Sediment and Beneficial Reuse Commissioner Working Group

September 15, 2023

Chair: Andy Gunther Vice-chair: Pat Showalter

Project Team: Maya McInerney, Brenda Goeden, Erik Buehmann, Pascale Sumoy, Jaime Lopez, Kathryn Riley

San Francisco Bay Conservation and Development Commission

San Francisco Bay Regional Sediment Management

Agenda

1. Welcome and Project Updates
2. Beneficial Reuse of Dredged Sediment
   - Jen Siu, U.S. EPA
3. Flood Control Projects as a Source of Sediment
   - Judy Namm, Valley Water
   - Roger Leventhal , Marin County
4. Public Comments
5. Adjournment

Photo: Hamilton Wetlands

Sediment for Wetland Adaptation Project

Goal:

*To **increase beneficial reuse of sediment and soil** for wetland habitat restoration, resilience, and sea level rise adaptation in the SF Bay Area.*

Beneficial Reuse for Green Infrastructure

Sediment & Soil

Dredging - navigation channels & flood protection channels

Upper watersheds - reservoirs, disconnected creeks

Excavated soils - construction

Where have we come from?

- Bay Plan amendment to incorporate fill for habitat
- Working Group Meeting Presentations:

January
- EPA Grant Details
- Sediment and Soil in SF Bay Region
- Existing related Bay Plan Policies Affecting Beneficial Reuse

March
- Bay Plan Amendment Process
- Project Direction and Goals

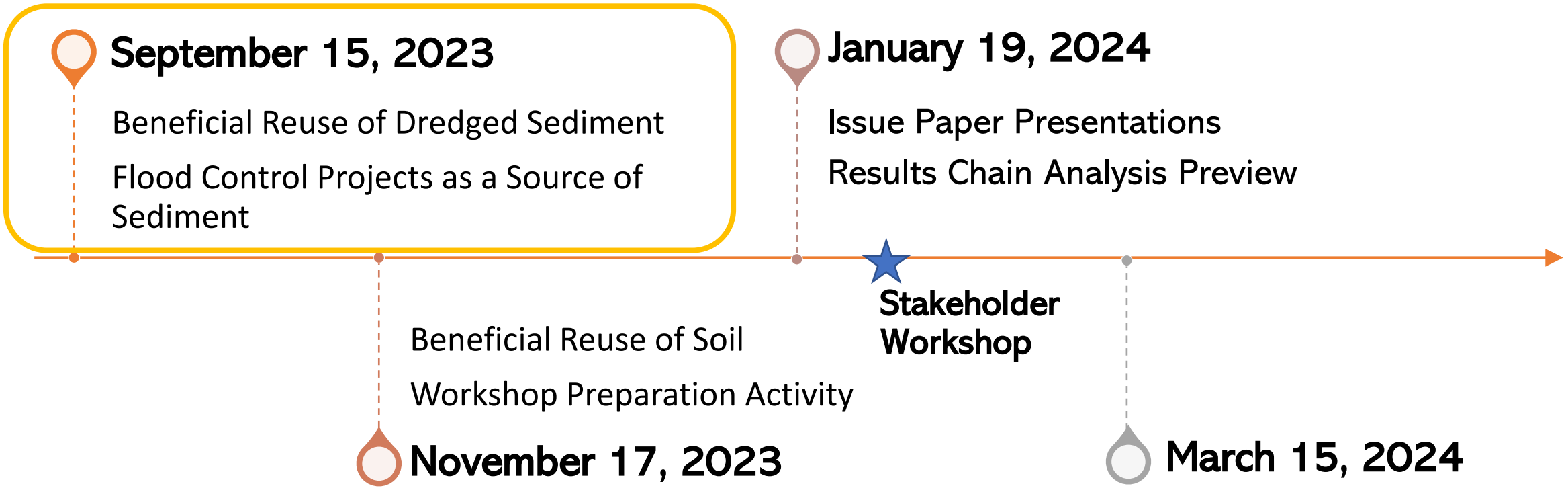
May
- Sediment Transport in SF Bay
- Tidal Marsh Sediment Supply and Transport

July
- Sediment Challenges and Considerations in Bay Area Restoration Projects

Photo: Newark Slough courtesy of King Tides Project

Where are we going?

Upcoming Working Group Meetings:



Preparing for Stakeholder Workshop

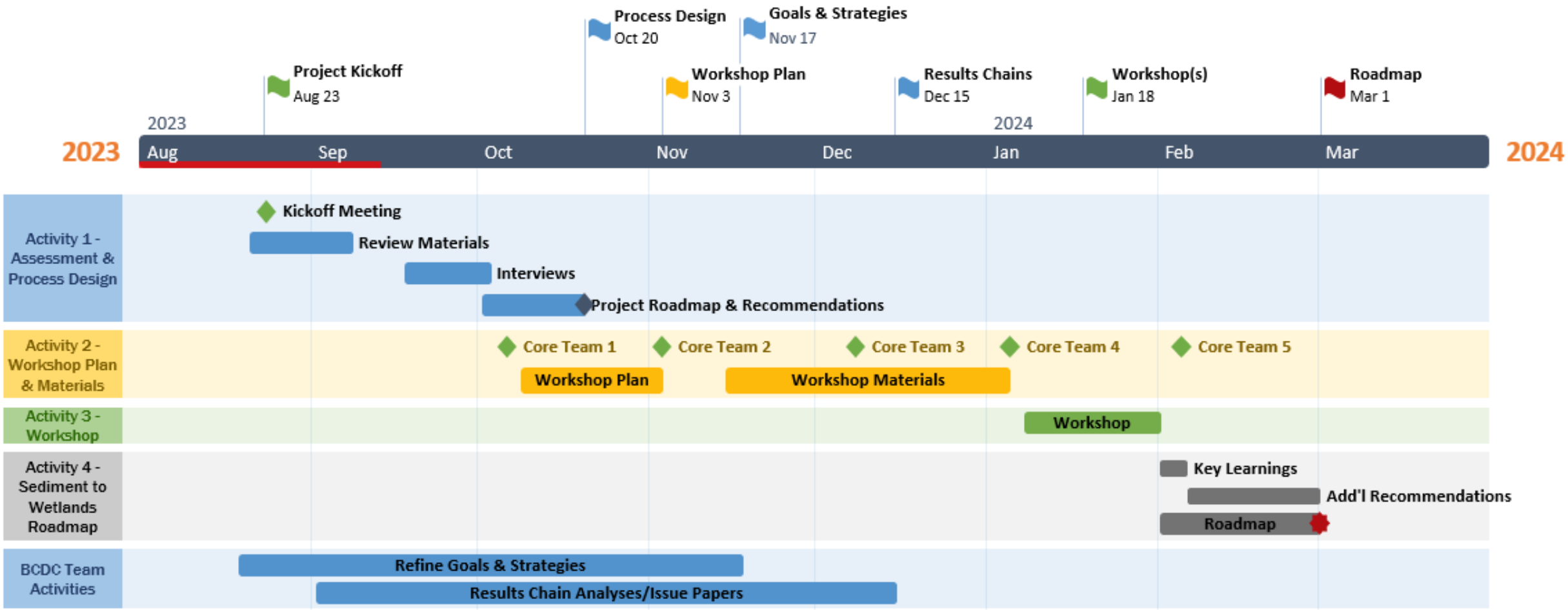
Working with our Facilitator

- Onboarding Catalyst Group (Aug-Sept)
- Stakeholder interviews (Sept)
- Process design and recommendations (Oct)
- Workshop plan (Oct-Nov)

BCDC Project Team

- Stakeholder outreach
- Refine goals and strategies
- Prep workshop materials (including issue papers and results chain analysis outline)

Preparing for Stakeholder Workshop



SWAP Facilitation Timeline, Catalyst Group

Questions / Discussion

Photo: Eden Landing

Dredging and Dredged Material Reuse Reflections

Jennifer Siu

Region 9, Environmental Protection Agency

BCDC Commissioners Sediment Working Group

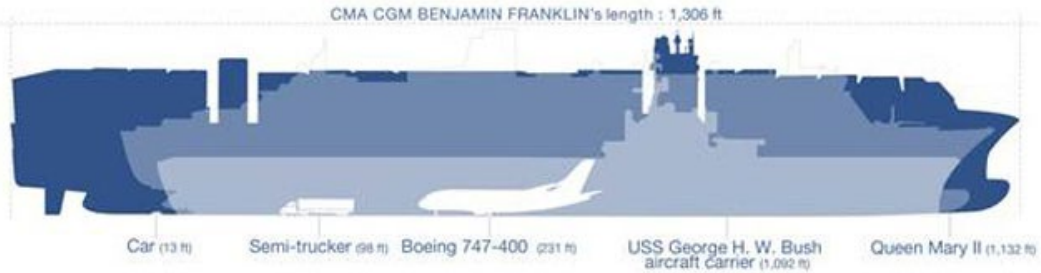
September 15, 2023

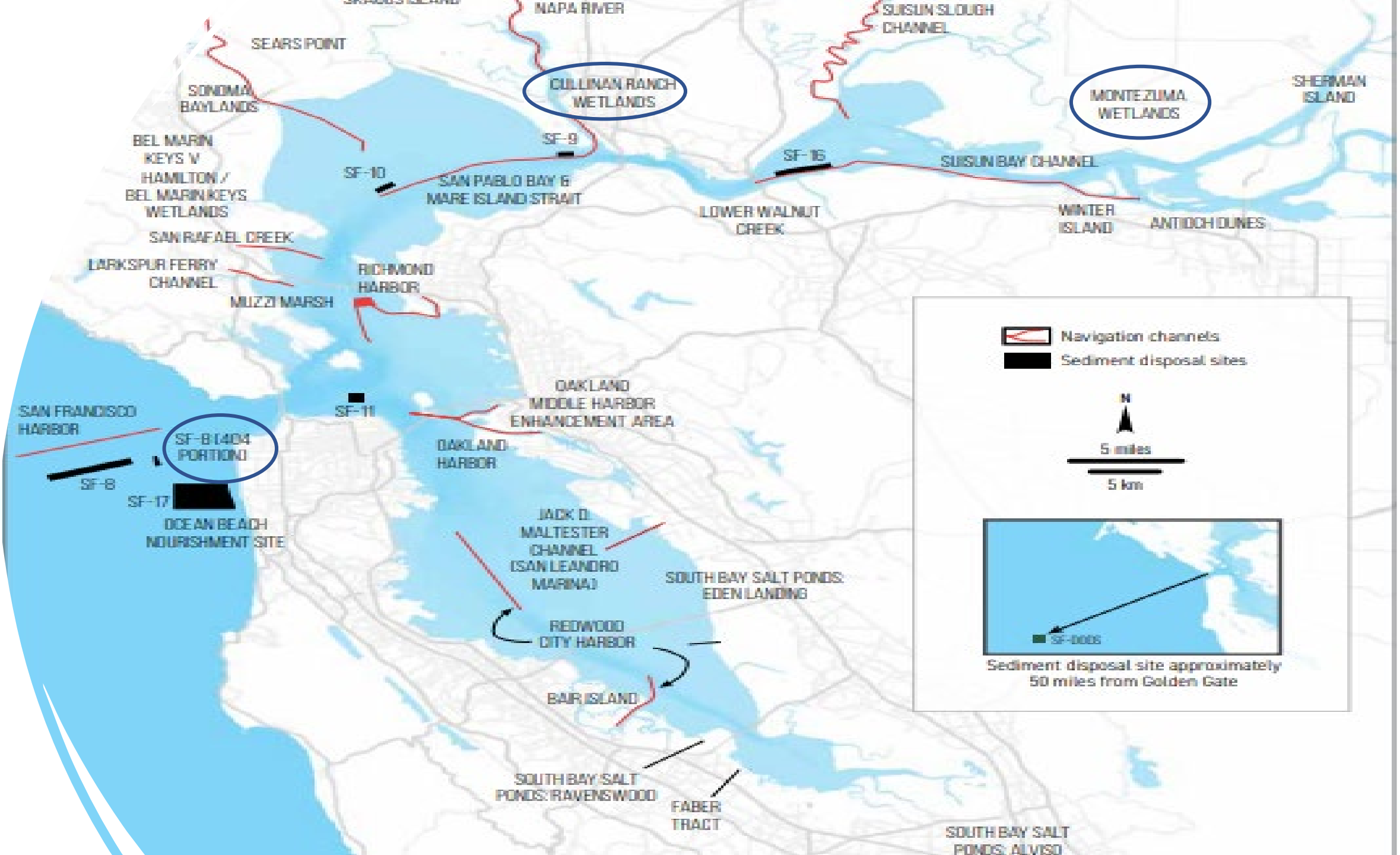
Outline

- Brief refresh on SF Bay Dredging Program & LTMS construct
- Beneficial Reuse of Dredged Material
  - Initiatives at federal & regional level
  - Opportunities and Constraints (past –present- future)

Dredging Importance:

- Several 100mcys sediment dredged nationally <u>every year</u> for safe navigation for $1.5+ trillion trade-related economy
    - R9 maritime commerce: >$500 billion/yr
    - SF Bay: 3.5 million cy/yr dredged
        - ~50% USACE, 50% private, non-federal
- BIL/IRA money to USACE, Ports for climate resiliency including deepening projects (reuse focus unclear)
- R9 Climate Priority Action: Beneficial Reuse of Dredged Material




NAPA RIVER
SUISUN SLOUGH CHANNEL
SEARS POINT
SONOMA BAYLANDS
CULLINAN RANCH WETLANDS
MONTEZUMA WETLANDS
SHERMAN ISLAND
BEL MARIN KEYS V
HAMILTON / BEL MARIN KEYS WETLANDS
SF-9
SF-10
SAN PABLO BAY & MARE ISLAND STRAIT
SF-16
SUISUN BAY CHANNEL
LOWER WALNUT CREEK
WINTER ISLAND
ANTIOCH DUNES
SAN RAFAEL CREEK
LARKSPUR FERRY CHANNEL
RICHMOND HARBOR
MUZZI MARSH
SAN FRANCISCO HARBOR
SF-11
OAKLAND MIDDLE HARBOR ENHANCEMENT AREA
OAKLAND HARBOR
SF-8 (404 PORTION)
SF-8
SF-17
OCEAN BEACH NOURISHMENT SITE
JACK D. MALTESTER CHANNEL (SAN LEANDRO MARINA)
SOUTH BAY SALT PONDS: EDEN LANDING
REDWOOD CITY HARBOR
BAIR ISLAND
SOUTH BAY SALT PONDS: RAVENSWOOD
FABER TRACT
SOUTH BAY SALT PONDS: ALVISO
Navigation channels
Sediment disposal sites
N
5 miles
5 km
SF-0005
Sediment disposal site approximately 50 miles from Golden Gate

Receiver Sites

- Beneficial reuse of suitable material
  - Wetland Restoration
  - Beach and nearshore sand nourishment
  - Dune nourishment
  - Levee re-building
- Site limited!
  - 4 current sites (green)
  - 7 completed (red)
  - Many potential but either not permitted nor accepting material (blue and yellow)

Multiple Approvals for Both Dredging and Disposal

Long Term Management Strategy (LTMS)

- Established 1990 as multi-agency framework with comprehensive stakeholder engagement process
- Programmatic strategy to accomplish both efficient dredging and push for environmentally beneficial outcomes to the region

LTMS Partnership: Goals and Outcomes

Program Goals	Implementation Results
1. Maintain navigation	• 67 mcy dredged • O&M dredging facilitated • Increased public confidence
2. Environmentally sound disposal	• In-Bay disposal one-sixth what it was • Ocean site provides a safe “third” option
3. Maximize DM resource value	• 30 mcy has built hundreds of acres of tidal habitat around the Bay
4. Cooperative permitting framework	• Collaborative, streamlined Dredged Material Management Office (DMMO) is a national model • “Programmatic” species consultations bring certainty for planning, faster decisions

LTMS Process Selected Alternative 3:
20% Bay, maximize reuse (min 40%), max 40% ocean

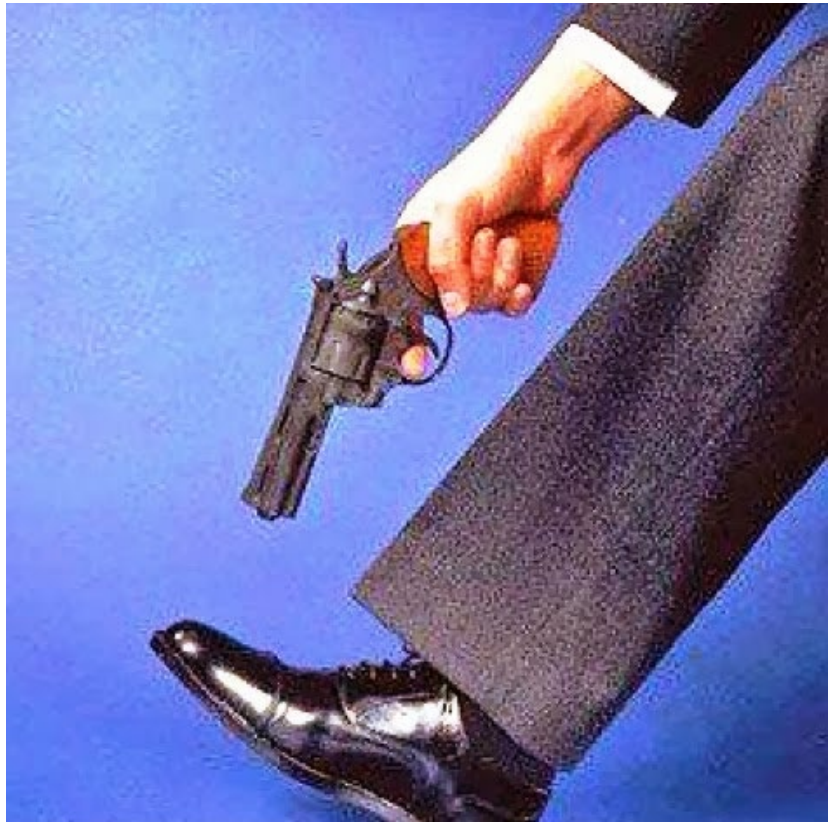
- **Environmentally Preferred**
  - Best meets LTMS goals, CCMP issues, & National Dredging Policy
  - Least ecosystem risks/impacts (incl to T&E species)
  - Most benefits (incl. to T&E species)
  - Policy-Level mitigation measures included
- **Most expensive over time**
  - Called for flexibility, transition period, small dredger relief
  - 404(b)(1) Practicability applied project-by-project
- **Not fully implementable w/current funding, laws & policies**
  - ID'd need for more reuse capacity to come on line
  - ID'd need for new funding mechanisms
  - ID'd several options for policy/legislative improvements

Harsh Reality

- Avg 60% dredged sediment disposed as waste – nationally and regionally
- Fed policies have not kept pace – playing catchup now with recent Federal commitments:
    - USACE 70% Nationally
    - E.O. on NBS (reuse is a tool)
    - No guidance for regulatory permitting

Constraints to Significant Reuse

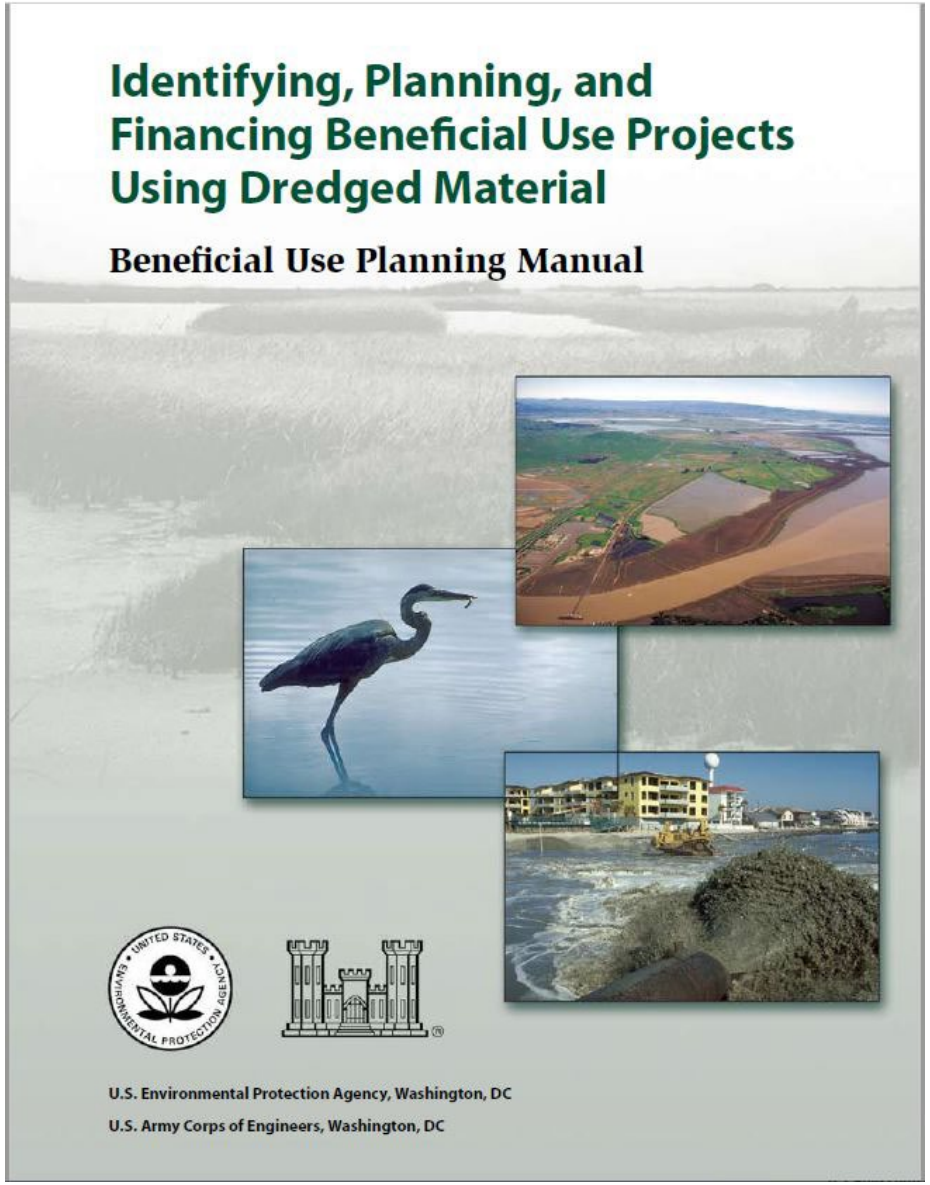
- ESA complications
- Psychological barriers (NOT SPOILS)
- Regulatory inflexibility
- Logistics (technical)
- $$$

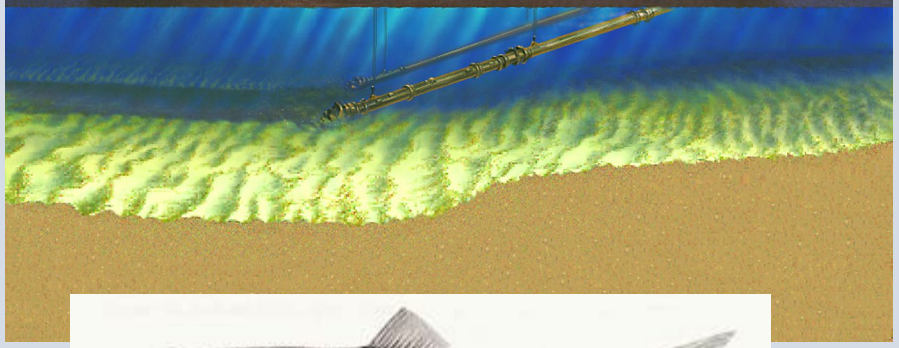


Matching Dredging with Beneficial Use

Dredging and Reuse are usually separate projects. For reuse to be practicable, must match:

- Dredging vs Placement ***Logistics***
  - Project locations (proximity, access, equipment)
  - Project timing (avoid costly rehandling)
- Dredging vs Placement ***Costs***
  - Reuse often more $ than disposal
  - Issue is often WHOSE Budget –FEDS, State, everyone?






MARMAC 400
NEW ORLEANS LA

So what has been done to innovate?

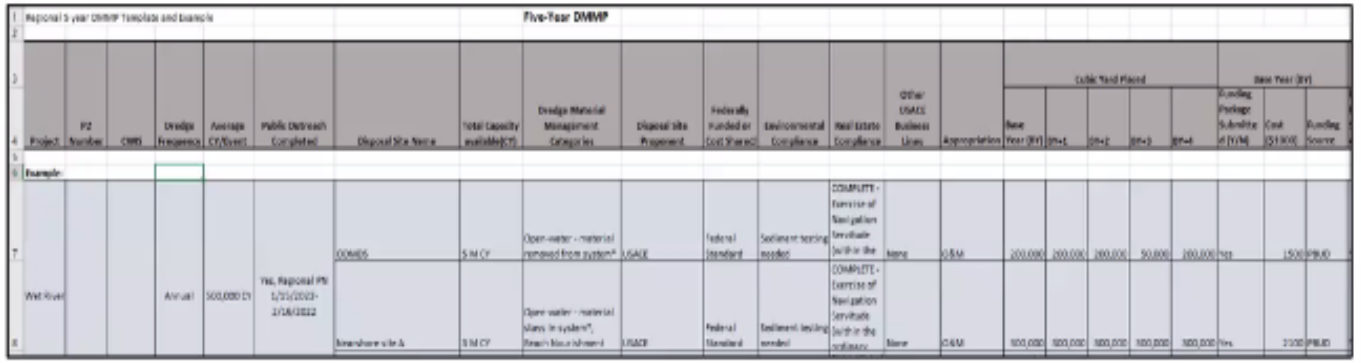
- LTMS :
  - USACE Value Engineering/Contracting Mechanisms
  - 2022 Pilot Placement
- Congressional & Regional Advocacy:
  - WRDA 2016 Section 1122 Pilot
  - Mullen Funds
  - Measure AA Funding & Permitting Framework
- 2019 BCDC Bay Plan Habitat for Fill Amendment

Where are we now?

- This grant!!!! It takes a village
- Continued work on regulatory framework initiatives
- Improvements in cost-benefit analysis to look at societal and environmental factors in addition to cost (e.g., BUDDI) [still variable methods across agencies]
- WRDA 2020 Section 125
- RDMMP

Sec. 125 of Water Resources Development Act (WRDA 2020)

- **Section 125(c) -** directs USACE to annually prepare dredged material management plans (DMMPs) with a 5-year outlook
  - Full Federal expense
  - Minimum 30-day public input
  - Spreadsheet format
  - BUDDI process for new sites



- **Section 125(a)** - authorizes USACE to cost-share (65%/35%) the incremental cost of BU placement opportunities
  - Incremental costs must be reasonable in relation to benefits
    - Federal share (65%) of increment < 25% of Base Plan Cost (or must complete benefit cost analysis)
  - Requires cost-share partner
  - Multiple placements over multiple years allowed

US Army Corps

USACE Regional Dredge Material Management Plan (RDMMP)

- 20yr planning vision to cover USACE's San Francisco Bay Federal O&M (12 federal channels and the Main Ship Channel)
- RDMMP must establish the "Base Plan" placement location(s) that meet the Federal Standard. The Plan will include a suite of reuse options available now and in the future that will be analyzed to demonstrate benefits of reuse.

Opportunities?

- Cost-share funding for placement
  - CA legislature cost-share pot? SF Bay regional set aside (similar to Measure AA)?
  - Continue advocacy & education to agency staff and public on connection between reuse and climate resiliency – and need to accelerate implementation
- Incentivize dredging contracts
  - Continue contract mechanism explorations (multi-yr contracts again?)
- Permanent stockpile areas?
- Equipment methods:
  - Situations where cutterhead or other dredge method could result in better ESA outcomes?
  - Regional offloader to increase sediment delivery (but still costly)

Contact Info:

Jen Siu
siu.jennifer@epa.gov

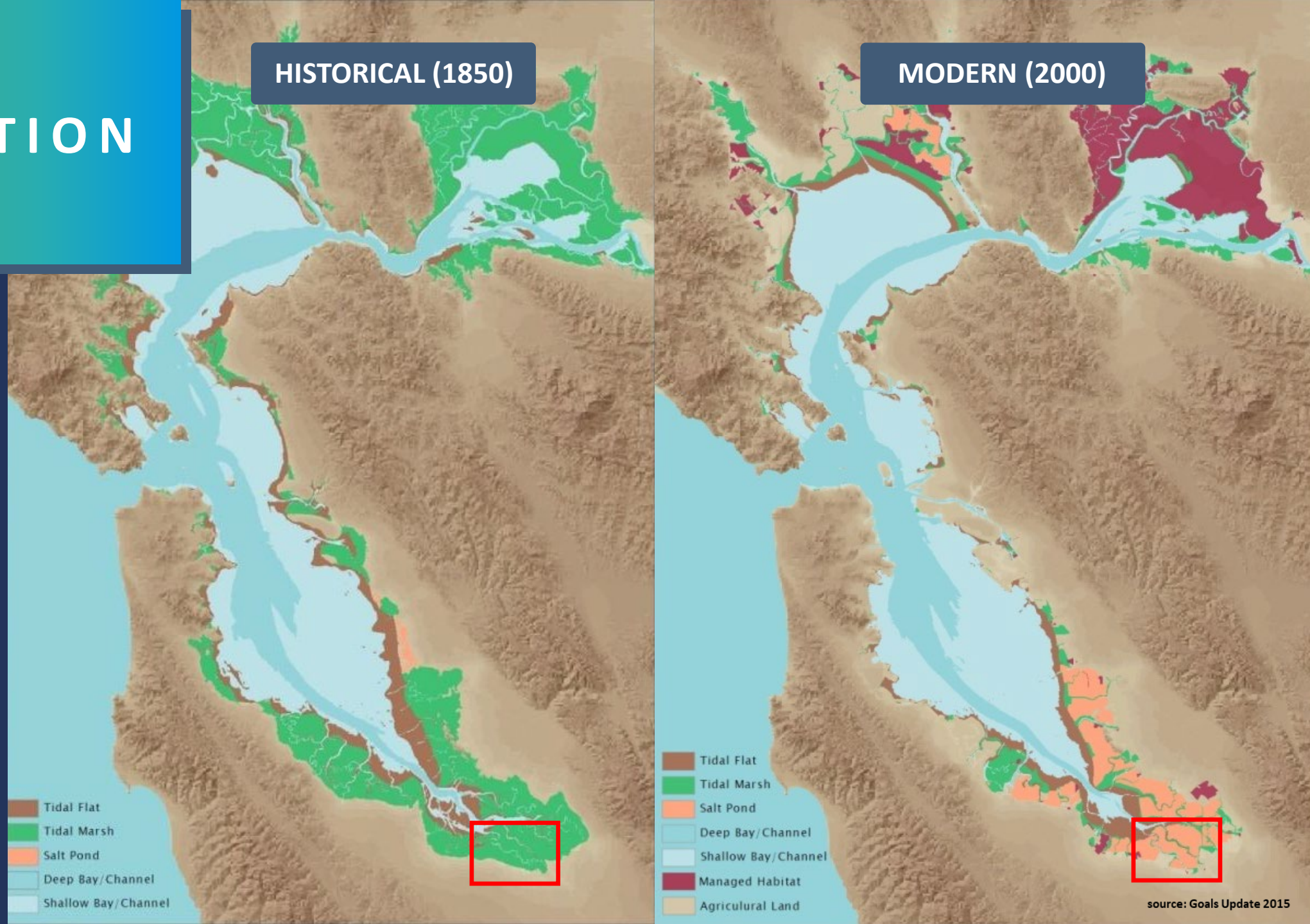
Valley Water's Beneficial Sediment Reuse Effort

Judy Nam, Senior Water Resources Specialist
September 14, 2023

Valley Water

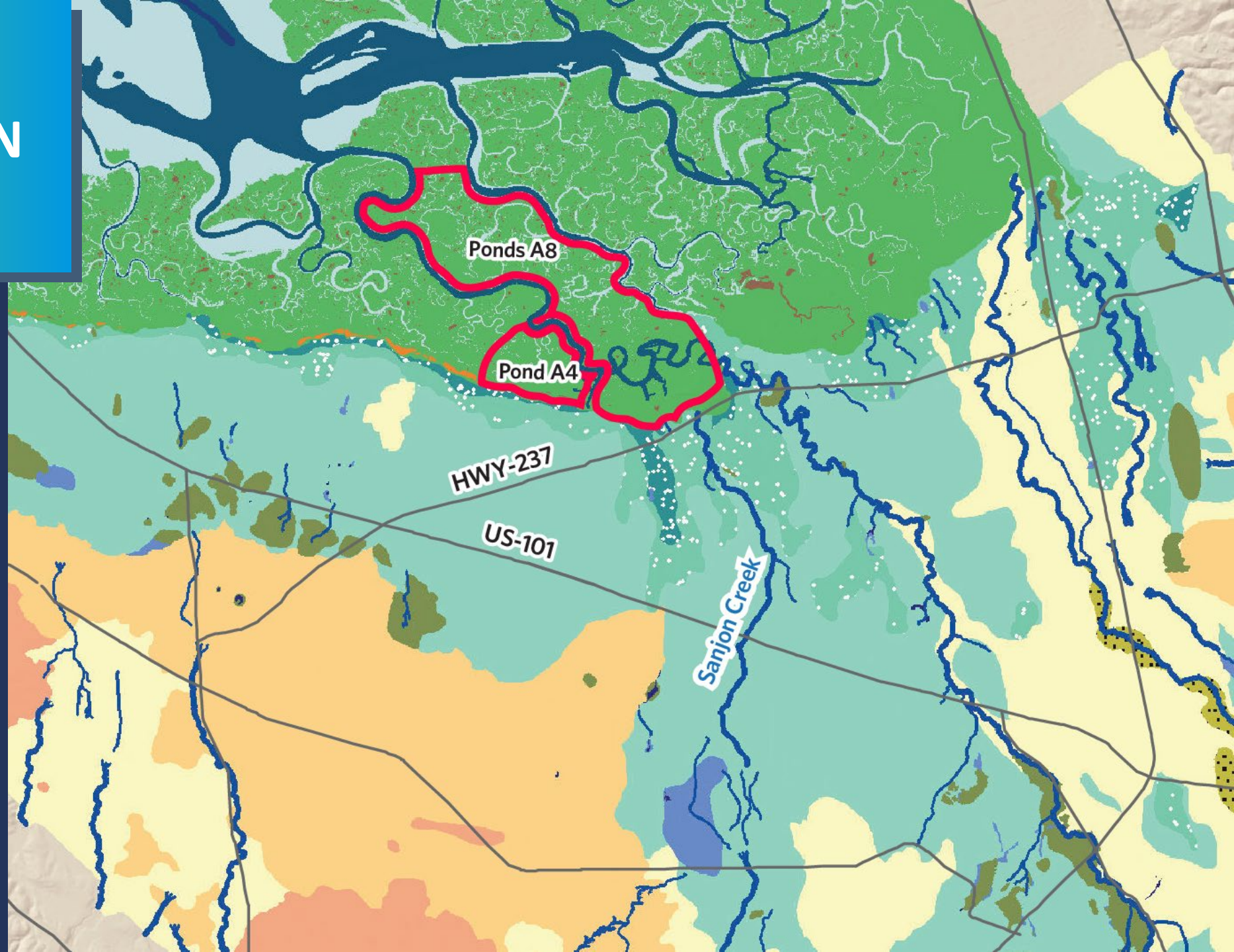
HABITAT RESTORATION

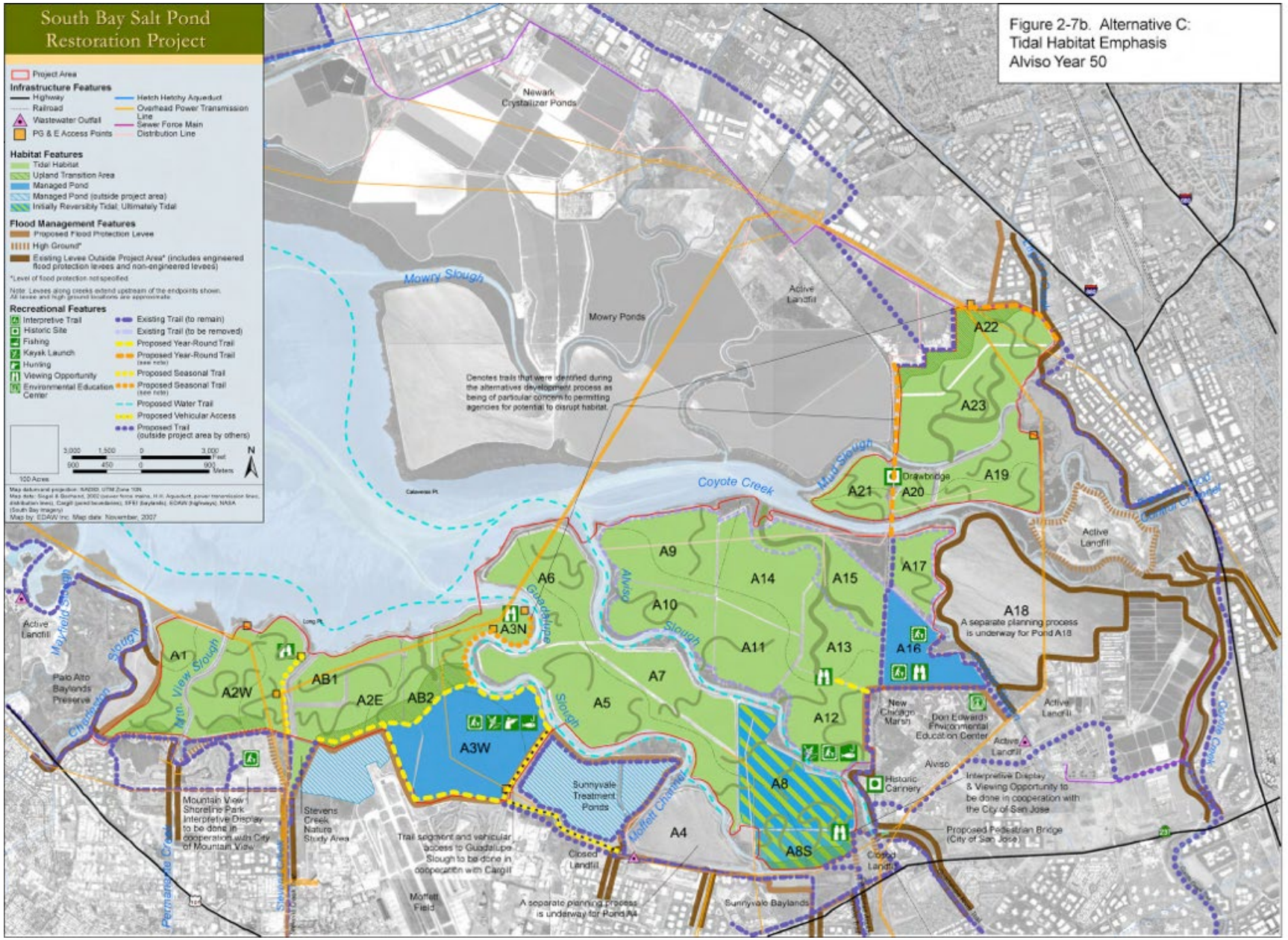
Since 1850, over 100,000 acres of tidal marsh lost around the Bay



HABITAT RESTORATION

Project will capture sediments from creeks and lower South Bay to build up to 1,800 acres of new tidal marsh habitats.

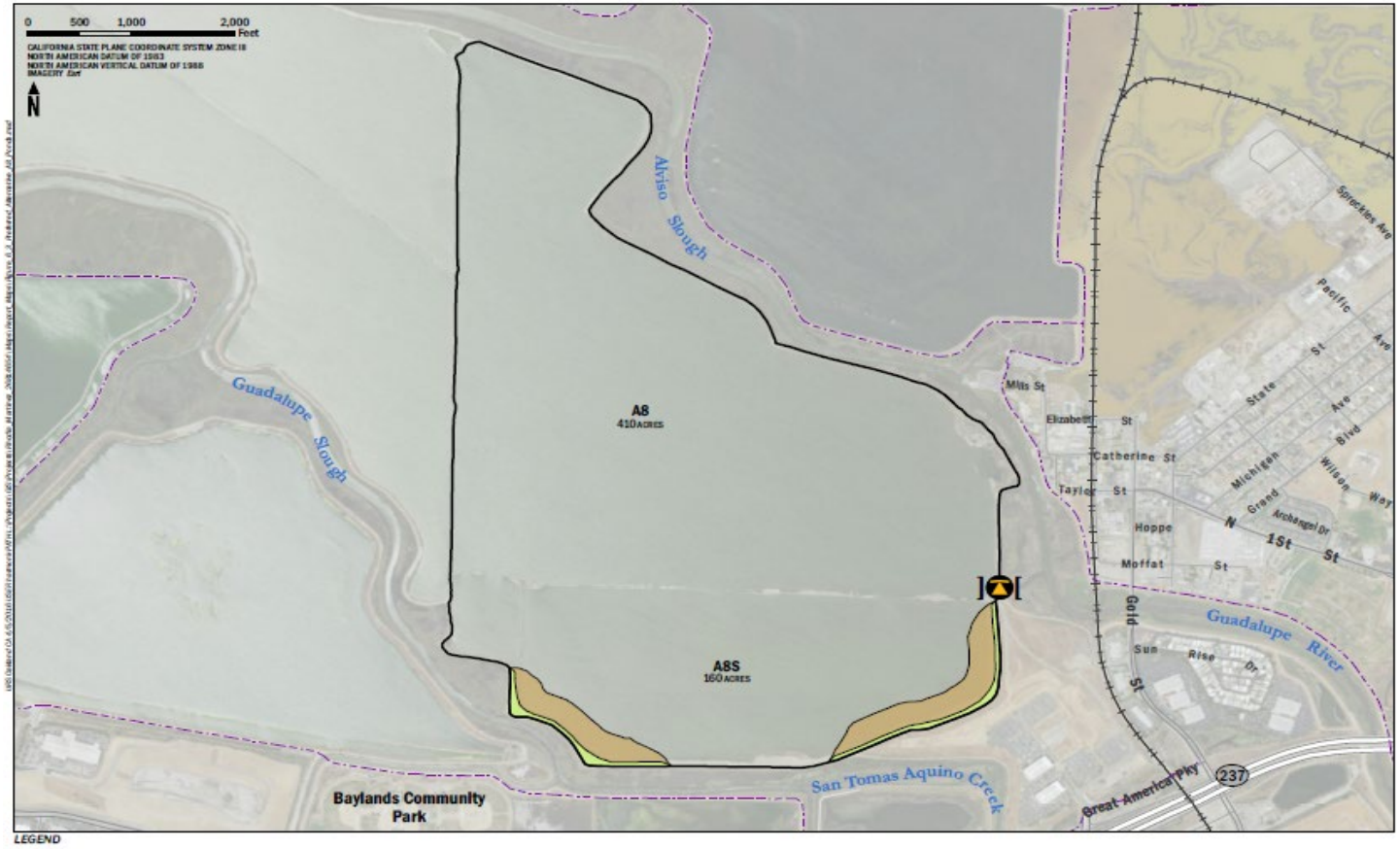




South Bay Salt Pond Restoration Future Alternative

Valley Water Partnership with SBSPRP Phase 1

Valley Water Partnership with SBSPRP Phase 2



Valley Water SCW D3 Project Supports South Bay Salt Ponds Restoration

Reuse SMP sediment to support SBSPRP restoration effort

Project Benefits:

- Accelerate progress of important tidal wetland restoration project
- Reduce disposal costs for sediment that has been removed from local channels to maintain flood carrying capacity
- Increase space availability in local landfills

Reuse of SMP Sediment for SBSPRP Habitat Restoration

SMP SEDIMENT TESTING PROGRAM

Year	Quantity of Sediment Tested (CY)	Quantity Approved as Surface (CY)	Quantity Approved as Foundation (CY)	Quantity Not Meeting Reuse Criteria (CY)	Quantity Placed at A8 Ponds (CY)
2019	131,398	0	78,023	53,375	4,600
2020	43,077	10,625	5,700	26,752	8,810
2021	33,425	0	8,500	24,925	6,472
2022	55,793	0	0	55,793	0

Issues Preventing Reuse:

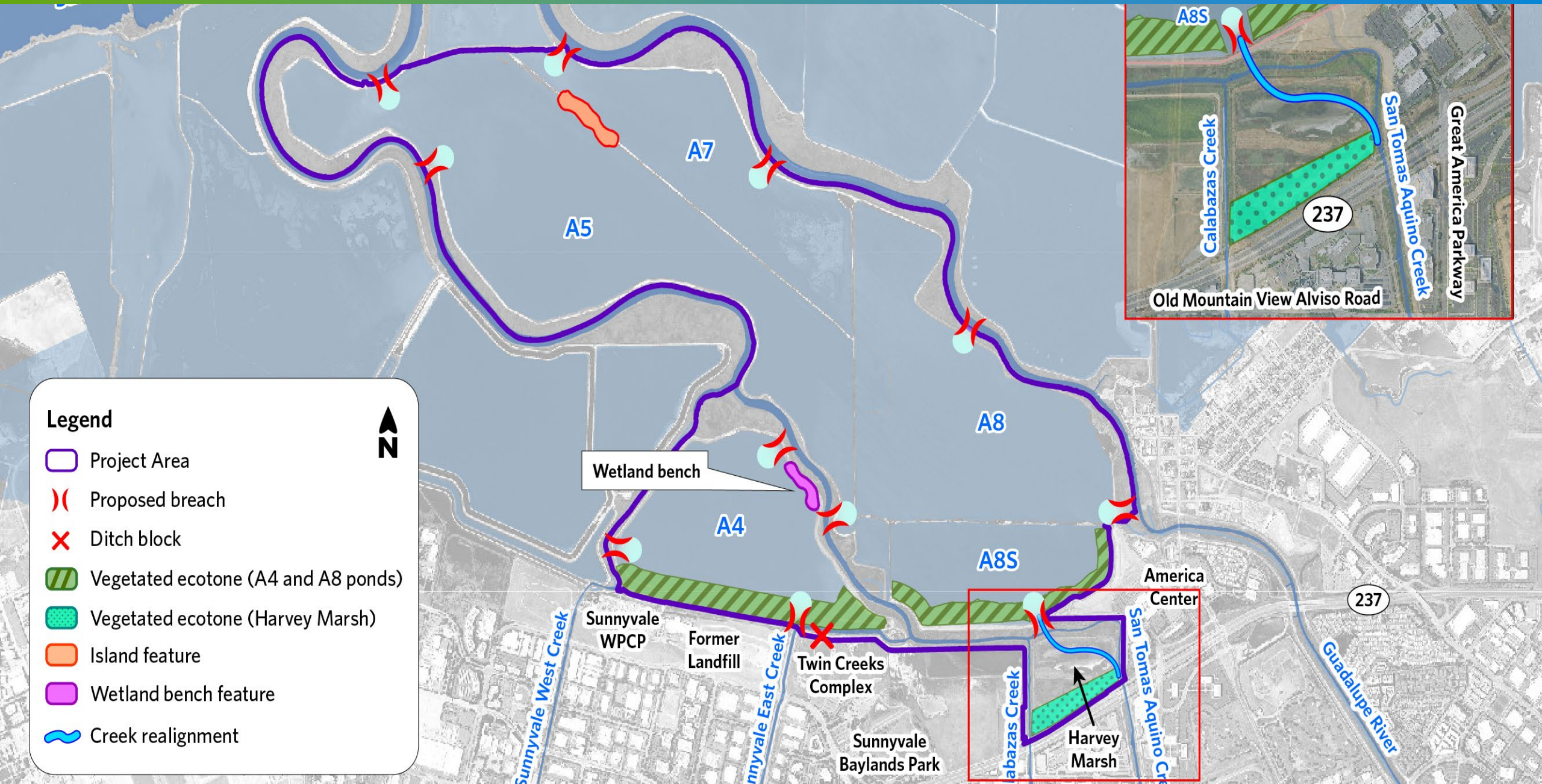
- Elevated levels of selenium, chromium, nickel, & pesticides
- Insufficient stockpile areas
- Dredging sites too far from A8 Ponds

Strategy to Increase Sediment Reuse

- Modify soil screening criteria in consultation with RWQCB & BCDC
- Secure additional stockpile areas (possibly interagency)
- Explore sediment reuse for projects such as Shoreline Project and gravel augmentation
- Receive mitigation credit for sediment reuse

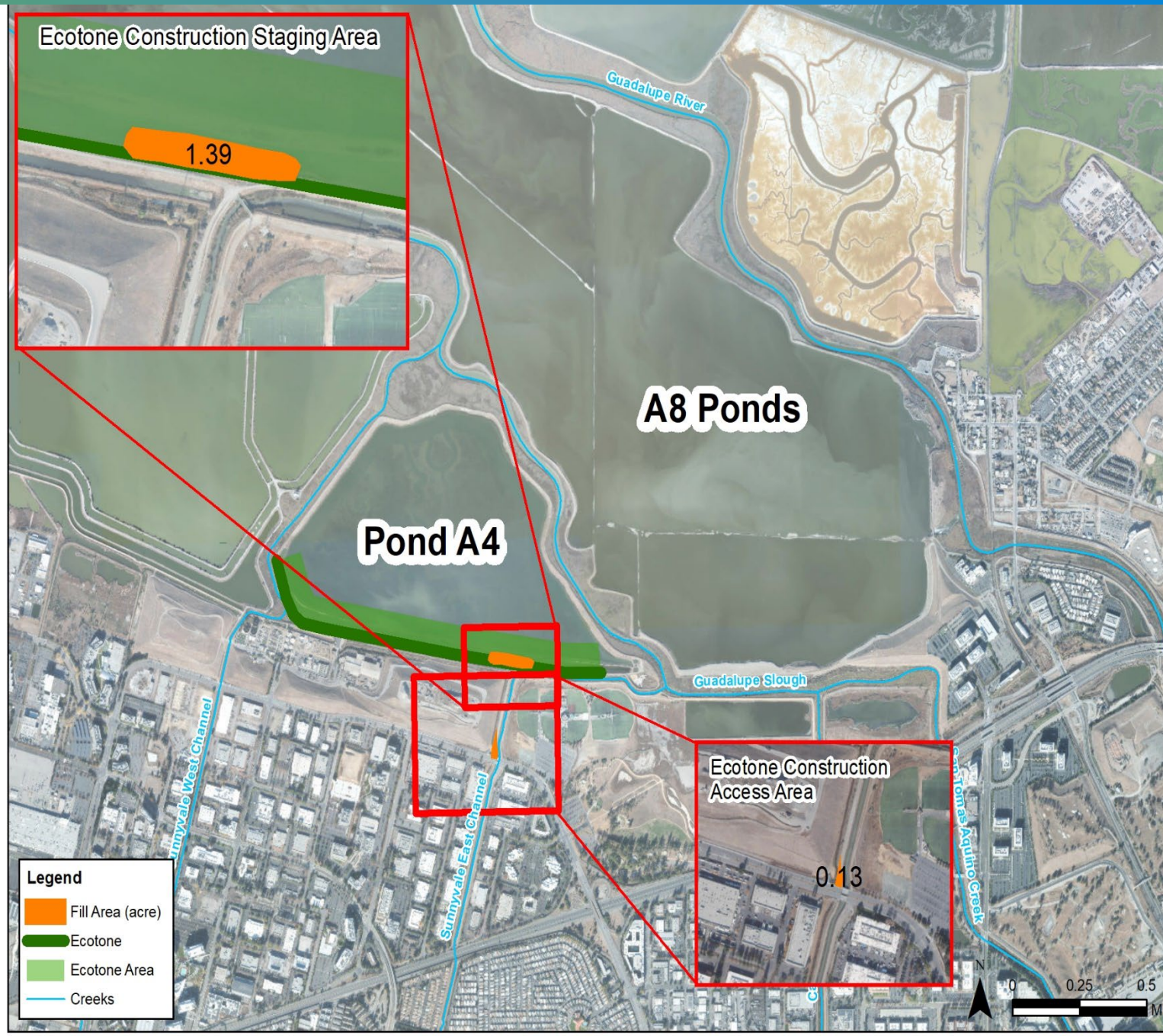
Real Life Example: artificial creek alignment cause sedimentation

Calabazas/STA Creek-Marsh Connection Project Vision

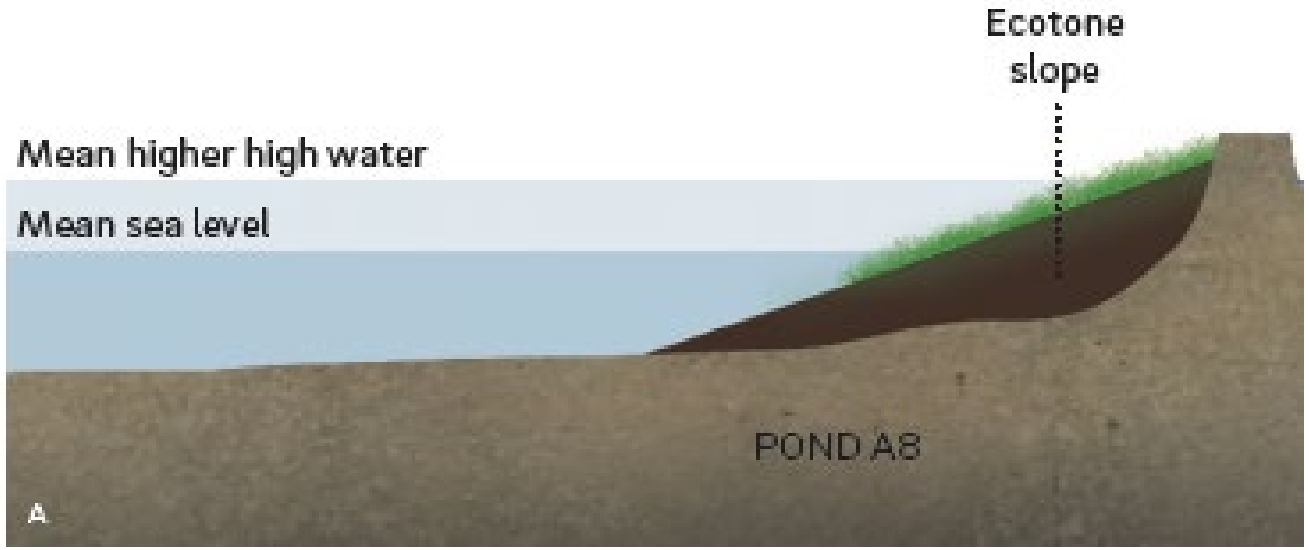


Real Life Example: Pond A4 Resilient Habitat Restoration Project

- Speed up sediment reuse at Pond A4 to build interim habitat
- Take advantage of Statutory CEQA Exemption under CDFW's Cutting Green Tape Initiative to expedite project schedule to start construction next year
- Use BRRIT to expedite permitting



- Ecotone provides resilient flood protection
- Racing against Sea level rise to establish tidal marsh



Questions : Valley Water Sediment Reuse Projects

Valley Water

Clean Water • Healthy Environment • Flood Protection

Marin County Flood Control & Water Conservation District

Mud on the *Move* in Marin
Beneficial Reuse of Dredge Sediments in Marin County
The Challenges and Opportunities

BCDC Commissioner Beneficial Reuse Sediment Working Group
September 15, 2023

Roger Leventhal, P.E.
Senior Engineer
Marin DPW Flood Control
rleventhal@marincounty.org

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

MARIN COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

Outline

- The Problems
- The Solutions – Pilots We Have Tried and Want to Try
- The Obstacles to More Beneficial Reuse
- Our Latest, Most Innovative and Perhaps Craziest New Idea Being Studied by the Army Corps

MARIN COUNTY
FLOOD CONTROL
& WATER CONSERVATION DISTRICT

Historically the Army Corp Gives the Flood Project Away to the Local Sponsor to Maintain w/ Dredging

- ✓"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 will be kicked out of the program"

And What Our Residents Say…

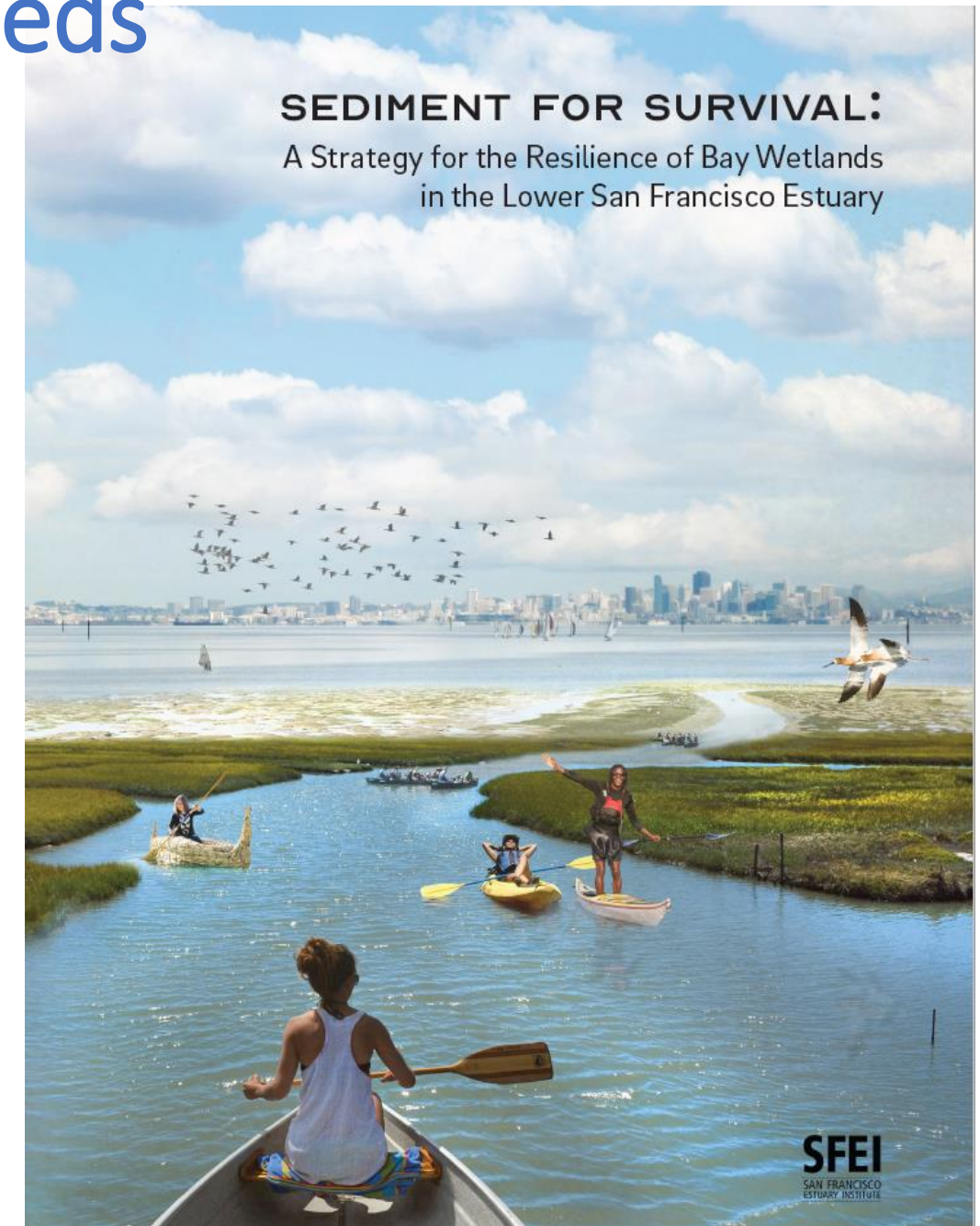
Petaluma River dredge protect (above)

San Rafael Canal dredge protest (right)

Gallinas Creek, Marin County

Awareness of Sediment Needs

- Estimate 5 to 10 % of sediment tied up in tidal flood control channels – not being beneficially reused (*estimate is low IMO*)
- Our silted In flood control channels are located closest to marshes and mudflats
- So…Why can't we dredge and place?



Marin Pilot Projects and Proposals

- Thin-Lift Hydraulic Placement on Adjacent Marshes (*move mud with pumps and pipes)*
- Connecting Creeks to their Adjacent Marshes (*let flood flows move it)*
- Shoreline Erosion and Coarse-Grained Sediments (*move sands and gravels)*

if time allows….

- Geomorphic Dredge Design (*reduce dredge volume and impacts*)
- New DwN Dredge Construction Approach (*let bay storms move it*)

MARIN COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

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- Thin-Lift Hydraulic Placement on Adjacent Marshes (*move mud with pumps and pipes)*
  - Novato – done mechanically 2016, 2020 and now proposed hydraulically for 2025
  - Gallinas to McInnis (proposing now)
  - Coyote to Bothin (proposing now)
- Connecting Creeks to their Adjacent Marshes
- Coarse-grained beach design and marsh edge erosion
  - Aramburu built 2011/2012
  - Greenwood beach, Tiburon, proposing for 2024 construction
  - Corte Madara Marsh Edge, part of SCC Living Shorelines Projects
- Geomorphic Dredge Design (*reduce dredge volume*)
- New DwN Dredge Approach (at end)

MARIN COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

Novato Creek Dredge Summary – 1st Bay Area Thin Lift

- Every four years, approx. 20,000 to 25,000 cy
- Historically gone to landfill or levees at airport or in 2020 to the ponds
- In 2016 and 2020, beneficially reused approximately 5,000 to 7,000 cy to lay foundation of eco-tone levee in Deer Island Basin (next slides)

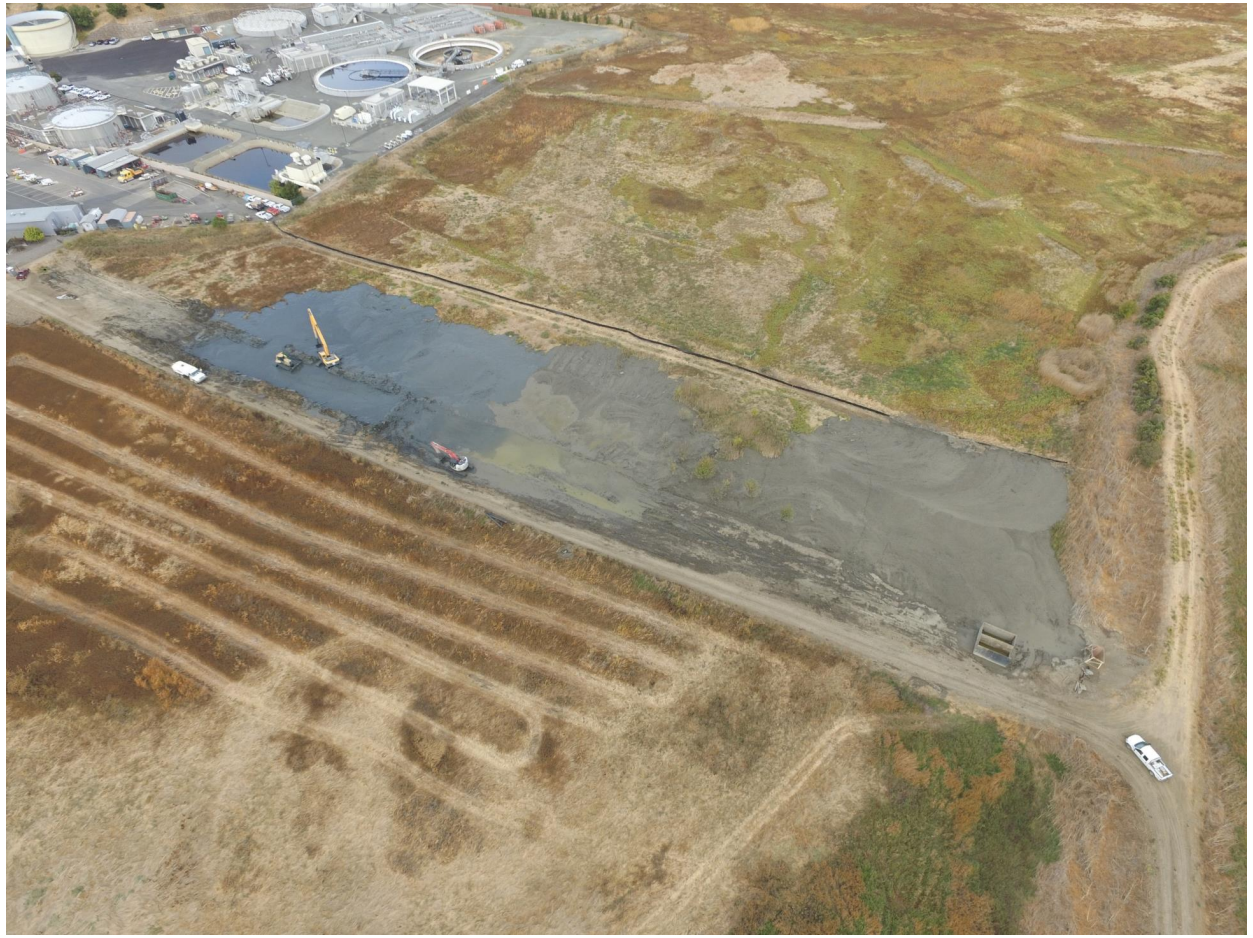
✓2025 looking to thin-lift hydraulic placement into Deer Island Basin

2020 dredge – dewatered creek at downstream end

Final Approved Placement Permit – 2016/2020

- Place approx. 8,000 cy and reduce fill thickness to two feet, no stockpiles below future MHHW elev of 6.5 ft NAVD88
- Called a “Temporary” impact
- Monitor and enhance revegetation

➢Move the needle on beneficial reuse at all?




NOVATO CREEK MAINTENANCE
SEDIMENT REMOVAL
Contractor:
Great Lakes Environmental & Infrastructure
6558 Lonetree Blvd. Rocklin, CA 95765
Contact: Emmett Black (916) 462-6400

Digging the creek

2025 Hydraulic Placement Proposal

Two Other Marin Thin-Lift Projects in Design and Permitting

- **Coyote to Bothin -** District applying for SFBRA funding for design and permitting of a Coyote to Bothin Marsh thin-lift pilot study of 3,000 to 5,000 cy
  - Direct placement at an active tidal marsh determined to be at high risk for loss of habitat under current and especially SLR conditions

- **Gallinas to McInnis -** District going to BRRIT for the 2nd time to permit thin-lift placement from Gallinas Creek into the main basin of McInnis Marsh to beneficially reuse sediments (100,000 cy) and build elevation capital for McInnis
  - **Placement at a diked off marsh with no immediate plans to restore to full tidal**

Other Real-World Issues Preventing the Wide-Spread Use of Thin-Lift Placement from Creeks to Marshes

Can't Always Time the Placement to a Restoration Projects. Placement at McInnis a diked off marsh with no immediate plans to restore to full tidal – tests the ability of BCDC and other agencies to permit opportunistic building of elevation capital with the goal of future tidal restoration either planned or due to levee failures that are coming.

Can't Put All Risks and Costs Onto the Applicant for Uncertain and Unknowable or Unavoidable Outcomes. Thin-lift is a goal not a scientific certainty in construction. Impossible to place sediment in the real-world with unformat thickness never exceeding 15 cm. This can be a design goal **on average** but cannot be written into permits as a requirement with measurement and mitigation

Same for decant turbidity. Fine-grained muds don't settle well by definition so just like stormwater BMPs, the standard should be treatment by design and not solely by measurement. Too much risk for issues like wind-waves that are beyond control of the designer and thus requires more risk only affordable by large agencies with needs and deep pockets.

Costs for Dredging/Placement Are Too High and Uncertainty Risks. Constructability issues for contractors are unknown so who bears the risk and costs?

Other Obstacles to Implementation …

- Costs and permitting complexity
- Environmental concerns in some areas (contaminants)
- Lack of demonstrations and proof for the professional engineering and contracting community (Marin's focus on pilot projects)
- Bureaucratic agency inertia
- How projects are funded and maintained and potential future liability
- Coarse grained sediments need a sediment rehandling strategy

Marin Pilot Projects and Proposals

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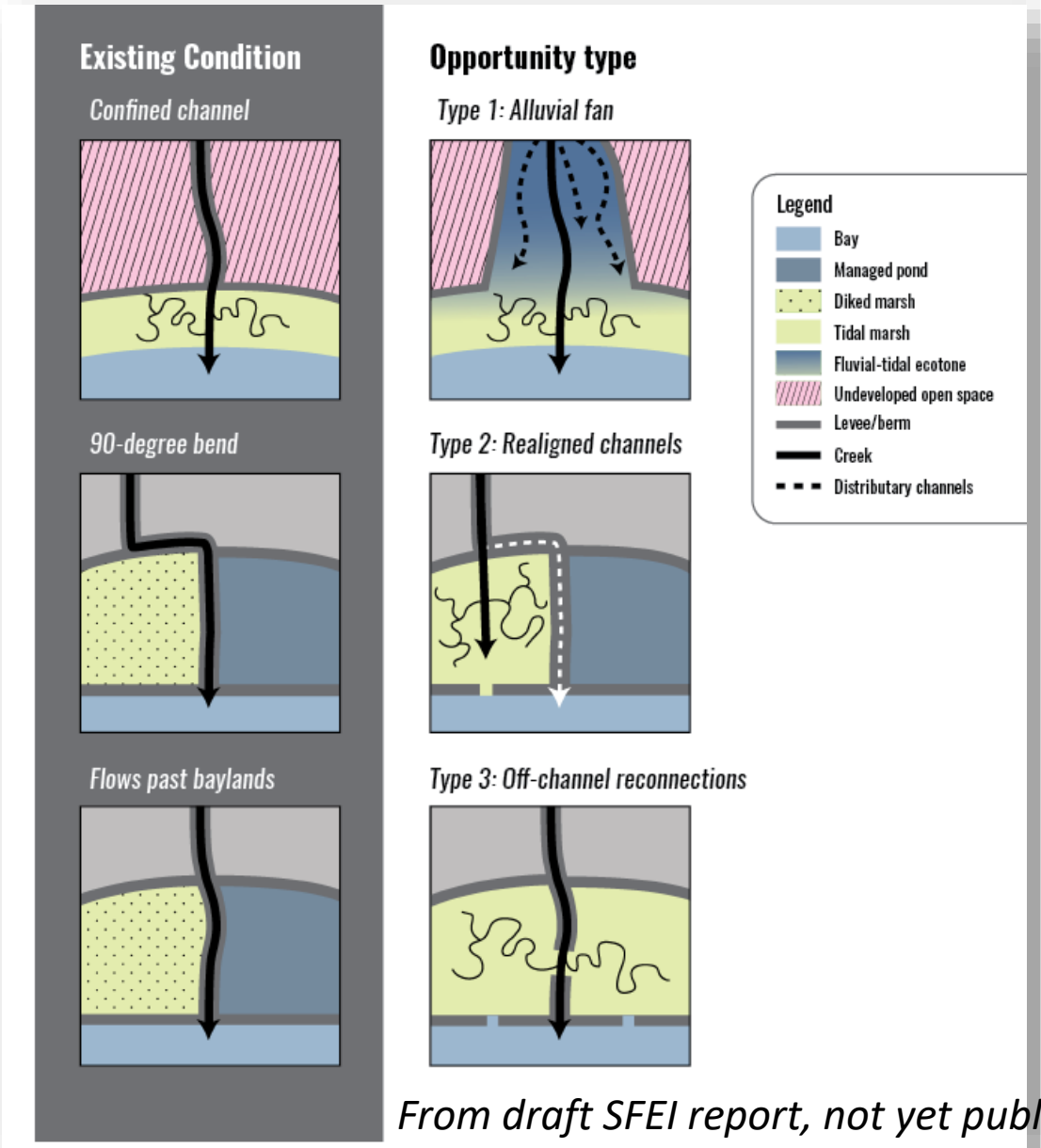
MARIN COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

Direct Connection of Channels to Their Marshes

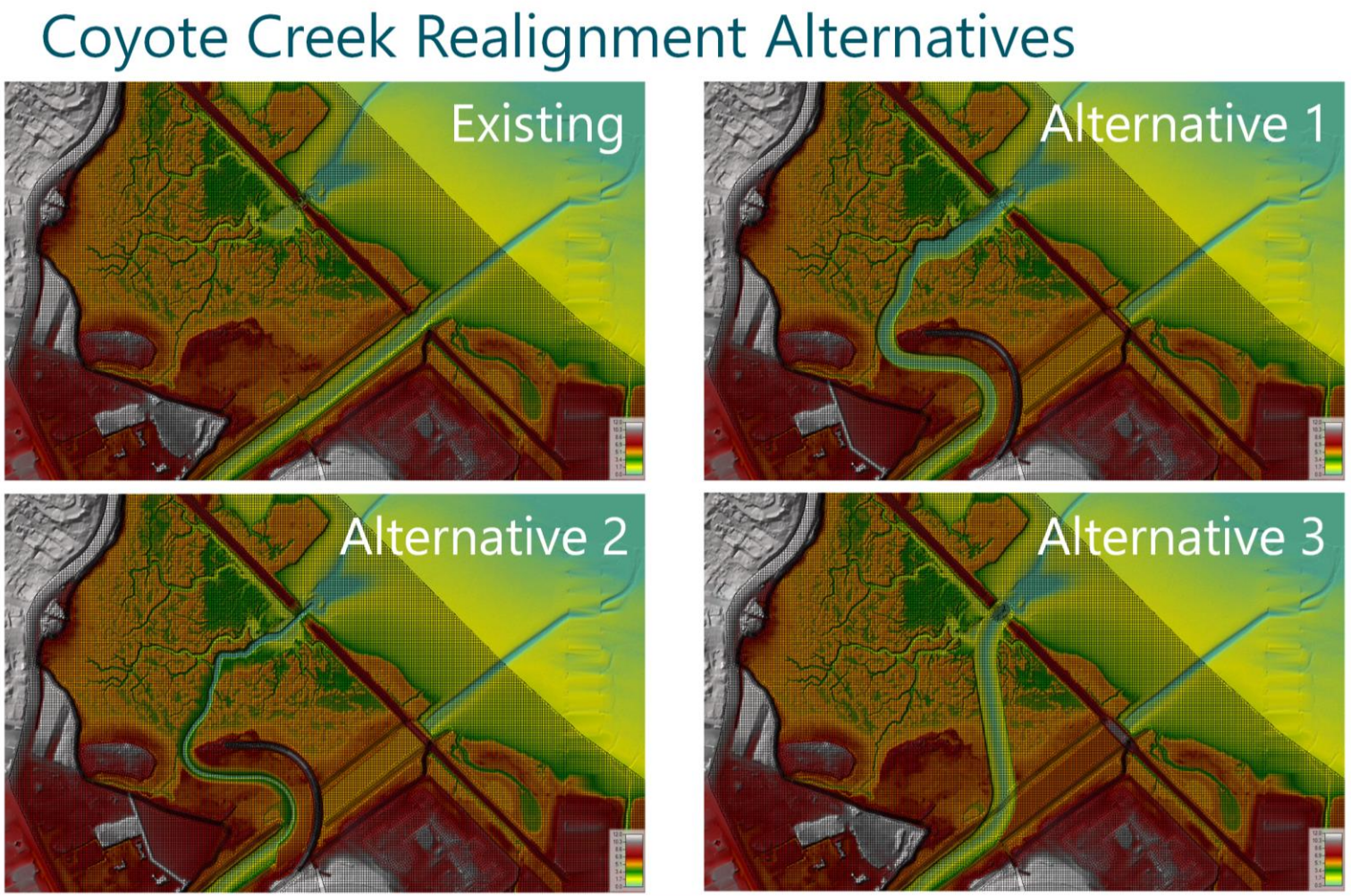
On SFEI TAC for this study of reconnecting creeks to Baylands

Coyote to Bothin is an included case study



From draft SFEI report, not yet published

Coyote Creek Channel Realignment



District working with Marin Parks studied alternatives for realigning Coyote Creek into Bothin Marth to deliver sediment natural and directly – hydrodynamic study

Upstream flooding issues limiting this alignment to less direct alts

Marin Pilot Projects and Proposals

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MARIN COUNTY
FLOOD CONTROL
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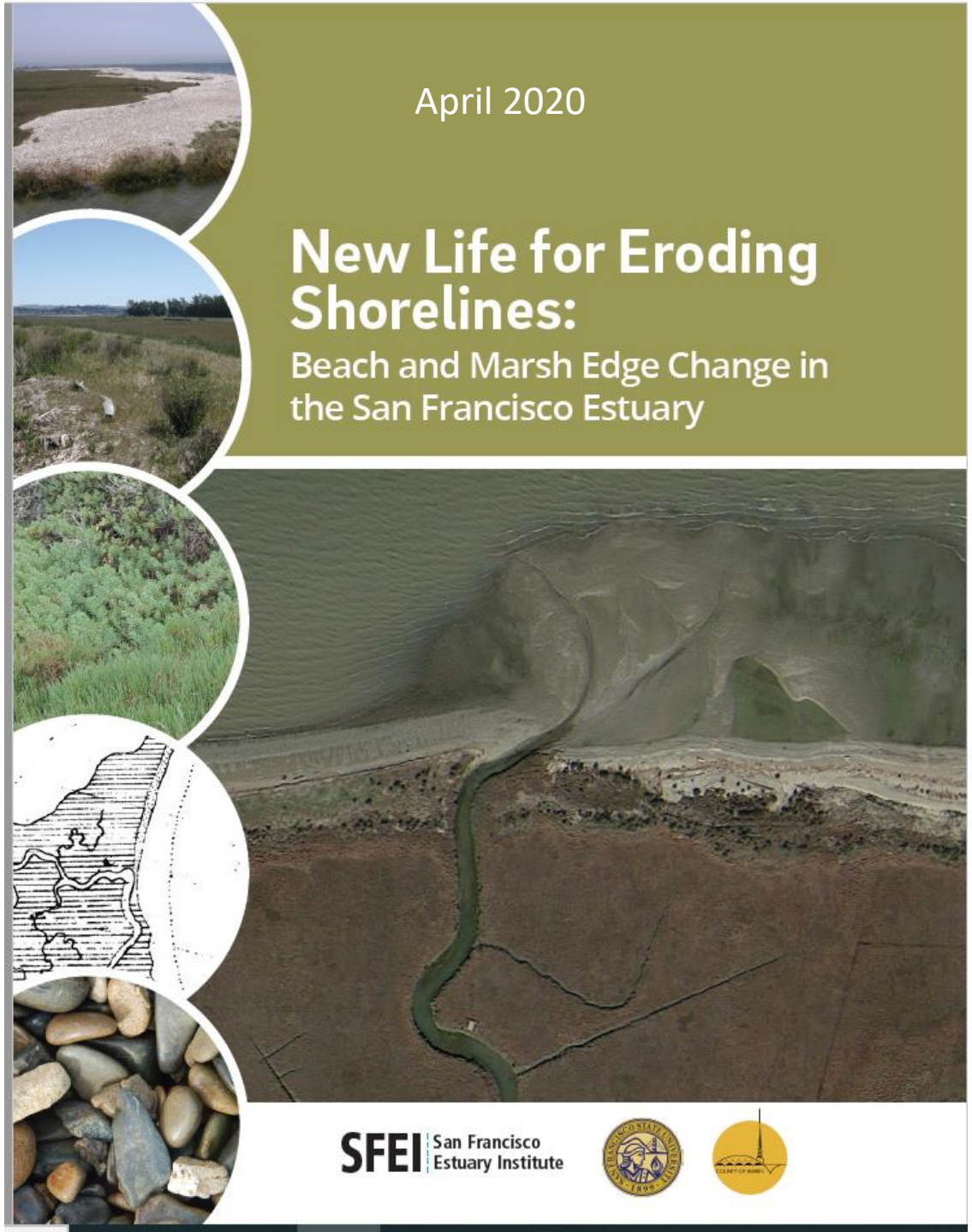


New Life for Eroding Shorelines:

Beach and Marsh Edge Change in the San Francisco Estuary

A Technical Memo Associated with the New Life for Eroding Shorelines Project

Prepared by

SFEI	Consultants
Julie Beagle	Peter Baye (*Coastal Ecologist*)
Katie McKnight	Roger Leventhal (*Marin Public Works*)
Ellen Plane	
Gloria Desanker	

Funded by

Marin Community Foundation
California Coastal Conservancy

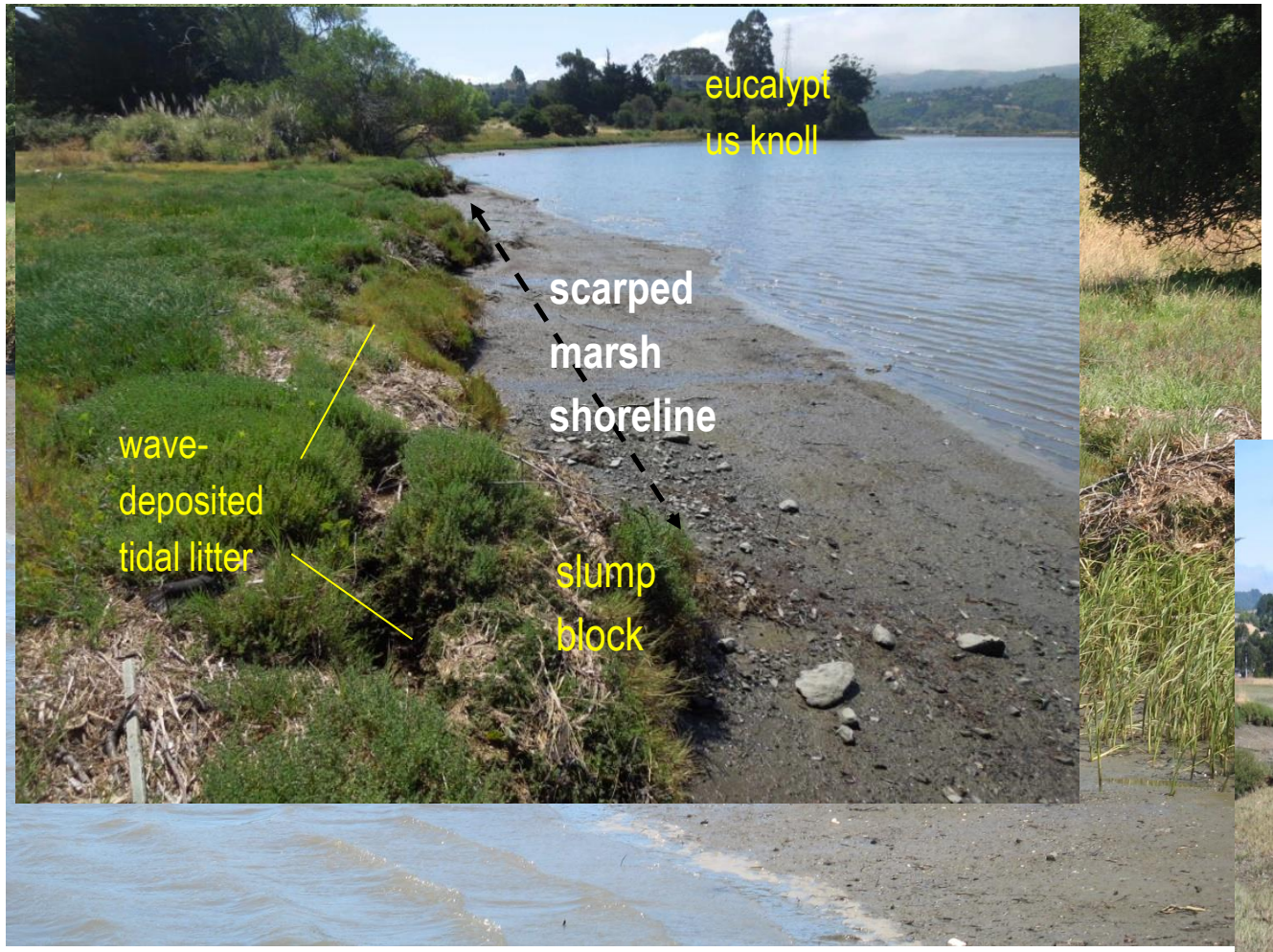
SFEI San Francisco Estuary Institute

SFEI PUBLICATION #984

APRIL 2020

https://www.sfei.org/projects/new-life-eroding-shorelines

Loss of Tidal Marsh Edge



Mill Valley Shoreline

Paradise Park, Marin County

Greenwood Beach Shoreline - Erosion of old bay fill exposes asphalt and concrete debris, rock

West shore (2019)

San Francisco Bay Shoreline Adaptation Atlas
SFEI 2019

BEACH CREATION

Sand, shell hash, gravel, and cobble beaches were part of the historical ecology of San Francisco Bay.

Composite (mixed) beaches

- commonly employed soft shoreline engineered solution
- provide ecological and recreational value while dissipating wave energy, reducing erosion, and protecting infrastructure.
- may be most effective for sea level rise adaptation.

Onto Beaches - San Francisco Bay Natural Coarse Sediments vary with local sources and shoreline setting

- headland, stream mouths, nearshore erosion sources
- local wave climate (fetch, offshore water depth gradient)

Pier 94 “waste” gravels

SHELL HASH

MEDIUM SAND

Mixed Sand-Gravel used at Aramburu

Large rounded rock (cobbles) are expensive and have to come from outside the Bay. Large tributaries from Sonoma or Central Valley.

1. ¾” to 6” rounded rock
2. ¾” - 3 inch rounded
3. screened 1-inch minus
4. Waste sand and gravels (recycle)

Aramburu Beach Construction

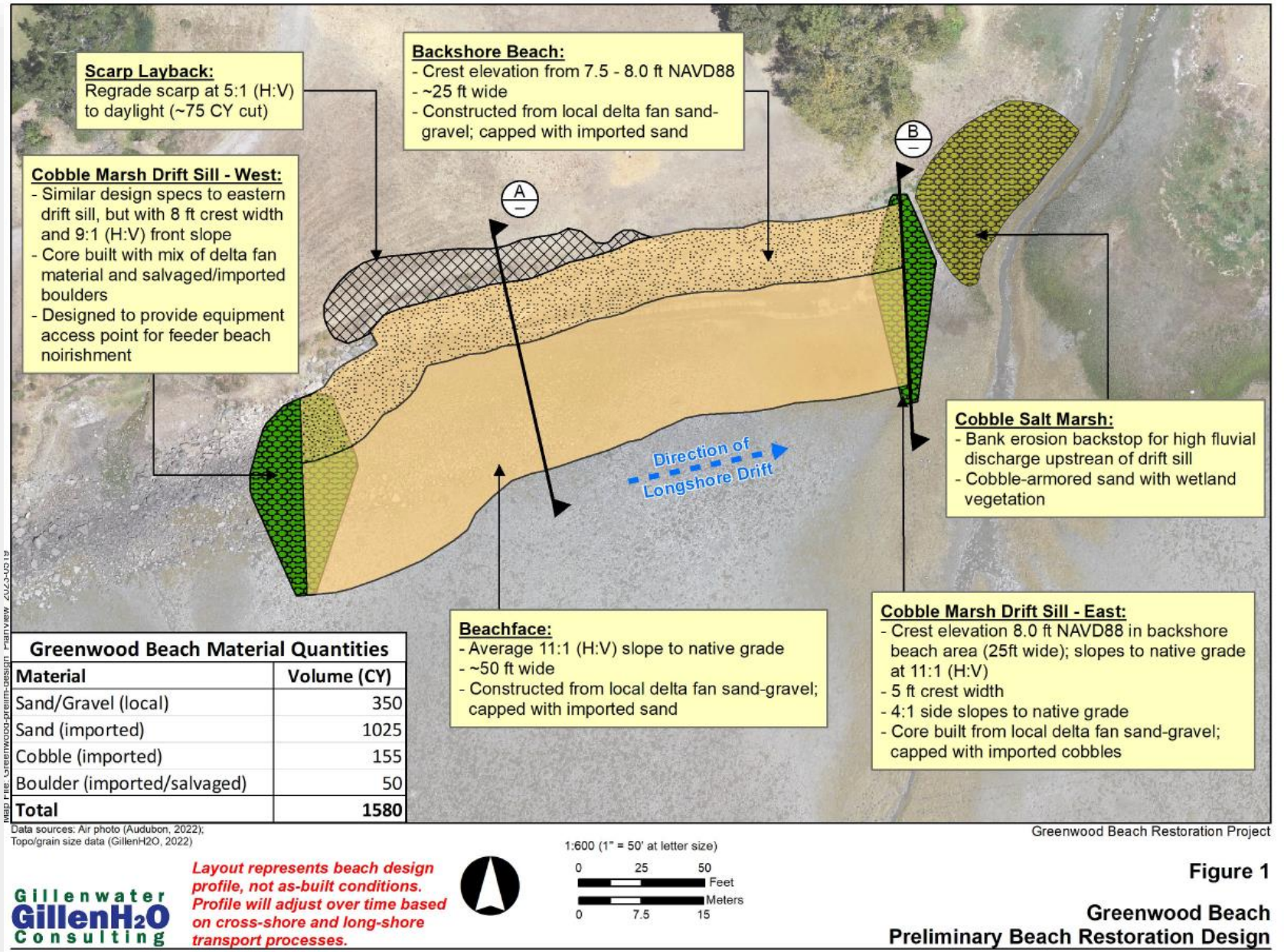
- Initial coarse sand, gravel and oyster shell hash beach sediment placement

- Process-based: *rely on natural wave-reworking* by erosion, transport, sorting, deposition for dynamic beach profile


Greenwood Beach, Tiburon
Sand and Gravel
Gravel / Cobble
Rubble

Greenwood Beach Design

- In final design and permitting for Greenwood beach at Blackies Pasture in Tiburon
- Demonstrate engineered beaches as a viable approach to shoreline erosion
- Determine limits of applicability
- Hope to construct 2024!



Marin Pilot Projects and Proposals

- Geomorphic Dredge Design (*reduce dredge volume and impacts*)
- Thin-Lift Hydraulic Placement on Adjacent Marshes
  - Novato – done mechanically 2016, 2020 and now proposed hydraulically for 2025
  - Gallinas to McInnis (proposing now)
  - Coyote to Bothin (proposing now)
- Connecting Creeks to their Adjacent Marshes
- Coarse-grained beach design and marsh edge erosion
  - Aramburu built 2011/2012
  - Greenwood beach, Tiburon, proposing for 2024 construction
  - Corte Madara Marsh Edge, part of SCC Living Shorelines Projects
- New DwN Dredge Approach (at end)

MARIN COUNTY
FLOOD CONTROL
& WATER CONSERVATION DISTRICT

Geomorphic Dredge Design Comes from Observing Natural Tidal Channels w/Connected Marsh Don't Need Dredging

Special to the Chronicle / Scott Hess

Petaluma River tidal channels

EwN Solution: The Geomorphic Dredge Design Approach

One sentence summary of "geomorphic dredge" design approach

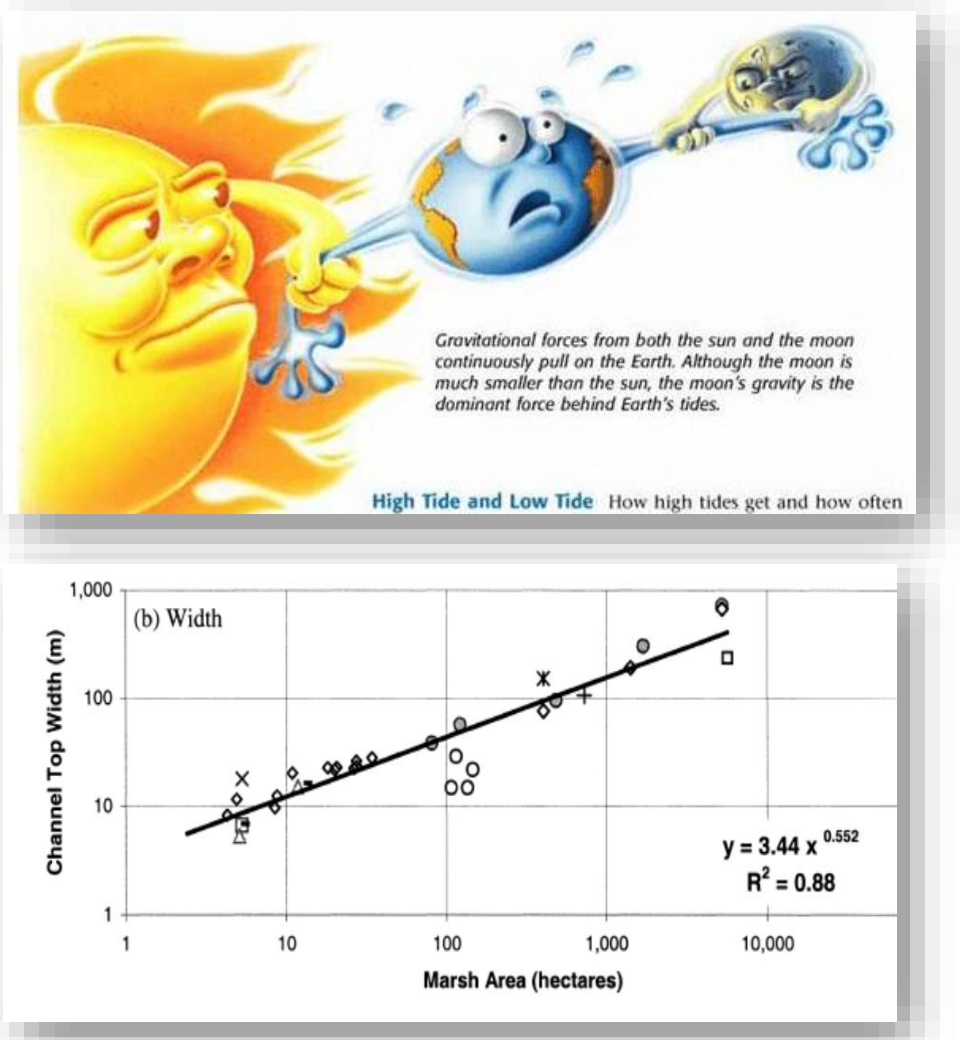
"A dredging plan developed for tidal creek channels designed to be in equilibrium with the available areas of connected tidal marsh (tidal prism)...
...and thus intended to work with the natural forces of the tides to transport sediment and maintain itself over time"

Not a flood control or navigation-based design –so may not work in all circumstances. For tidal channels only.

What it is….

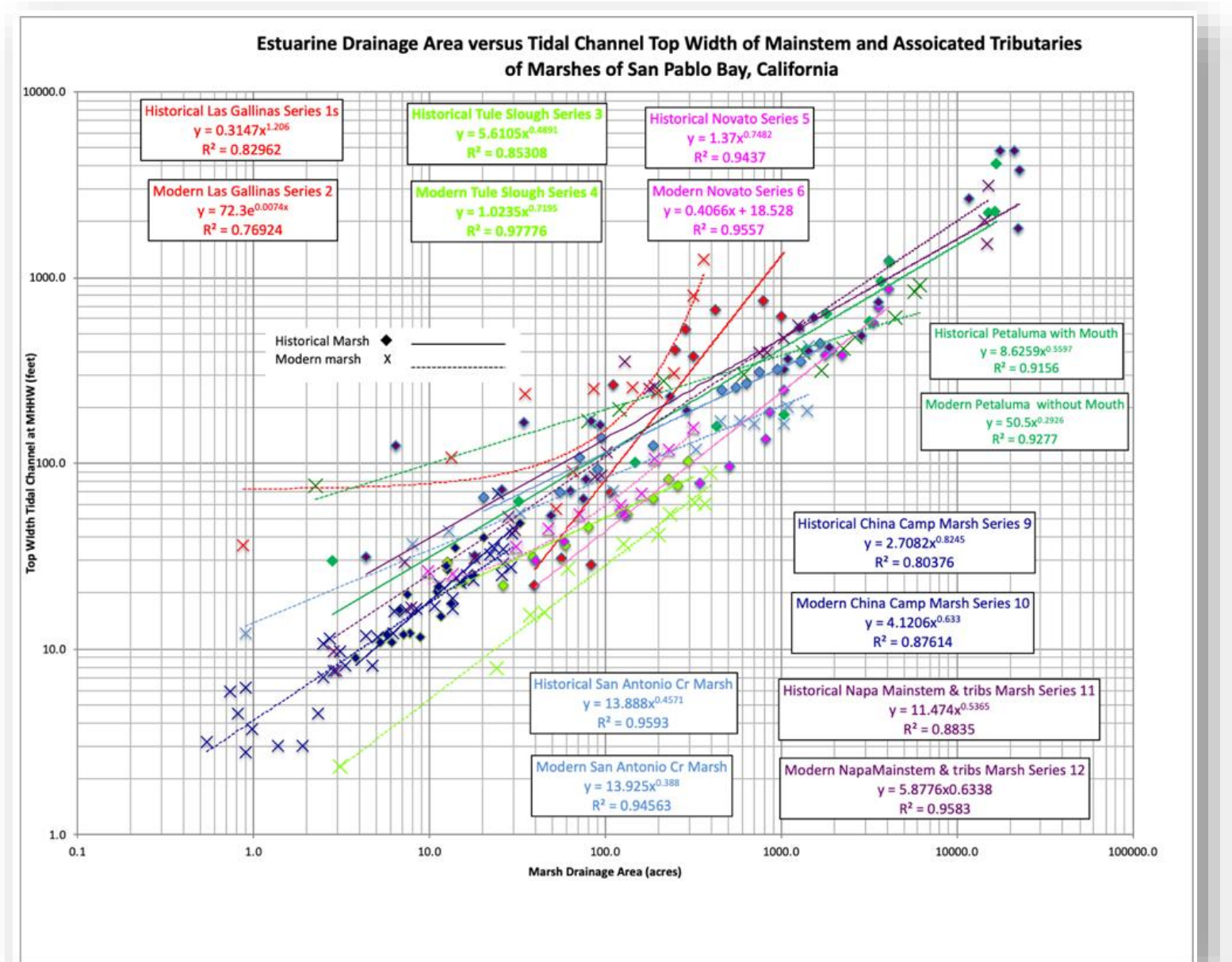
- *A "design with nature" design approach to managing tidal channels. Uses the daily tides (generated by the sun and moon) to maintain the channel geometry*

- Developed from analyzing other *natural* tidal marsh systems around the Bay (field data) - into design curves that relate width, depth, area to connected tidal marsh (tidal hydraulic geometry)
- Builds from 2002 PWA paper
- Greatly expanded by Leventhal and Collins (in-preparation)



Typical curve of equilibrium tidal hydraulic geometry

We Prepared Many New Design Curves of Tidal Hydraulic Geometry (Leventhal and Collins 2024 we hope)



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MARIN COUNTY
FLOOD CONTROL
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Do We Need a New Dredge Approach in Our Toolbox for Tidal Flood Control Channels?

- ✓Dredging tidal channels is impactful
- ✓Difficult to permit
- ✓Its expensive so that typical DPW flood agencies cannot afford to dredge – increasing flood risk especially under SLR conditions
- ✓We don’t get the Federal Cost Share
- ✓Generates huge amounts of GHGs

2020 Novato standard dredge – dewatered creek at downstream end

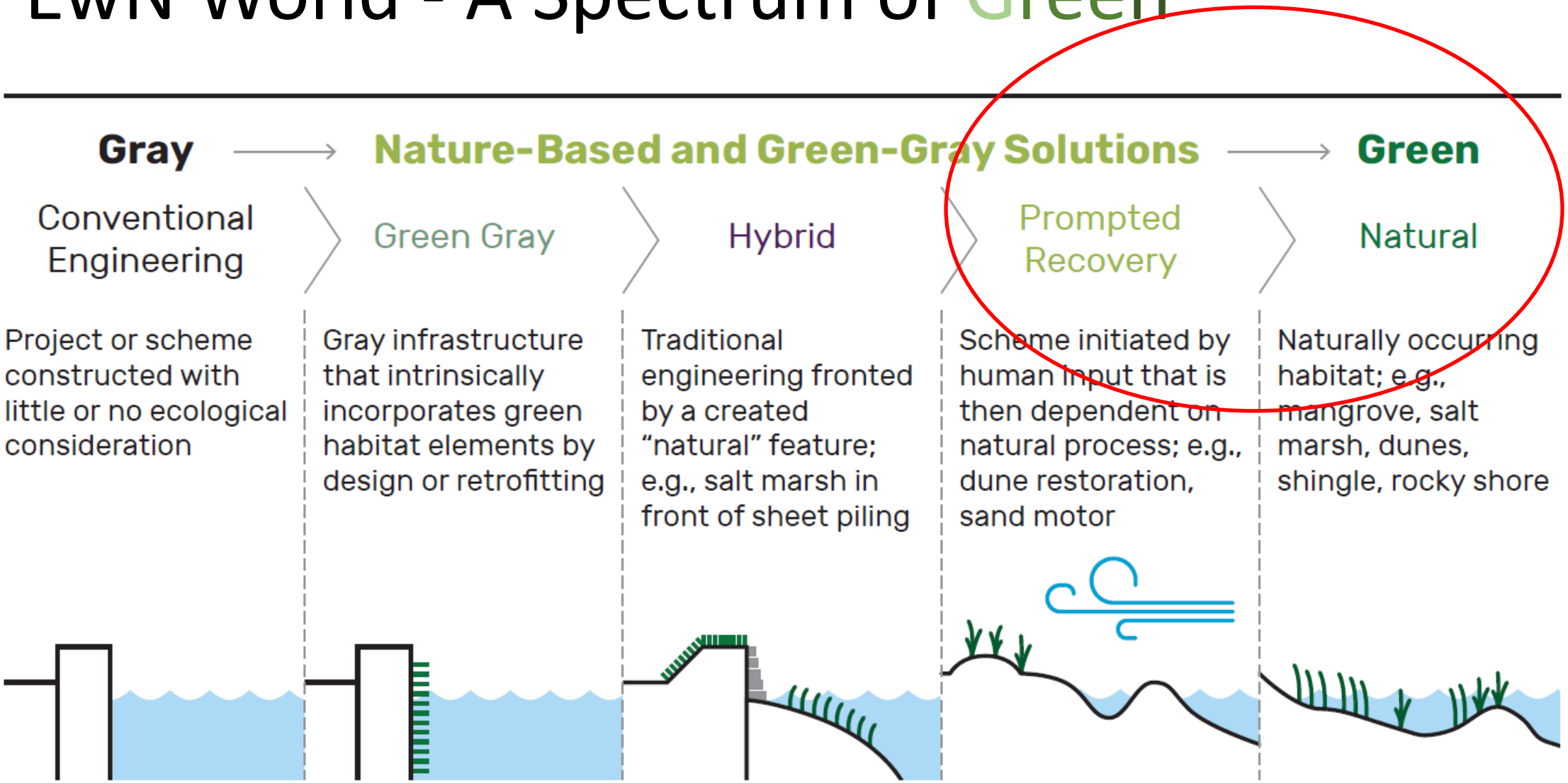
EwN Storm Driven Dredging - NSPD

- A 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 during AR type events. Recent science shows do the most to sustain tidal marshes (Thorne 2023)
- Low cost and low carbon

✓Very EwN but difficult to permit in SF Bay

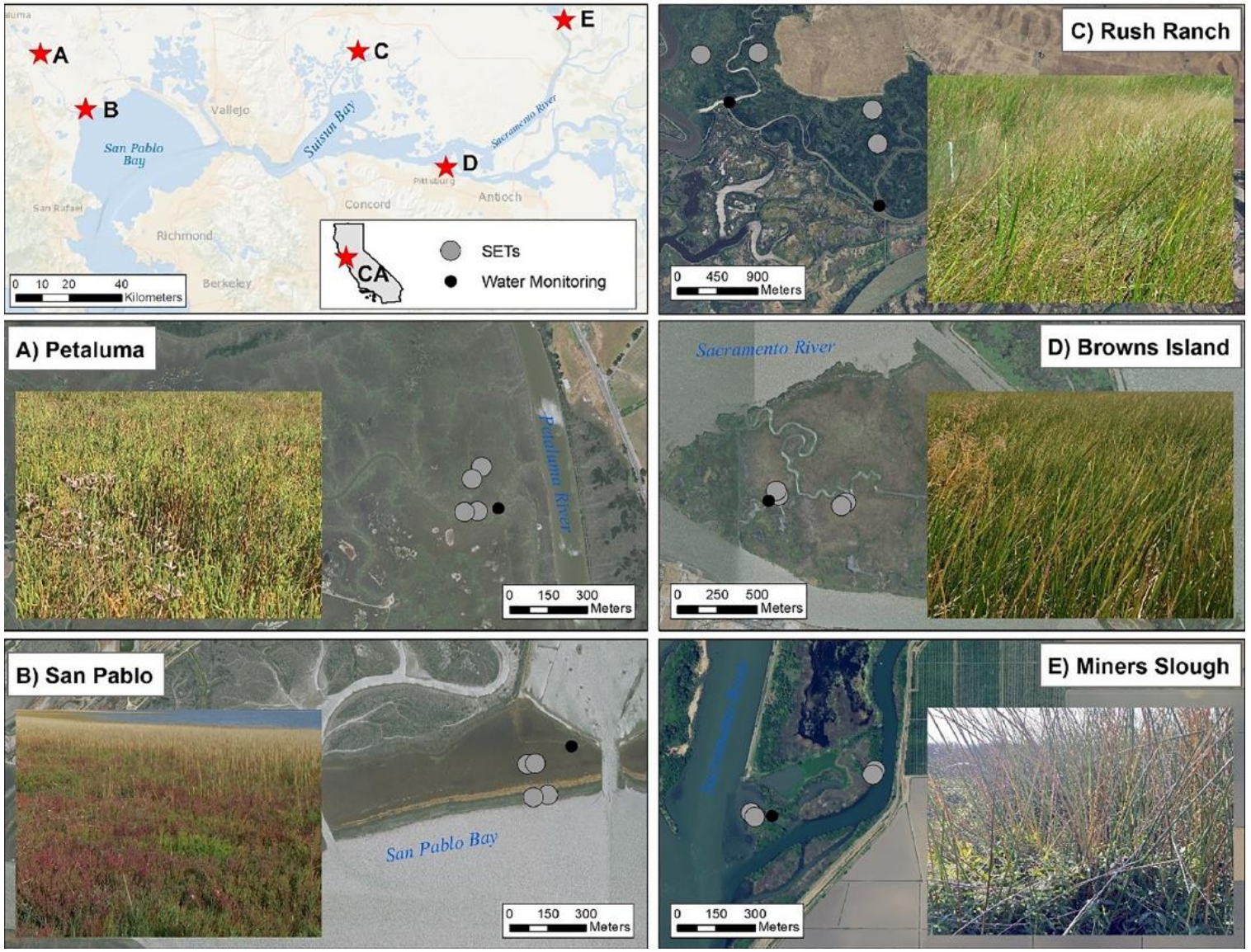
SF Bay in storm conditions

EwN World - A Spectrum of Green



Storm Driven Deposition 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 the 2017 Atmospheric River (AR) event
- ERDC staff will use this same 2017 event for modeling in this project



from Thorne 2022

USACE Has Taken Sediment Pulse Dredge Proposal Up and Starting a Feasibility Study

- First TAC meeting end of September
- Assess ecological benefits and impacts, develop a holistic evaluation of environmental impacts including GHG emissions as compared to traditional dredging, discuss impacts to communiites of not being able to dredge tidal flood control channels
- Assess benefits and limitations, i.e. available equipment, channel size restrictions, contracting mechanisms
- Prepare summary report with graphics, conduct outreach to permitting agencies and the public
- Make recommendations for a Phase II on the ground implementation pilot study and apply for funding, if appropriate

STRATEGIC SEDIMENT PULSE DELIVERY PILOT STUDY

Source: International Association of Dredging Companies

Technical Working Group (TWG) Meeting #1

USACE SPN District
Floodplain Management Services (FPMS)
Marin County Public Works
SEPT 2023

U.S. ARMY

US Army Corps of Engineers®

Sediment is my art…Q&A

War is Over... again! Yoko Ono launches latest London exhibition with some suitably wacky artwork

- **Her first show in a London public institution for more than a decade**