily F. Eidam[2,3] · Tyler D. Souza[3] · Jenni Schmitt[4] · Alicia Helms[4] · David K. Ralston[5]

Received: 5 March 2024 / Revised: 12 March 2025 / Accepted: 15 March 2025

Abstract

Studies of sedimentation in low-elevation coastal zones often focus on long-term average sediment accumulation rates. Although decadal and centennial sedimentation rates are key to understanding resilience to relative sea-level rise, they overlook short-term (often seasonal or shorter) fluctuations that complicate impacts on ecosystems. Using a combination of field observations and hydrodynamic model results, we examined event- to seasonal-scale sediment dynamics and deposition rates in the Coos estuary, Oregon, a small, strongly forced system representative of estuaries along the U.S. Pacific Northwest coast. During rainfall events, peaks in turbidity are followed by up to 3 cm of mud deposition on tidal flats in the middle and upper estuary. Meanwhile, little or no deposition (0–1 cm) occurs in the lower estuary. The spatial pattern of sedimentation on tidal flats is consistent across timescales (event to centennial) but is inconsistent with sedimentation patterns in higher-elevation marshes. Whereas deposition on tidal flats in the middle and upper estuary occurs 2–3 times faster than deposition in the lower estuary, deposition in marshes appears to be slowest in the middle estuary. After a storm, the sediment deposited on tidal flats in the middle and upper estuary is reworked on the scale of weeks to a month and thus is not preserved in the long-term record. Projected climate-driven increases in the frequency and intensity of rainstorms will likely increase event-driven peaks in turbidity, bed stress, and sediment deposition, heightening the importance of short-term events as drivers of long-term estuary change from both ecological and sedimentological perspectives.

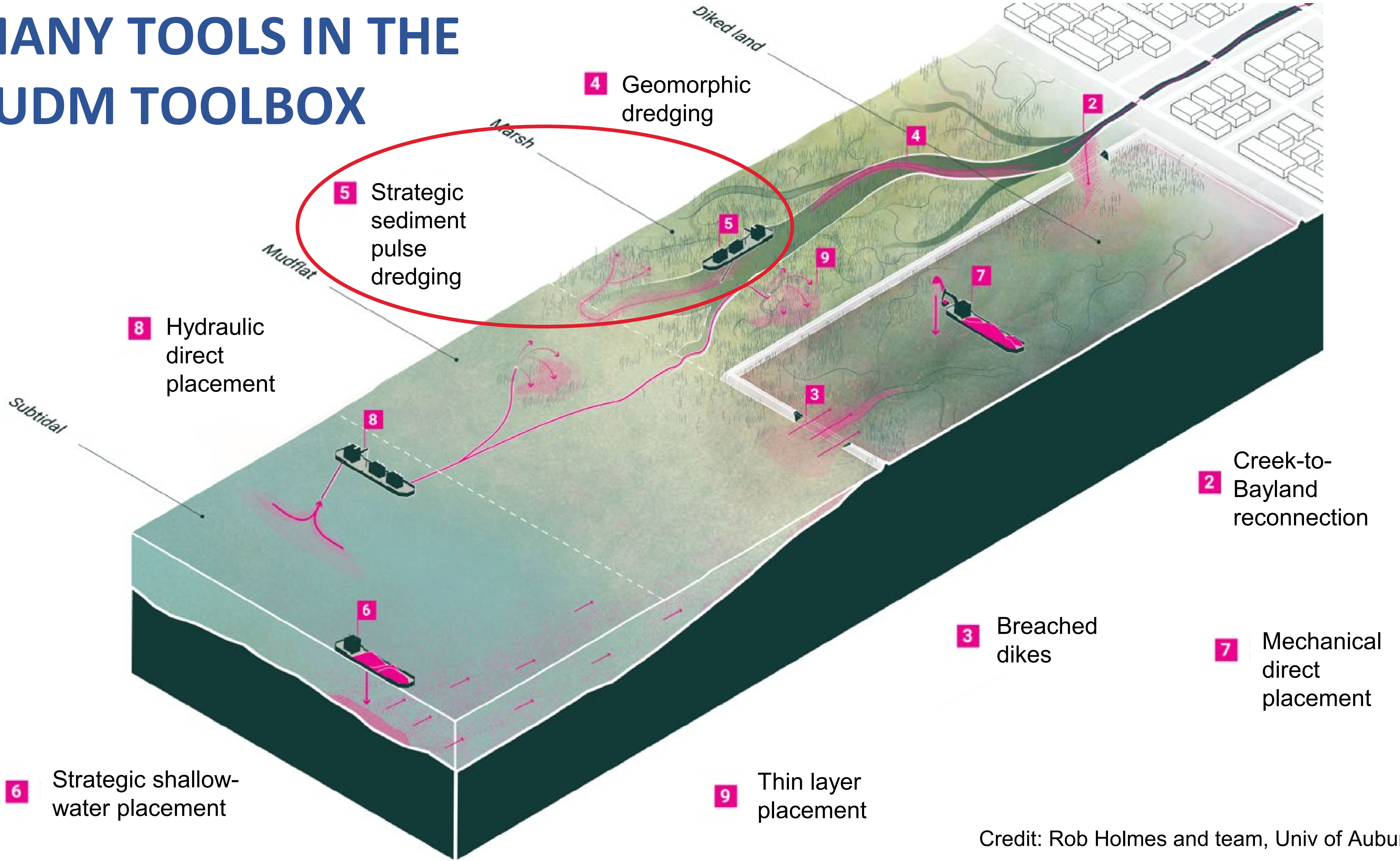
EWN Storm Driven Dredging - SSPD

- Marin proposal to naturally dredge tidal channels tied to episodic storm events when the Bay is naturally turbid – *a paradigm change in contracting*
- Limited to tidal channels
- Feeds the system with sediment when it's needed, that recent science shows does the most to sustain tidal marshes
- Low cost and low carbon

✓Very EWN, but difficult to permit in SF Bay

SF Bay in storm conditions

MANY TOOLS IN THE BUDM TOOLBOX



Credit: Rob Holmes and team, Univ of Auburn

FPMS Strategic Sediment Pulse Delivery Pilot Study

Program: USACE Floodplain Management Services

NFS + Project Partners:
Marin County Public Works, USACE ERDC

Study Duration: AUG 2023 – OCT 2024

Total Budget: $250,000 for report

Problem Statement: Traditional dredge approach in flood control tidal channels are cost-prohibitive and highly impactful, resulting in elevated flood risk to neighboring communities and up to 10% of Bay Area sediment supply trapped in out-of-compliance channels.

Proposed Solution: Low cost and low carbon hydrodynamic dredge method during times when Bay is naturally turbid (e.g. pre/post extreme event, summer high tides) **to achieve flood risk resilience by flood control tidal channels** and **feed Bay-wide sediment supply, which would bolster marsh and mudflat resilience to SLR.**


Roger Leventhal, PE


Tiffany Cheng, PE


Jessica Ludy

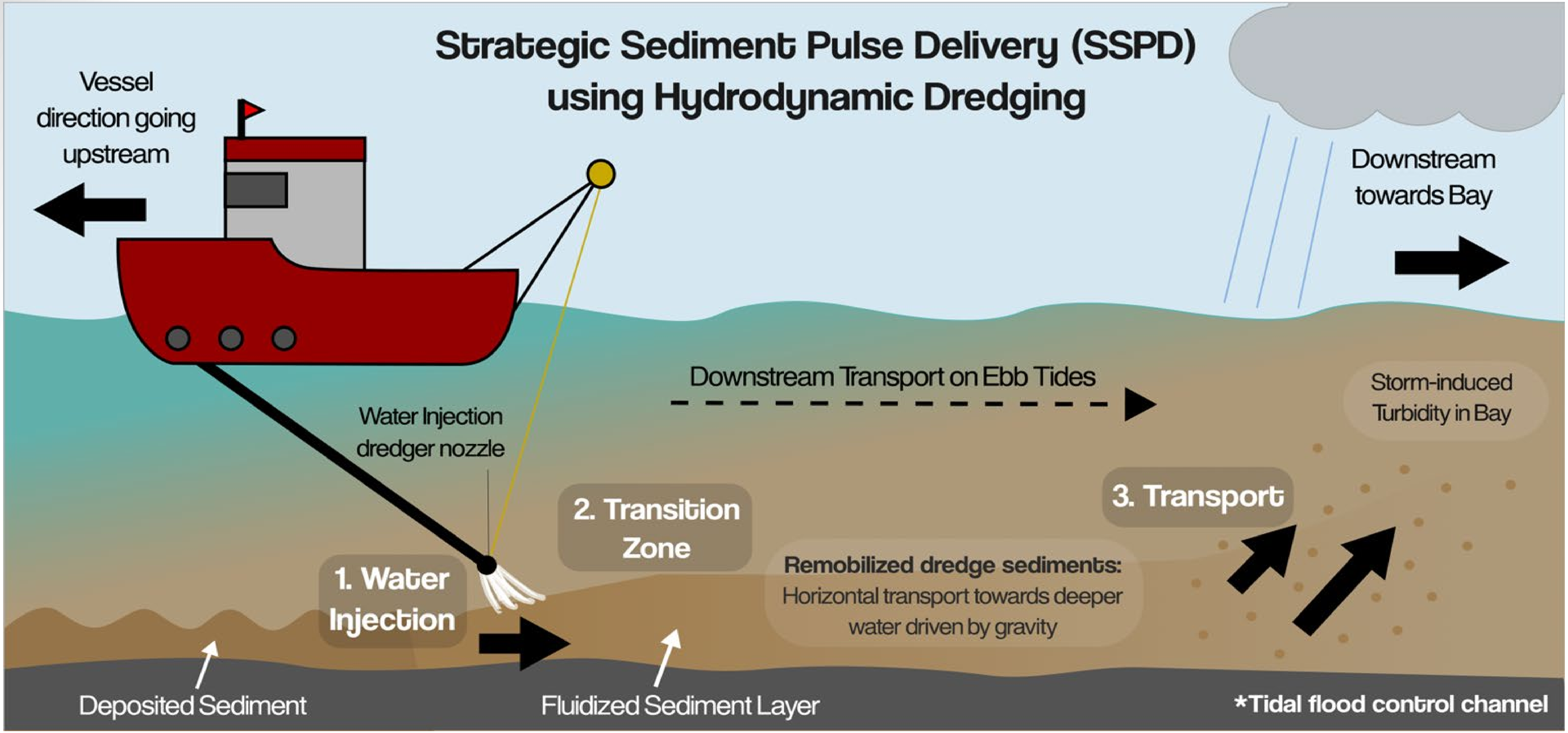

Julie Beagle


Seongjun Kim


Jade Ishii


Jared Mcknight


Water Injection Dredge Vessel (Jetsed)



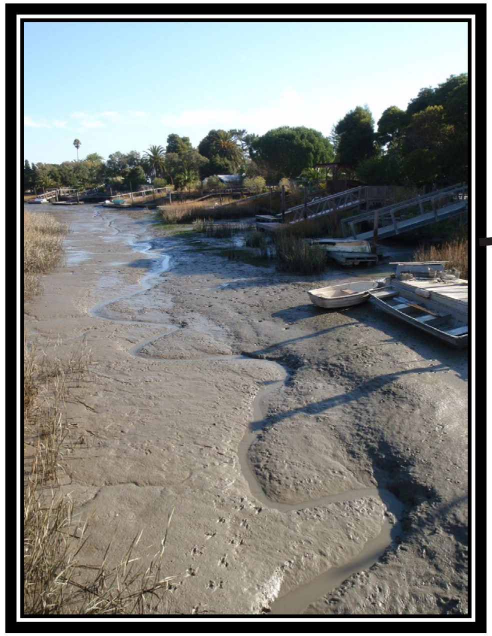
Note: Vertical scale in graphic is exaggerated

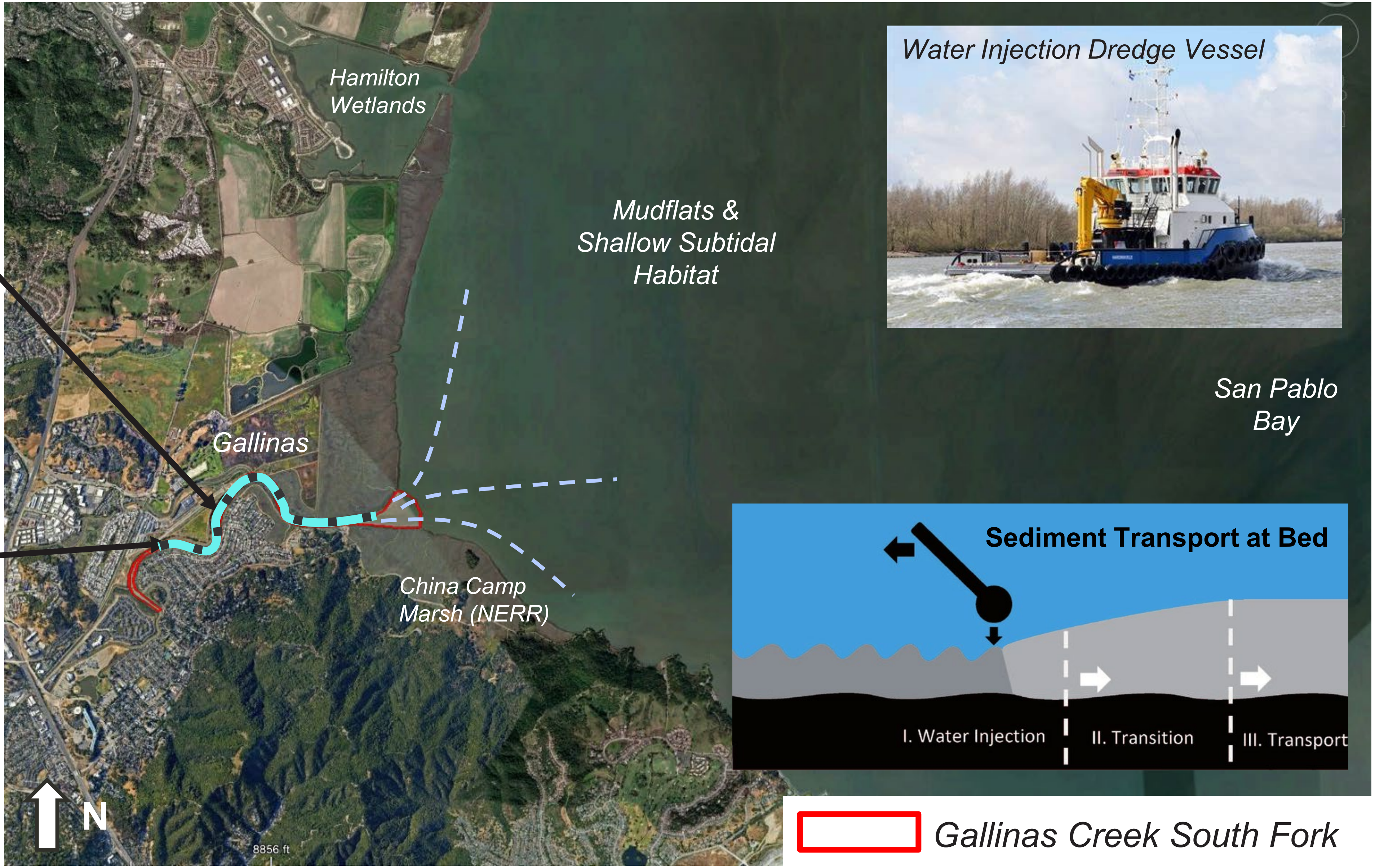
WID is Proven Technology

Michoud Channel	2002	WID applied for maintenance dredging of federal navigation channel (deepwater)	232,235 CY removed over 96 h. 2,419 CY/hour production rate. Median grain size of 0.06 mm.
Mississippi River Gulf Outlet	2003	WID applied for maintenance dredging of federal navigation channel (deepwater)	350,000 CY removed over 96 h.3,645 CY/hour production rate. Similar grain sizes to Michoud Channel.
Port of Wilmington, NC - North Carolina State Ports Authority (NCSPA)	2022	Custom-built WID for harbor maintenance dredging	71,000 CY removed from permitted dredging area. 2,450 CY/hour production rate. Monitoring conducted by USACE ERDC.
Harwich Harbor, UK	2023	Tiamat agitation dredge	2,875 – 5,875 CY/hour production rate. Shown to be effective in removing silty sediment from navigation channels.
Tuttle Creek Lake	2024	WID for reservoir sediment management	Proposed pilot project is undergoing public comment and environmental review
Dutch Mud Motor	On-Going	Dredge and Place	Reports working very well

FPMS Strategic Sediment Pulse Delivery Pilot Study

Excessive sedimentation in existing flood control channel





Gallinas Creek South Fork

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?*

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*

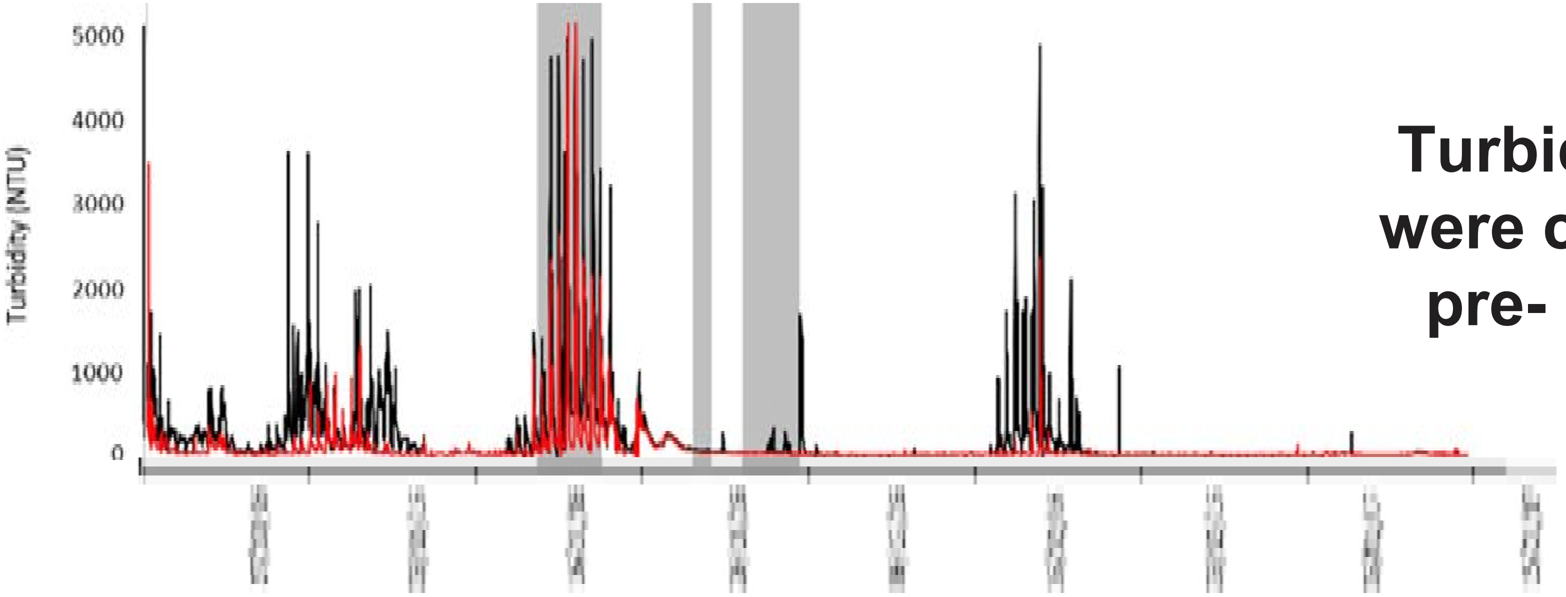
Water Quality Effects of Hydrodynamic Dredging (Pledger et al. 2020)

Changes in water quality parameters were short-lived (~1h) **and could not be isolated from effects of other processes/factors in tidal influenced, heavily modified systems.**

*statistically significant

Water Quality (Short-Term) Effects Summary: turbidity ↑*, salinity ↑, DO ↓*, pH ↓*

Grey bands = water injection dredging occurring, red=upstream, black=downstream.



Turbidity peaks during dredging were comparable in magnitude to pre- and post-dredge high tide peaks

Ecosystem Effects of Hydrodynamic Dredging (Pledger et al. 2021)

"Results suggest that mobile organisms and marginal communities were largely unaffected by thalweg water injection dredging"

Fish:

- **Low magnitude effects to fish community (no time dependence):**
  - Within dredge footprint: no *effects to fish
  - Downstream: abundance ↓, diversity ↓*, dominance ↑*, taxonomic richness ↓*
- **No effects on fish health and mortality:** all fish captured during dredging were alive and showed no obvious signs of distress, 3% had split/torn caudal fins

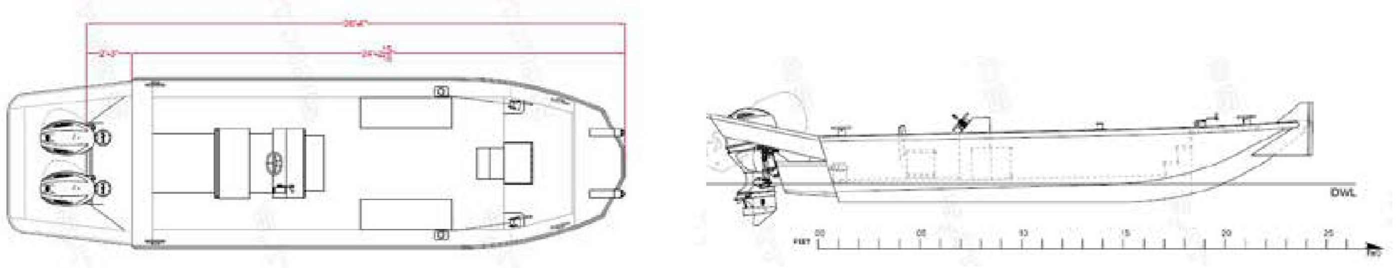
Macroinvertebrates:

- **Temporary effects to benthic macroinvertebrates:**
  - Within dredge footprint and downstream: abundance ↓*, diversity ↓*, dominance ↑, and taxonomic richness ↓*
  - All recovered to control within 5 months

*statistically significant

Pilot Study Proposal

- Two to three week study with full biological monitoring of benthos/WQ/fish is possible
- Dredge is limited to 3 to 6 hours per day (high tides)
- Design, Permitting, Bidding ~ $500k
- Pilot Unit Design and Fabrication ~$400k
- Field test (14 days) plus monitoring and reporting ~ $900k
- Approx $1.8M total



Final Report Completed January 2025

https://publicworks.marincounty.gov/documents/fpms-strategic-sediment-pulse-delivery-report/

THANK YOU! Time for Q&A

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