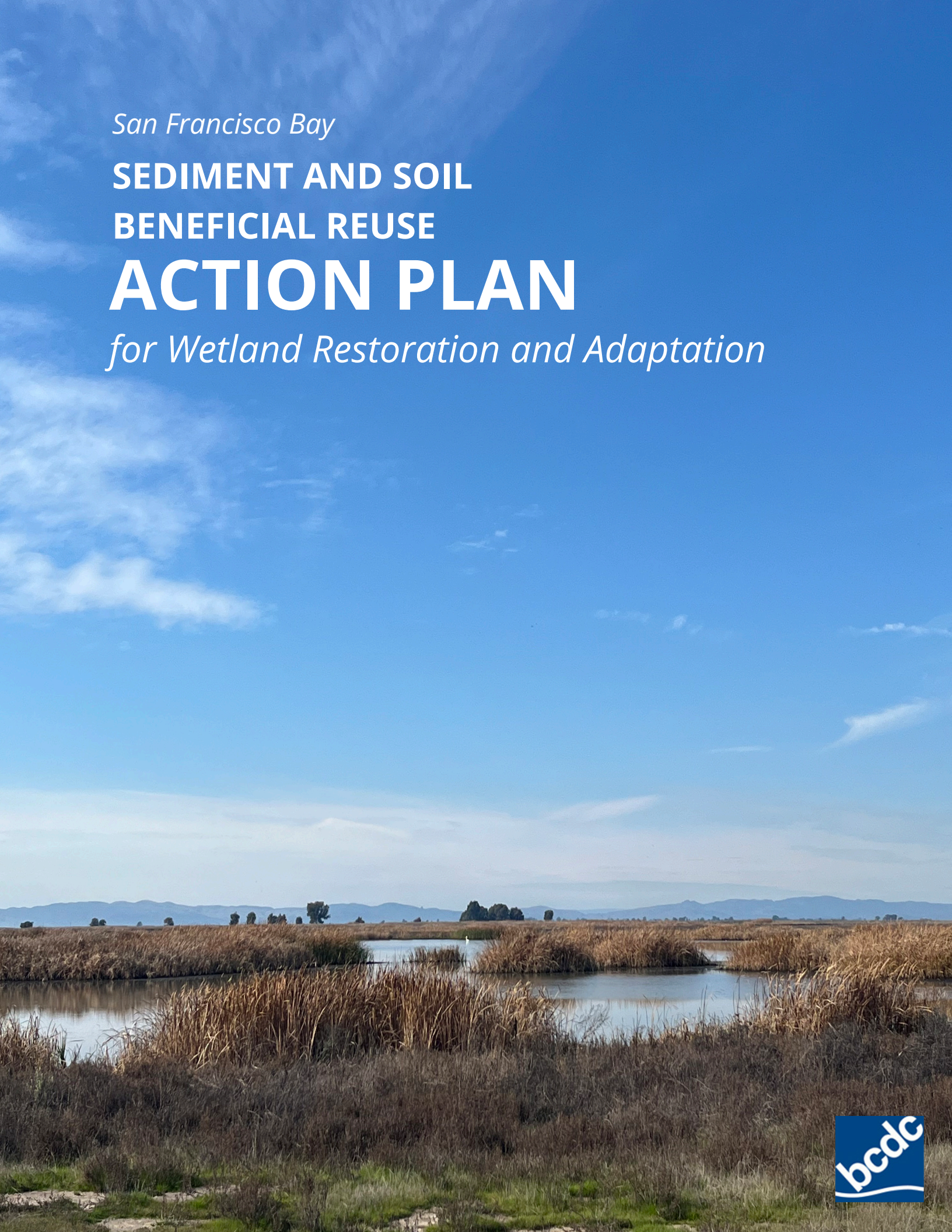
San Francisco Bay

SEDIMENT AND SOIL BENEFICIAL REUSE ACTION PLAN

for Wetland Restoration and Adaptation



San Francisco Bay Sediment and Soil Beneficial Reuse Action Plan for Wetland Restoration and Adaptation

Project Team:

BCDC
Rachel Cohen, Project Manager
Brenda Goeden, Sediment Program Manager
Erik Buehmann, Long-Range Planning Manager
Pascale Soumoy, Sediment Analyst
Jaime Lopez, Environmental Scientist
Maya McInerney, Project Manager (former)
Kathryn Riley, Management Services Technician

Core Team
Luisa Valiela, U.S. Environmental Protection Agency
Jennifer Siu, U.S. Environmental Protection Agency
Xavier Fernandez, San Francisco Bay Regional Water Quality Control Board
Evyan Borgnis Sloane, California Coastal Conservancy
Scott Dusterhoff, San Francisco Estuary Institute
Nikki Roach, San Francisco Bay Joint Venture
Kelli McCune, San Francisco Bay Joint Venture

Sediment and Beneficial Reuse Commissioner Working Group:
Dr. Andrew Gunther, Chair
Patricia Showalter, Vice-Chair
Dr. Tessa Beach
Ellen Blake
Pat Eklund
Yoriko Kishimoto
John Vasquez

The Catalyst Group, Inc.
Charles Gardiner
Linadria Porter
Peter Bluhon

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Executive Summary

This San Francisco Bay Sediment & Soil Beneficial Reuse Action Plan for Wetland Restoration Adaptation (Action Plan or Plan) is a foundational strategy for how the Bay Area can more effectively and efficiently beneficially reuse sediment and soil to sustain and adapt the Bay's wetlands in light of increased shoreline flooding due to sea level rise. Created through a collaborative process, this Plan will guide agencies, dredgers, flood control managers, restoration practitioners, and other stakeholders on the steps necessary to improve and increase beneficial reuse of sediment and soil in wetland restoration and sea level rise adaptation projects.

Restoring and adapting the wetlands that fringe San Francisco Bay is critical to protecting the region from increased shoreline flooding. Hydraulic mining during the Gold Rush caused a significant influx of sediment into the Bay beginning in the mid-1800s. This sediment has largely moved through the Bay, and suspended sediment in the Bay has significantly declined since the late 1990's. With subsided baylands and rising sea level, natural sedimentation processes alone cannot meet our wetlands' current and future adaptation needs through 2100. Sediment and soil available naturally and collected from managed activities including dredging, construction, and flood control, can be and are beneficially reused to elevate and nourish marshes. However, due to a range of impediments, beneficial reuse is not currently being maximized to the extent that would be necessary to adapt wetlands to sea level rise.

For many years, resource managers engaged in sediment issues have discussed the many possible strategies to increase beneficial reuse, but implementing them has been slow and piecemeal. This Action Plan presents, for the first time, a cohesive approach to guide coordinated regional action. The Plan also aligns with the San Francisco Bay Conservation and Development Commission's (BCDC) Regional Shoreline Adaptation Plan (RSAP) which was approved by the Commission in December 2024 to support local governments creating Subregional Shoreline Adaptation Plans pursuant to Senate Bill 272. Specifically, several actions in this Plan are consistent with RSAP priorities, such as an emphasis on nature-based solutions for adaptation, and the goal to facilitate habitat connectivity through resource management to create sustainable sediment sources.

This Action Plan was developed by BCDC in concert with a Core Team of partner agencies and organizations including the San Francisco Estuary Institute, the San Francisco Bay Joint Venture, the San Francisco Bay Regional Water Quality Control Board, the California State Coastal Conservancy, and the U.S. Environmental Protection Agency Region 9. The Plan incorporates actions identified through interviews with experts and interested parties, two stakeholder workshops supported by The Catalyst Group, and feedback from BCDC's Sediment and Beneficial Reuse Commissioner Working Group. Funding for the Action Plan was provided through a Wetlands Program Development Grant from the U.S. Environmental Protection Agency and from the State of California Ocean Protection Council.

An annotated bibliography of literature supporting this Action Plan can be found on the Commission's website or by contacting BCDC and requesting a copy.

The first section of the Action Plan introduces the challenges to restoration and beneficial reuse in the Bay Area, the Action Plan development process, and the foundational assumptions that underlie the Action Plan.

The second section outlines the goals to be achieved and the guiding principles that should inform action implementation. The goals are:

Goal 1. **Expanded Partnerships for Action.** Maintain and expand regional partnerships to improve coordination and advance sediment and soil reuse among government agencies, the restoration community, and industries involved in sediment management.

Goal 2. **Site Identification and Preparation.** Identify restoration sites and existing wetlands that need sediment augmentation to accelerate success and to address rising seas. For sites with established need, identify sources of material, and support development of restoration site features necessary to receive soil and sediment.

Goal 3. **Coordination and Timing.** Enhance the coordination and timing of delivery of available sediment and soil, and restoration site needs.

Goal 4. **Policies and Regulations.** Identify, improve, and create programming, policy, and regulations that support beneficial reuse of sediment and soil.

Goal 5. **Funding.** Where possible, reduce costs of beneficial reuse through coordination and efficiencies. Expand and secure federal, state, regional, and private funding for beneficial reuse of sediment and soil at wetland restoration projects.

The third section provides background information on the various sources of sediment that the region could use to facilitate beneficial reuse for wetland restoration.

The fourth section presents the actions necessary to meet the beneficial reuse goals, organized around 8 focus areas.

During the Plan's public comment period, BCDC heard a common request for prioritization of actions. The BCDC project team worked to sequence actions based on urgency, existing plans to undertake actions as part of the SWAP, and necessary order of operations based on feasibility. Thus, the fifth section of this Plan concludes with one possible action prioritization sequence and next steps for the Plan's implementation. As they convene to lead implementation of the Plan's actions, agencies and stakeholders will likely assess and reprioritize the actions based on new information and regional needs. This Plan gathers, in one document, the region's priority actions to increase beneficial reuse of sediment and soil for wetland restoration adaptation; it will be the task of agencies and stakeholders to implement the actions to meet the Plan's goals.[1]

PHOTO CREDIT: Jaime Lopez, BCDC

[1] This document is not intended to be regulatory in nature or function. It does not establish legal rights or obligations or otherwise purport to alter the existing legal or regulatory authority of any government agency that has participated in the creation of this document. Any specific project proposal for beneficial reuse of sediment and soil may be subject to existing regulatory requirements, including the need for a permit for proposed placement of sediment or soil for beneficial reuse within any regulatory agency's jurisdiction.

Summary of Focus Areas and Actions

Focus 1. Implementation and Regional Coordination

1.1: Align Regional Coordination and Action Plan Oversight

Focus 2. Federal, State, and Regional Policy and Collaboration

2.1: Align Federal Standard with Maximizing Beneficial Reuse

2.2: Support Regional Dredged Material Management Plan and USACE Beneficial Reuse Programming

2.3: Improve State and Regional Coordination

2.4: Update State and Regional Policies

Focus 3. Regional Planning and Evaluation

3.1: Solidify Regional Priorities and Strategy

3.2: Assess Site Conditions for Beneficial Reuse

3.3: Foster Outreach and Advocacy

Focus 4. Regulations and Permitting

4.1: Evolve and Clarify Permitting Regulations and Practices

Focus 5. Pilot Projects

5.1: Support Indirect Placement Pilot Projects

5.2: Support Direct Placement Pilot Projects

Focus 6. Sediment and Soil Quality

6.1: Evaluate and Coordinate Testing Requirements for Upland/Flood Control Soil and Sediment

6.2: Improve Data Management and Use

Focus 7. Coordination of Sediment and Soil Availability and Placement

7.1: Assess Land-Based Stockpiling Feasibility and Develop Management Procedures and Best Practices

7.2: Improve Flood Protection Programming

Focus 8. Costs and Funding

8.1: Address Funding Gaps

8.2: Evaluate Costs and Benefits

Glossary

Dredging – the removal of sediment from a water channel using mechanical (clamshell or barge-mounted excavator) or hydraulic (drag head, pipeline, or cutterhead) equipment. The most common form of dredging in the San Francisco Bay Area is navigation dredging but also includes flood protection channels.

Excavation – the removal of soil from a dry environment, usually for development or changes to shoreline or upland areas. Excavation is usually performed with a long-range or short-range excavator, or other digging equipment.

Sand mining in San Francisco Bay – the use of dredging equipment (primarily hydraulic drag head and pipeline dredging) to obtain sand for the construction industry. Primary uses are concrete and asphalt creation, but also for backfilling trenches and other areas where stable materials are needed. This work is not to maintain safe navigation.

Disposal of dredged sediment/soil – the treatment of sediment and soil as a waste product by dumping it by aquatic disposal, such as an authorized in-Bay or ocean disposal site, or by upland disposal at a site such as at a landfill.

Beneficial reuse of dredged sediment/soil – the treatment of sediment and soil as valuable resources that benefit habitat, shoreline protection, levee maintenance, and more, instead of as waste products to be disposed of. Most beneficial reuse of dredged sediment occurs through wetland restoration due to its fine-grained properties. Upland soil is often used for restoration in ecotone and levee maintenance/construction or raising site elevations. Construction soil can also be reused to raise site elevations for development projects.

Dredged Sediment – sediment removed from tidal, brackish, or freshwater systems. Sediment dredged from the Bay most commonly takes the form of clay, silt, and mud, with some areas having sand as well. Sediment can contain contaminants based on previous uses, movement of contaminants from nearby sources, or runoff from urban environments.

Construction soil – terrestrial soil excavated during a construction project. This soil is generally considered a waste product that can be captured and reused. Construction soil can contain contaminants from previous site uses or the movement of contaminants from nearby sources.

Quarry soil – soil, rock, or gravel that is excavated from a quarry, specifically for use for development but that could also be used in a wetland restoration project.

Natural sedimentation – the process by which sediment is naturally deposited on a site, without human intervention. Wetland restoration projects that are connected to the Bay or a tributary allow water to bring suspended sediment onto the site. This also applies to existing wetlands that are connected to aquatic systems.

Direct placement – a placement method by which dredged sediment or soil is placed directly onto a restoration site or an existing marsh, either mechanically or hydraulically. There are many methods for directly placing sediment or soil. Some immediate examples are provided below:

1. **Hydraulic placement** – during hydraulic placement, sediments (usually dredged sediment) are slurried with water and pumped from a barge via an offloader directly onto a site. The site is generally a subsided restoration site in which the sediment is used to raise the elevation of the site either through open filling or in cells. The equipment used for hydraulic placement includes a hydraulic offloader of various sizes (snorkel, pumps) and pipelines.
2. **Trucking** – the transport and placement of sediment and soil by trucks directly onto a site, often to raise subsided site elevations or to construct project features, such as ecotones and levees.
3. **Thin-lift placement** – the process by which sediment is applied onto a site in thin layers (up to 10-14 cm) through various methods described further below, often to mimic natural events such as storm surges that deposit sediment naturally onto a site.
4. **Marsh spraying** – spraying slurred dredged sediment directly onto a vegetated marsh to add a thin layer of sediment to raise marsh elevation. The sediment layer targeted is generally 10-14 cm to allow vegetation to emerge after placement. An example of marsh spraying can be found in Southern California at Seal Beach Refuge.
5. **Shallow-water placement** – using dredged sediment or other materials to create islands or wetlands by pumping sediment into an area, often contained by berms or other barriers, to adapt or create habitat (e.g., wetlands). An example of shallow-water placement can be found at Marker Wadden in the Netherlands (2014), where an island wetland was constructed using dredged sediment.

Indirect placement – placement methods that do not place sediment directly within the project site, but use other mechanisms, such as tides or currents to transport the material to the site. Examples include:

1. **Water-column seeding** – the slow release of sediment into the water column near the entrance of a marsh channel during a flood tide using a hydraulic pipe, with the goal being that the sediment enters and deposits onto the site.
2. **Nearshore aquatic placement** – a placement method that places sediment in shallow water near a target wetland and utilizes wind waves and tidal action to resuspend the sediment and transport it onto the marsh.

Terrestrial stockpiling – placing soil and sediment at a site for later reuse. Stockpiling can occur within a project site for later use, or offsite at a location where it can be shared by project proponents. Wet soil/sediments can also be dried in these locations. Terrestrial stockpiling requires double handling of soil/sediments, which can increase cost.

Aquatic transfer facility – the creation of an in-water basin that would allow sediment to be deposited by dredge scows and then dredged from the transfer facility and pumped to a restoration site when the site is ready to receive sediment. This method requires dredging the same sediments twice, and an aquatic transfer facility must be located proximal to the project site to reduce pumping distances.

Legacy sources – a source that once contributed or supplied the Bay with sediment but has since been blocked off due to human development such as dams, rerouting channels, reservoirs, flood-control bypasses, etc.

Surface-quality sediment – sediment that is suitable to be placed on the surface of wetland restoration projects because it does not contain elevated levels of contaminants that would pose an ecological risk.[2]

Foundation-quality sediment – sediment with elevated levels of contaminants that it is suitable to be placed in wetland restoration projects that have institutional controls that isolate the contaminated sediment from water bodies, plants and wildlife to prevent harm or contaminant exposure to wildlife or plants.[3]

[2] "LTMS Dredger's Handbook," San Francisco Bay Region's Long-Term Management Strategy Program, January 2021

[3] Ibid.

Acronyms

BAFPAA – Bay Area Flood Protection Agencies Association

BARC – Bay Area Regional Collaborative

BCDC – San Francisco Bay Conservation and Development Commission

BUDDI – Beneficial Use Decision Document Integration

BRITT – Bay Restoration Regulatory Integration Team

CDFW – California Department of Fish and Wildlife

CMANC – California Marine Affairs & Navigation Conference

CNRA – California Natural Resources Agency

cy – cubic yards

DMMO – Dredged Material Management Office

LTMS – Long-Term Management Strategy for the Placement of Dredged Material in the Bay Region

MOU – Memorandum of Understanding

MPRSA – Marine Protection, Research and Sanctuaries Act

OPC – Ocean Protection Council

QAPP – Quality Assurance and Protection Plan

RDMMP – Regional Dredged Material Management Plan

RSMP – Regional Sediment Management Plan

SAP – Sampling and Analysis Plan

SCC – California State Coastal Conservancy

SFBJV – San Francisco Bay Joint Venture

SFEI – San Francisco Estuary Institute

SWAP – Sediment for Wetland Adaptation Project

USACE – United States Army Corps of Engineers

U.S. EPA – United States Environmental Protection Agency

SFWQIF – San Francisco Water Quality Improvement Fund

WRDA – Water Resources Development Act of 2020

WDPG – Wetland Development Program Grant

Introduction

This collaborative regional roadmap focuses on identifying challenges and barriers and outlining solutions to accelerating the beneficial reuse of dredged sediment and excess construction soil for wetland restoration and adaptation purposes. By implementing the Plan's actions, the San Francisco Bay Area (Bay Area) will be able to more effectively reuse sediment from navigation dredging, flood-control channels, and excess soil from construction sites to meet the urgent need to preserve and restore wetlands and adapt to rising sea levels.

The Sediment and Soil Challenge

Wetlands provide transitional habitat between estuarine waters and upland areas, absorb flood waters, buffer waves along the shoreline, and can assist the region in adapting to rising sea levels. 85-95% of the San Francisco Bay's original 540,000+ acres of wetlands have been lost or deteriorated in the last 200 years due to human activities such as diking, draining, and development, which has caused large areas of the Bay Area to fall below sea level. These subsided areas need sediment to restore their elevations to above sea level to support plant colonization and adapt to coastal flooding, storm surge, and erosion.

The San Francisco Estuary Institute's (SFEI) 2021 Sediment for Survival report[4] determined that the Bay needs about 550 million metric tonnes of sediment and soil to preserve, restore, and sustain existing and planned wetland habitat, and adapt to rising sea levels through 2100. However, as sea levels continue to rise, the suspended sediment supply in Bay waters – which has decreased significantly from the period following the Gold Rush – is not sufficient to restore subsided baylands and existing wetlands to marsh plain elevation. Without interventions to maximize the amount of dredged sediment and upland soil for beneficial reuse amidst rising sea levels, the Bay will lose many of its vital tidal marshes. Restoring wetlands and subsided baylands is a nature-based flood protection strategy that will lessen wave action and coastal flooding, creating more protected shorelines and serving as crucial habitat for fish, birds, and other organisms.

The Bay Area community has acted to restore many of these subsided areas under the guidance of the 1999 Baylands Habitat Goals Report[5] (updated in 2015). As of 2021, there were approximately 78,000 acres of healthy tidal marshes existing (40,000 acres as of 2000), restored (13,000 acres), and protected or planned for restoration (25,000 acres).[6] The Baylands Habitat Goals Report encourages the region to endeavor to have 100,000 acres of existing and restored tidal marsh, leaving 22,000 acres left to be planned. The Long-Term

[4] Dusterhoff, S., McKnight, K., Grenier, L., and Kauffman, N. 2021. Sediment for Survival: A Strategy for the Resilience of Bay Wetlands in the Lower San Francisco Estuary. A SFEI Resilient Landscape Program. A product of the Healthy Watersheds, Resilient Baylands project, funded by the San Francisco Bay Water Quality Improvement Fund, EPA Region IX. Publication #1015, San Francisco Estuary Institute, Richmond, CA.

[5] Monroe, M; Olofson, PR; Collins, JN; Grossinger, RM; Haltiner, J; Wilcox, C. 1999. Baylands Ecosystem Habitat Goals. SFEI Contribution No. 330. U. S. Environmental Protection Agency, San Francisco, Calif./S.F. Bay Regional Water Quality Control Board, Oakland, Calif. https://www.sfei.org/sites/default/files/biblio/2024-08/sfbaygoals031799.pdf

[6] Quigley, J. 2021. Bay Restoration Funding Puzzle: State and Federal Efforts May Finally Provide the Missing Pieces. Save the Bay. https://savesfbay.org/bay-restoration-funding-puzzle/

Management Strategy for the Placement of Dredged Material in the Bay Region (LTMS) Management Plan, adopted in 2001, contributes to restoration efforts by maximizing the beneficial reuse of dredged sediment from navigation projects in the Bay region.[7]

The primary beneficial reuse of dredged sediment in the region has been to raise the elevation of subsided baylands to restore wetlands. Other beneficial reuses include construction fill, maintenance of un-engineered levees, and more. Under the LTMS, over 30 million cubic yards of sediment have been beneficially reused at five landscape-scale restoration projects, one large subtidal habitat restoration project, and several other smaller habitat projects and levee repair projects in the region. Additionally, a significant volume of upland soil has been used as general fill at Bair Island and to create ecotone and flood protection levees for the South Bay Salt Pond Restoration Project and South San Francisco Bay Shoreline Project.

How this Plan was Developed

Beginning in 2023, the San Francisco Bay Conservation and Development Commission (BCDC) began working with its partner agencies and organizations – San Francisco Estuary Institute (SFEI), the San Francisco Bay Joint Venture (SFBJV), the San Francisco Bay Regional Water Quality Control Board (Water Board), the California State Coastal Conservancy (SCC), and the Environmental Protection Agency Region 9 (U.S. EPA), supported by The Catalyst Group consultants, to identify challenges, barriers, solutions, and actions to increase the beneficial reuse of sediment and soil at wetland restoration sites. In addition, BCDC conducted research and compiled an Annotated Bibliography of literature supporting this Action Plan which can be found on the Commission's website or by contacting BCDC and requesting a copy. Through this collaborative effort, this Action Plan was created, which incorporates background research, feedback from multiple interviews with experts and interested parties, lessons learned in a two-day workshop with stakeholders, additional outreach to resource managers, and the help of a Core Team and BCDC's Sediment and Beneficial Reuse Commissioner Working Group.

Foundational Assumptions of the Action Plan

To understand the context of this Action Plan, it is important to acknowledge key facts and challenges that provide the basis for some of its actions and conclusions.

- Restoring wetlands and supporting existing wetlands with beneficial reuse of sediment and soil is sea level rise adaptation.
- Sediment and soil play a critical role in raising the elevations of both subsided baylands and existing wetland habitats throughout the Bay.

[7] For more information regarding the LTMS Management Plan, see BCDC's website or visit the following link: https://bcdc.ca.gov/programs/sediment-management/long-term-management-strategy/.

- Additional management actions are necessary to increase sediment and soil supply to re-establish wetlands across the region and assist in their adaptation to rising sea levels.
- The development of a regional or state strategy that increases the beneficial reuse of sediment and construction soil is necessary to restore wetland habitat and create green infrastructure along the shoreline.
- Treating appropriate sediment and soil as a waste product and disposing it, rather than beneficially reusing it at restoration sites and/or existing marshes, should be a last resort.
- The Bay Area is dynamic – its sediment transport, species, history, politics, collaborative nature, funding, and policies continue to change, and thus unique solutions tailored to a multifaceted estuary and community are required.
- Vulnerable communities along the Bay shoreline face risks due to existing burdens that limit their ability to respond to and recover from flooding. More research is necessary to fully understand the impacts and benefits that dredging and beneficial reuse have on communities. The communities that would either be impacted by or benefit from these actions should have ample opportunity to be part of the effort, especially as they work to adapt to rising seas.
- Beneficial reuse of sediment and soil requires additional equipment, time, and energy to accomplish, which means additional funding is necessary to support these efforts.
- This large and multifaceted effort requires a regional approach with organizations and entities at varying levels of government leading and contributing to different actions.
- The timeframe for beginning implementation of the actions contained herein is expected to be approximately five years to ensure that near-term results can be realistically achieved. Actions must be reasonable, implementable, and must support the beneficial reuse of sediment and soil for wetland restoration and adaptation.

Goals and Principles

Goals

The actions for each focus area work toward meeting the Action Plan's goals, as provided below. By working toward the following goals, BCDC and its partners will progress the project's overarching purpose of increasing beneficial reuse of sediment and soil to support wetland habitat across the region.

Goal 1. **Expanded Partnerships for Action.** Maintain and expand regional partnerships to improve coordination and advance sediment and soil reuse among government agencies, the restoration community, and industries involved in sediment management.

Goal 2. **Site Identification and Preparation.** Identify restoration sites and existing wetlands that need sediment augmentation to adapt to rising seas. For sites with established need, identify sources of material and support development of restoration site features needed to receive soil and sediment.

Goal 3. **Coordination and Timing.** Enhance coordination to align timing of delivery of available sediment and soil with restoration site needs.

Goal 4. **Policies and Regulations.** Identify, improve, and create programming, policy, and regulations that support beneficial reuse of sediment and soil.

Goal 5. **Funding.** Where possible, reduce costs of beneficial reuse through coordination and efficiencies. Expand and secure federal, state, regional, and private funding for beneficial reuse of sediment and soil at wetland restoration projects.

Principles

The principles listed below will help guide a unified coalition in effectively implementing the actions to ultimately increase beneficial reuse of sediment and soil for wetland restoration and adaptation. Implementation of the actions identified within this Plan should embody the following principles:

Principle 1. Coordination and Collaboration to organize the many entities working in this space.

Principle 2. Meaningful Community Engagement to ensure that communities around the Bay understand the positive and negative impacts of increased beneficial reuse of sediment, and to ensure communities have opportunities to provide input on restoration planning and decision-making about the use of sediment and soil.

Principle 3. Environmental Stewardship to support existing and restored wetlands as sea levels rise and adaptation becomes key.

Principle 4. Transparency to ensure that all stakeholders can track progress and provide input.

Principle 5. Speed and Agility because there is limited time to restore wetlands and capture available sediment and soil as sea levels rise.

Principle 6. Capitalizing on Other Work in this space and building off existing progress.

Sources and Sites of Sediment and Soil

Wetlands in the Bay provide a range of ecological services, including carbon sequestration, water purification, flood water absorption, wave and storm surge reduction, and fish and wildlife habitat. However, as with many coastal areas, their survival and the essential services they provide are threatened by rising sea levels. Existing and restored wetlands continue to receive sediment through natural transport processes, but current and future wetland restoration projects will need large volumes of sediment and soil in relatively short periods of time to be successful. Long-term studies indicate that wetlands require a consistent supply of sediment to keep pace with sea level rise and room to migrate. However, development landward of wetlands and reduction in natural sediment supply from watersheds and the Bay has limited the ability of wetlands to migrate over time as sea levels rise. After the sediment load from the Gold Rush and the replumbing of the Delta, there was a reduction in the amount sediment entering the Bay from Sacramento-San Joaquin Rivers. With this reduction, local tributaries are now the primary contributor of suspended sediments to the Bay (Milligan and Holmes, 2017).

The Bay Area faces several challenges in reaching its target of achieving 100,000 acres of wetlands regionwide, including minimal sediment supply, limited material placement methods, and the logistical challenges of transporting sediment and soil to available restoration sites. The climate plays a significant role, with wet and dry years influencing the volume of sediment entering the Bay in any given year (SFEI, Dusterhoff et. Al, 2021). With deeply subsided baylands rimming the Bay, restoration and support of existing wetlands are the primary focus of beneficial reuse efforts in the region. Thus, it is critical that we understand potential sources of sediment and soil for beneficial reuse, and challenges associated with their use.

Source: Construction Projects

Construction projects around the Bay Area often excavate soil that is not needed on-site. Traditionally, this soil gets trucked to a landfill where it is either disposed of or used as daily landfill cover. This soil can be used in wetland restoration projects such as levee construction, berms, ecotones, or general fill, depending on its geotechnical composition and soil quality. Currently, larger restoration sites in the South Bay are working with companies that assist in identifying upland soil and supplying them to restoration projects.

General grading and the removal of soil to create below-grade spaces such as parking garages, basements, building foundations, roadways, and other features produce significant quantities of excess soil. For beneficial reuse, excavated soil is loaded into 10-cubic-yard trucks or larger rail cars (when available) and brought directly to restoration sites.

A restoration site's readiness to receive soil when it is available is key to beneficial reuse. When construction soil cannot be transported directly from the source site to the restoration site, the soil is either disposed of or the restoration project must be delayed. There are no stockpiling sites available other than at large construction or restoration projects where on-site soil can be managed. The ability to store soil would facilitate more beneficial reuse,

however there are many barriers. Excavated soil takes up valuable space at project sites, if space is available at all. Soil from different sources may need to be managed separately due to its quality or characteristics. Identifying land and entities willing to provide a stockpile location can be challenging. Lastly, stockpiled soil would need to be double-handled to bring it to the restoration once it is ready, increasing the cost of beneficial reuse.

Assessment of construction soil is necessary to determine whether its quality and proposed use would not negatively affect the plants and animals that would be exposed to it. Human activities and land uses, such as pesticide use, dumping of chemicals, leaky storage tanks, street run-off, and historic military activities have been known to contaminate soil and watersheds. Depending on the quality of the soil, the restoration site design, groundwater connection, and placement methodology, some soil can be used as surface quality. Surface quality soil is in contact with plants and animals living on, in, or feeding on plants and animals that live on or in the soil. Surface quality soil will also be in contact with Bay water and therefore must be clean. Soil with minor exceedances of some contaminants may also be useful in restoration projects and can be used as foundation soil, which is buried beneath approximately 3 feet of clean soil.

PHOTO CREDIT: Dave Halsing, South Bay Salt Pond Restoration Project

To address the possibility of contaminants, projects that import upland soil are required to develop either a Sampling and Analysis Plan (SAP) or a Quality Assurance and Projection Plan (QAPP). These documents contain information about the number of samples, collection and testing methods, and quality assurance protocols. QAPPs often contain specific soil handling and tracking protocols, detailing the how the soil is managed from excavation to placement. QAPP development is most common for sites that accept soil from multiple contractors.

The Don Edwards San Francisco Bay National Wildlife Refuge and the Eden Landing Ecological Reserve (both part of the South Bay Salt Pond Restoration Project and South San Francisco Bay Shoreline Project) have the most developed and detailed QAPP in the region and are considered models for other projects considering a QAPP or SAP. The South Bay Salt Pond Restoration Project and its consultants, working in conjunction with the Water Board and BCDC, have recently completed an effort to update upland soil acceptance criteria and testing protocols. As described in the actions below, further standardizing and sharing protocols can remove barriers to construction soil use.

Source: Flood Control Channels and Streambeds

In the Bay Area, most rivers and streams have been channelized and/or realigned to move water off the land quickly during storms.[8] In part due to watershed development impacting flow and the channelization and rerouting of rivers and creeks, sediment builds up and needs to be periodically removed to prevent adjacent flooding and maintain water flow requirements. In addition, some areas require sediment or soil removal to stabilize or set back banks. Regionally, these projects can provide approximately 145,000 cubic yards of sediment and soil annually in a localized fashion.[9]

Ideally, reconnecting channelized creeks and rivers to wetlands, expanding flood plains, and/or lowering berms would allow flood waters to naturally bring sediment into marshes as occurred historically. Realigning creeks and channels to a more natural state, as well as connecting them to marshes as they move across the landscape, would be ideal in some locations, while a modified version in other locations may improve wetland health and the ability to protect areas from flooding. Flood plain expansion is often hindered by limited landownership, or development that hems in creeks and channels. In some areas, simply lowering dividing berms or levees would allow water and sediment to flow into the sites. As the water is absorbed or discharged through tidal channels, sediment would be left behind to raise elevations. Concerns over flood impacts on listed species in this scenario has created a challenge for this potential practice.

Flood protection and watershed managers remove sediment most often with mechanical equipment such as a long-reach excavator from the bank. Sediment removed from a

[8] San Francisco Estuary Institute-Aquatic Science Center. 2017. Changing Channels: Regional Information for Developing Multi-benefit Flood Control Channels at the Bay Interface. An SFEI-ASC Resilient Landscape Program report developed in cooperation with the Flood Control 2.0 Regional Science Advisors, Publication #801, San Francisco Estuary Institute-Aquatic Science Center, Richmond, CA.

[9] Ibid.

flood protection channel edge is often placed in stockpiles adjacent to to the channel and dried to be trucked to landfill, or in some cases taken to restoration projects (the Santa Clara Valley Water District and South Bay Salt Pond Restoration Project for example). However, in some locations, such as in Suisun Marsh where there are managed wetlands, sediment is placed directly on outer unengineered levees for maintenance purposes. In these cases, the maintenance of exterior unengineered berms is necessary to maintain habitat and prevent flooding during storms.

Removal of sediment through dredging can occur with either a clamshell or hydraulic dredge and occurs in larger rivers and creeks. The USACE is responsible for dredging shallow draft federal navigation channels, which sometimes overlap with flood protection channels, while the cities, counties, and special districts are responsible for maintenance of flood protection channels. Hydraulic dredges have been used and can pump sediment to immediately adjacent sites. However, hydraulic dredging in rivers and creeks has been used sparingly due to species concerns, such as its potential to entrain endangered and threatened species. Clamshell dredges have fewer species concerns but require an offloader to transfer sediment to a restoration site.

Flood protection or streambed maintenance projects that are closer to restoration sites are considered optimal locations to partner with a restoration project, particularly with those that need relatively small volumes of material. However, this kind of partnership has been limited to a few maintenance projects, including those undertaken by the Marin County Flood Control District and the Santa Clara Valley Water District (Valley Water), a local flood protection and stream maintenance agency.

While stream and flood management channels make up the smallest source of sediment and soil material by volume of sources considered in this Plan, they too need to be assessed for contaminants before being beneficially reused. Urban runoff from developed areas and roadways can contaminate sediment such that it could pose a risk to sensitive wildlife found in wetlands. In some flood control programs, the sediment is well tested. However, not all flood control agencies test their sediment for ecological risks because the material is not traditionally disposed of in wetland or aquatic settings. Testing protocols and guidance for this work are not well established or uniform across the region, leading to lack of knowledge on the sediment and soil quality in some channels, thereby impacting the potential for beneficial reuse.

Source: Navigation Dredging

Dredging federal navigation channels, ports, oil terminals, recreational marinas and docks provides the largest volume of sediment in the region. Between 2 and 3.5 million cubic yards of maintenance dredging happens annually,[10] with more dredging occurring when a new or deepening project occurs. Through the LTMS program, approximately 40 percent of navigation dredged sediment has been beneficially reused in the last 20 years, amounting to 31 million cubic yards to date. Sediment from navigation dredging is too fine to be used in structural elements but is appropriate for general fill at wetland restoration sites. The large quantities produced from dredging projects make them ideal for wetland restoration projects that need to raise site elevations.

Both mechanical and hydraulic dredges are used for navigation dredging in the Bay Area. Mechanical dredging is most frequently used because it is readily available and less likely to entrain sensitive fish species. Sediment that is removed mechanically is loaded onto a scow and transported to its final location, whether an aquatic disposal site or beneficial reuse site. If taken to an aquatic disposal site, sediment is released directly from the scow into the water above the disposal site. If taken to a beneficial reuse site, it is unloaded either with a clamshell bucket or backhoe, or with an offloader, which pumps the sediment through a pipe to the site.

Most dredging projects occur in the Central and North Bay. In the shallow South Bay, where there is little deep water, bringing material close to the outer edge of restoration sites is difficult and expensive because of the need to pump sediment long distances across broad mudflats. The location of South Bay restoration projects and the significant distances to dredging projects increase costs for the dredging and restoration community.

Hydraulic dredges remove sediment by suctioning it through a drag or cutter head and pumping it onto a scow or into the hold of a hopper dredge. Hopper dredges transport the dredged sediment from the dredging site to the disposal or beneficial reuse site if they have pump off capability. If they do not, the hopper dredge releases sediment over an aquatic disposal site much like a scow, by opening the bottom of the vessel to allow the sediment to fall out. A cutter pipeline dredge's rotating blades break up the sediment and inject water into it, creating a slurry that is then drawn into a pipe. If the site is nearby, the dredged sediment can then be discharged directly to the site.

Dredging projects routinely test sediment for contaminants of concern in coordination with the Dredged Material Management Office (DMMO), and all data from the last 23 years is publicly available. Sediment quality assessments are completed through a well-established process described in the DMMO's Inland and Ocean Testing Manuals, modified to be applicable to regional contaminant concerns. Once tested, the sediment is given a suitability determination by the DMMO for all potential beneficial reuse and

[10] Dredge Material Management Office (2022). Annual Report 2022. https://www.spn.usace.army.mil/Missions/Dredging-Work-Permits/Dredged-Material-Management-Office-DMMO/Annual-Reports/.

disposal options that were tested for. Some restoration sites have specific sediment acceptance criteria while others rely on the Water Board's Beneficial Reuse of Dredged Material Guidelines (updated in 2020).

The LTMS Management Program established goals that reduced in-Bay disposal to 1.25 million cubic yards annually[11] and seek to maximize beneficial reuse of sediment. The dredging community voluntarily seeks to maximize beneficial reuse and manages the volumes placed at different disposal or beneficial reuse sites on a three- to five-year basis. The placement options available to the dredging community include two multi-user beneficial reuse sites (Cullinan Ranch and Montezuma Wetlands), individual restoration sites, one of four in-bay disposal sites, and the San Francisco Bay Deep Ocean Disposal site, which is located approximately 50 miles offshore of San Francisco. The LTMS agencies determine if a project proponent's proposal is appropriate and approve plans based on sediment quality, equipment availability, site availability and capacity, and funding.

Storage options for dredged navigation sediment are limited. Dredging projects can result in a large amount of material, often with significant volumes of water, which makes stockpiling a challenge. Stockpiling sediment on land requires it to be dried and trucked to the restoration site, which is less efficient and more expensive than transport by barges. The concept of storing or transferring dredged sediment into an aquatic basin would allow the bottom dumping of sediment that would be re-dredged later and pumped to a restoration site through a hydraulic dredge. This concept was investigated in the mid-2000's by the USACE but was not pursued primarily due to habitat loss and concerns for potential impacts to listed species.

PHOTO CREDIT: Jaime Lopez, BCDC

[11] 250,000 cubic yards of the 1.25 million cubic yards is a small dredger set aside, with the total available for large and medium sized dredges of 1 million cubic yards annually. See the LTMS Management Plan for more details.

PHOTO CREDIT: Brenda Goeden, BCDC

Restoration Sites

Wetland restoration sites throughout the region, including tidal, seasonal, brackish, and fresh water, are diverse in nature, size, topography, location, goals, and project sponsors. Some restoration practitioners follow tried and true methods, while others are experimenting and creating new techniques. Some projects and existing marshes do not need sediment augmentation, while others may need sediment support as sea level rises. Other deeply subsided sites need large volumes of sediment or soil to raise elevations or construct site features such as ecotones, islands, and/or flood protection features to protect communities adjacent to them. Some can receive sediment from the Bay side, while others are reliant on land-based soil sources or could be reconnected with flood channels or creeks.

Currently, four landscape-scale restoration projects in the Bay Area actively receive sediment or soil as part of the project, and another is in the planning stage. Montezuma Wetlands, Cullinan Ranch, South Bay Salt Pond Restoration Project, and South San Francisco Bay Shoreline Project are large, multi-user beneficial reuse sites that employ different strategies for obtaining sediment and soil.

In the South Bay, where access to dredged sediment is limited by the shallowness of the Bay, the South Bay Salt Pond Restoration Project has been using free soil primarily from the construction industry and to a limited extent from Valley Water. This free soil and sediment have been used to build restoration site features such as ecotones, flood risk reduction levees, habitat islands, and general fill. While the “free dirt market” can produce large volumes of soil, it also is tied to the cycling of the construction industry and development, making both planning and managing the anticipated levels of soil, and thus the construction of the restoration site, challenging. Further, as developers work to adapt the built environment to sea level rise, this source of soil will become more competitive.

The South San Francisco Bay Shoreline Project, which includes a 3-mile flood risk levee and restoration of former salt ponds, has had to purchase much of its soil from quarries. This is primarily due to the need for specific soil quality for an engineered levee. As the site progresses, it too will look to the free dirt market for available fill, in addition to using on-site soil that was removed in constructing the levee for transitional habitat development (ecotone).

In the North Bay, the restoration projects work with the dredging industry, accepting both surface and foundation quality sediment that can be pumped onto the site. Montezuma Wetlands has a dedicated offloader that can accept sediment from most dredging projects, and the use of this offloader includes a fee that is charged to the dredging project on a per-cubic yard basis, increasing the cost of the dredging project. Like Montezuma, Cullinan Ranch charges a tipping fee to dredgers which is used to help manage the site.

PHOTO CREDIT: Jaime Lopez, BCDC

Cullinan Ranch does not have a dedicated offloader and therefore the dredging contractor must bring an offloader to the site to offload dredged sediment. Until about seven years ago, there was no contractor in the region that had its own offloader. As of March 2025, there are three dredging companies (Curtin Maritime, Lind Marine, and Mason Construction Company) with offloaders that have successfully brought sediment to Cullinan Ranch. When equipment is not provided by the restoration site, operation and use of offloading equipment for beneficial reuse is included the contract costs for the dredging project.

Cullinan Ranch is anticipated to be completed by 2026 and has approximately 1 million cubic yards of remaining capacity. Montezuma Wetlands Phase 2 has estimated 15-20 million cubic yards of capacity over approximately 20 years and can receive “foundation quality sediment” – sediment with modest levels of contaminants that are isolated in specially designed cells. Bel Marin Keys Unit V is another project in planning stages that is anticipated to come online by the end of 2027) and would have between 7-21 million cubic yards of capacity depending on available funding and final project design.

Beyond these sites, there are few restoration projects currently planning to bring sediment and/or soil to their site. This creates a challenge in promoting beneficial reuse, but more importantly, it means many restoration sites will be solely dependent on natural sedimentation to reach elevations sufficient for vegetation to colonize. This will either take many decades, or be impossible given the rate of sea-level rise.There is growing concern that restoration projects that do not augment the sediment supply will not reach marsh plain development in advance of rising seas. Work by SFEI is underway in its Resilient Landscapes Program to develop tools to identify important restoration sites and their sediment and/or soil needs.

Compared to natural sedimentation at subsided sites, the beneficial reuse of dredged sediment and soil has been very successful at raising site elevations, allowing vegetation to recolonize sites relatively quickly (e.g. Sonoma Baylands, Bair Island, Montezuma Phase 1 and Hamilton Wetlands). Each year the sediment and/or soil that is not used puts the region further behind sea level rise and creates a greater deficit in restoration and adaptation projects.

Reusing sediment and soil has its challenges. Site designs must consider a construction and design that anticipate and plan for receiving sediment and soil; water and equipment management; the time necessary to bring in volumes sufficient to raise elevation; and the associated costs. Restoration site practitioners need information to support decision-making around the need for sediment. Site assessments would assist in understanding sedimentation rate and the need for augmentation during construction. This knowledge informs design and prioritization of sediment and soil needs. As more restoration sites assess the need for sediment, best practices for beneficial reuse of sediment and soil can be developed and shared.

Most restoration site managers and practitioners are not primarily engaged in searching for and identifying sediment and soil that can be brought to the site, or developing the infrastructure to make it possible, and do not have the staff to undertake this work. Therefore, support is needed in the form of coordination with regional and local governments and communities, technical support, identifying and creating collaborative partnerships between restoration sites and local sediment and soil management projects, and educating existing and prospective funders to support changes to project design and management to allow for beneficial reuse.

PHOTO CREDIT: Jaime Lopez, BCDC

PHOTO CREDIT: Jaime Lopez, BCDC

While sites that are currently deeply subsided require additional sediment to raise their elevation, existing and restored wetlands will also need additional sediment to maintain their elevation as sea level rises. Methods, best practices, and appropriate timing need to be developed. Having the ability to support existing and restored wetlands over time through sediment augmentation will allow wetlands to adapt rather than drown.

Pilot projects are being tested to determine their efficacy, with special attention given to protected and native wildlife that depend on the limited existing wetlands. For example, Marin County Flood Control District piloted thin-layer placement of sediment excavated from flood control channels in Novato Creek at Deer Basin, a subsided site, in 2016. This project identified some challenges in placing sediment but found flexibility with the regulatory agencies and completed its first phase. In 2023, the USACE piloted the "Strategic Shallow Water Placement Project," which deposited 90,000 cubic yards of dredged sediment from Redwood City federal navigation channel two miles offshore of Whale's Tail Marsh in the South Bay, to assess whether tides and currents can transport suspended sediment to the adjacent mudflats and marshes. Monitoring is underway, though more pilot projects are necessary to identify successful methods of augmenting sediment supply.

Focus Areas and Actions

The eight Focus Areas in this Action Plan are detailed below and have accompanying objectives and specific actions that can be accomplished by organizations wishing to further support beneficial reuse. The focus areas are: Implementation and Regional Coordination; Federal, State and Regional Policy and Collaboration; Regional Planning and Evaluation; Regulations and Permitting; Pilot Projects; Sediment and Soil Quality; Coordination of Sediment and Soil Availability and Placement; and Costs and Funding.

Each focus area includes an "Issue Summary" that provides a general overview of the considerations related to each focus area, and an "Objectives" section which includes the context and actions. The actions included in each focus area are aligned with the overarching goals of the Action Plan. To be included in the Action Plan, an action must focus on increasing beneficial reuse of sediment and soil, be potentially achievable in one to five years, have a potential champion or champions, and have regional support. The action tables state whether each action was "in progress" or "not yet started" at the time of this Action Plan's publishing. For actions identified as "in progress," the champion(s) currently leading the actions are listed beneath the status in italics. This Action Plan is intended to comprehensively document solutions identified by the sediment community, and guide future work by the various agencies, resource managers, and stakeholders. As a result, it was important to ensure that actions of different scales and specificity be included.

PHOTO CREDIT: Jaime Lopez, BCDC

Focus 1: Implementation and Regional Coordination

Issue Summary

Increasing beneficial reuse of sediment and soil requires expanded and strong collaboration. There is an established, interconnected, and well-coordinated network of partners that support beneficial reuse in the Bay Area, working to increase funding, reduce policy hurdles, and improve processes at the federal and regional level. The partnership has included federal and state agencies, and non-profit organizations representing the restoration and environmental community and construction (both marine and terrestrial) industry. The LTMS program has led to successful efforts to beneficially reuse navigation dredged sediment but is limited in scope and community. Regional partnership needs to grow to include leaders from more sectors of sediment management, including the private sector. This Action Plan includes a focus on building partnerships that will support the implementation and achievement of additional actions that remove barriers to beneficial reuse.

Objective 1.1: Align Regional Coordination and Action Plan Oversight

BCDC partnered with the San Francisco Estuary Institute, San Francisco Bay Joint Venture, San Francisco Bay Regional Water Quality Control Board, State Coastal Conservancy and U.S. Environmental Protection Agency to guide development of the Action Plan, and these entities will continue working together to track the Plan's implementation. Once a coordinated approach to implementation is established, this effort can be transformed and transferred to that forum. The objective of this set of actions is to align and create broader regional coordination and establish a partnership structure for implementation of the Action Plan.

Index #	Action	Status & *Champion(s)*
1.1.1	Convene a working group of agencies, restoration project sponsors, dredgers, and core stakeholders to explore and ultimately select a preferred implementation model and entity or entities to lead implementation of this Action Plan. The working group will provide direction to oversee this work and establish regular check-ins to track progress.	In progress *U.S. EPA and other partners*
1.1.2	Create an Action Plan tracking mechanism to document progress on focus areas and actions.	In progress *BCDC*
1.1.3	Explore the potential for a regional beneficial reuse coordinator to develop a better system to work with sediment and soil source providers and sites.	Not yet started *U.S. EPA and other partners*

Focus 2: Federal, State, and Regional Policy and Collaboration

Issue Summary

A committed program is necessary at every level of government to maximize the beneficial reuse of sediment and soil throughout the Bay Area. The state and regional agencies involved in sediment and restoration must consider whether their policies and regulations hinder or support beneficial reuse. Federal and state collaboration agencies can indicate their support for this work by funding and collaborating on beneficial reuse projects. Further, there is currently no dedicated permanent funding program at the federal or state level that supports the beneficial reuse of sediment and soil.

The United States Army Corps of Engineers (USACE) is the largest dredger and constructor of flood risk management systems in the region. The USACE's leadership has recognized the importance of beneficially reusing dredged sediment from its navigation program and has set goals to significantly increase beneficial reuse nationally. However, the USACE's "Federal Standard" regulation requires the USACE to choose the least costly sediment disposal alternative,[12] which poses an obstacle to achieving beneficial reuse of dredged sediment unless additional funding is provided, or the beneficial reuse option is the least cost alternative. Because beneficial reuse is often not the least cost option, the USACE has disposed of sediment either at dispersive in-Bay disposal sites or at the deep ocean disposal site where it cannot be used for restoration or adaptation.

Historically, beneficial reuse could occur, but required identification of a "cost-share partner" that would pay for the incremental cost of beneficial reuse beyond traditional aquatic disposal. Cost evaluations of disposal alternatives do not currently reflect the true value of beneficial reuse, such as the cost savings of reducing flood impacts, and other ecosystem services of restored habitat. The existing laws, regulations, and programing that focus on the cost of rather than the need for beneficial reuse of sediment in wetland restoration are barriers to increasing beneficial reuse.

Recently, consistent national advocacy for beneficial reuse and for interpreting the Federal Standard[13] to support beneficial reuse has resulted in some improvements to the Water Resources and Development Act (WRDA) and the USACE program. In WRDA 2016, Congress included a new pilot program in which the federal government covers

[12] The Federal Standard refers to the dredged material disposal alternative(s) identified by the USACE as the least costly alternative(s) consistent with sound engineering practices that meet the environmental standards established by the 404(b)(1) evaluation process or ocean dumping criteria. 33 CFR 335.7 "Federal Standard"

[13] Water Resources and Development Act (WRDA) 2016, Section 1122 provides federal funding for beneficial reuse of dredged sediment for 10 pilot projects. SCC and BCDC put forth a proposal to the USACE that was one of ten accepted proposals nationally. As a result, the USACE has agreed to provide $51 million dollars for beneficial reuse of sediment from four navigation projects at four restoration projects over ten years. Approximately $19 million of that funding has been used locally to beneficially reuse sediment and conduct the Nearshore Strategic Placement Pilot Project.

the added cost of beneficial reuse above the Federal Standard for a limited time. In 2020, Congress further amended WRDA to include Section 125, which provides new policy tools that are being integrated into the USACE dredging programs nationally.

WRDA 2020, Section 125 has three parts that together allow the USACE to cover 65% of the incremental cost above the Federal Standard for beneficial reuse to support wetland restoration or other environmental benefits. The least cost plan (Federal Standard) is still identified, but the incremental cost-sharing covered by a local or state partner has been decreased from 100% to 35%. Additional guidance has been provided that supports analysis of the true cost of dredging, which can reduce the imbalance of aquatic disposal and beneficial reuse.

In addition to the Federal Standard issue, the federal Marine Protection, Research, and Sanctuaries Act (MPRSA) could better support beneficial reuse and decreased waste of dredged sediment. The U.S. EPA and the USACE manage the San Francisco Deep Ocean Disposal Site (SFDODS). Decisions regarding whether a project can use SFDODS are considered per MPRSA, which includes an alternative disposal site analysis that evaluates cost, among other factors. Strategic changes to MPRSA could result in less ocean disposal in favor of beneficial reuse in wetland projects.

At the state level, while policies and regulations favor beneficial reuse, they too include alternative disposal analysis that considers cost. To increase beneficial reuse, the state has contributed significant funds through the State Coastal Conservancy (SCC), either through site preparation or direct funding to the USACE on a limited basis.

Objective 2.1: Align Federal Standard with Maximizing Beneficial Reuse

In 2023, two USACE memoranda directed the USACE to increase beneficial reuse of the navigation sediment they dredge from 30-40% to 70% by 2030.[14] [15] The actions in this Objective would assist the USACE in achieving this goal but does not provide funding or changes to the "Federal Standard." To meet their goal of 70% beneficial reuse, the USACE and its partners must continue to work together to refocus and potentially seek changes to the Federal Standard, identify funding sources from partner organizations, develop a long-term plan, and identify benefits the USACE can support beyond the least cost disposal alternative.

Index #	Action	Status & *Champion(s)*
2.1.1	Identify the elements of the Federal Standard regulation that encourage or impede beneficial reuse. Consider and support proposed changes to the implementation and interpretation of the USACE Federal Standard regulation, and evaluate potential changes to the Standard itself, to allow beneficial reuse of dredged sediment to be selected for a project or region, even if it is not the least cost alternative.	Not yet started *USACE and other partners*
2.1.2	Further evaluate and implement the Water Resources Development Act of 2020 (WRDA) Section 125 guidance, WRDA 2024, and General Spellmon's directive to beneficially reuse 70% of dredged sediment by 2030. Work with the USACE to interpret and integrate Section 125a and c of WRDA 2020 to evaluate the true cost and benefits of dredging and sediment reuse.	In progress *SCC, USACE, and other partners*
2.1.3	Evaluate whether the Marine Protection, Research and Sanctuaries Act (MPRSA) regulation should be revised to decline approval of ocean disposal if it is feasible for the sediment to be beneficially reused.	Not yet started
2.1.4	Work with the Bay Area Congressional delegation to identify and promote federal actions through WRDA or other means to increase beneficial reuse, decrease ocean disposal, and provide appropriate funding to support beneficial reuse, restoration, and marsh enhancement.	In progress *SCC, BCDC*

[14] "Beneficial Use of Dredged Material Command Philosophy Notice," USACE LTG Scott Spellman (January 25, 2023).

[15] "Expanding Beneficial Use of Dredged Material in the USACE," USACE Civil Works Director Edward E. Belk, Jr. (August 28, 2023).

Objective 2.2: Support Regional Dredged Material Management Plan and USACE Beneficial Reuse Programming

In 2020, the USACE initiated its first Regional Dredged Material Management Plan (RDMMP), a planning document required by the USACE to evaluate the San Francisco District's dredged sediment disposal capacity over the next 20 years. The USACE engaged with stakeholders in the development of this document to maximize beneficial reuse through this process. Through Section 125 and this process, the USACE developed new ways for the USACE to incorporate beneficial reuse in its program. This effort aims to manage federal navigation channels as an estuarine system rather than channel by channel, create new cost sharing options, and update the RDMMP every five years to include annual changes to the program. In addition, it included the use of Beneficial Use Decision Document Integration (BUDDI) which allows new beneficial reuse sites to be identified and recommended for inclusion in a 5 or 20-year RDMMP, without undertaking a new RDMMP.

The USACE has drafted its RDMMP for federal fiscal years 2025-2044. The draft, available on the USACE website, lays out three potential options that would presumably meet the Federal Standard, two of which include increasing beneficial reuse. In addition, the USACE San Francisco District is designated as an Engineering with Nature (EWN) proving ground, meaning it is dedicated to integrating nature-based solutions across all business lines. This designation emphasizes the need for nature-based solutions to sea level rise and other flood risks.

Index #	Action	Status & *Champion(s)*
2.2.1	Continue to collaborate with USACE's RDMMP and Engineering with Nature team and assess internal agency processes to increase indirect and direct placement pilot projects.	In progress *Water Board, SCC, U.S. EPA, BCDC, Bay Planning Coalition, CMANC, USACE*
2.2.2	Analyze the Federal Operations and Maintenance program as a regional approach (e.g., USACE RDMMP effort). Use benefits analyses, regional flood protection metrics, and other means to quantify benefits to support and complete section 125a BUDDI documents.	In progress *USACE and other partners*
2.2.3	Develop information, guidance, and public engagement on different tools that can be applied to further fund USACE's beneficial reuse strategy such as (i) RDMMP yearly evaluation; (ii) WRDA 2020, Section 125a guidance, which uses a Beneficial Use Decision Document Integration (BUDDI) system to revise the "Federal Standard" or base plan; (iii) WRDA 2020, Section 204 which combines habitat restoration and coastal enhancements with federal navigation projects ; and (iv) other policy and funding tools.	Not yet started *USACE and other partners*

Objective 2.3: Improve State and Regional Coordination

Through the Ocean Protection Council's 2020-2025 Strategic Plan, the State of California recognizes the need for a state-wide beneficial reuse program with a focus on the coast and the San Francisco Bay estuary. The State Coastal Conservancy has also recognized the importance of beneficial reuse and has included beneficial reuse in its 2023-2027 Strategic Plan. The LTMS Management Plan's goal of maximizing beneficial reuse of navigation dredged sediment can be further expanded to achieve more than forty percent beneficial reuse of sediment. State and regional programs should expand their programming to emphasize the need to increase beneficial reuse of dredged sediment, sediment excavated from flood control channels, and excess construction soil.

Index #	Action	Status & *Champion(s)*
2.3.1	In coordination with the Ocean Protection Council (OPC), the California Natural Resources Agency (CNRA), and the California Environmental Protection Agency (CalEPA), develop regional recommendations on a state-wide beneficial use policy and implementation structure. Work with other regions and state agencies to establish these beneficial reuse recommendations.	In progress *California Sediment Management Workgroup (CSMW), OPC, CalEPA*
2.3.2	Work with CNRA, CalEPA, other state agencies, and state legislators to develop a funding and state-wide legislation strategy focused on supporting beneficial reuse of sediment and soil for sea level rise adaptation, habitat benefits, and recreation. Formalize the existing coalition to pursue legislative approaches/opportunities in the interest of the San Francisco Bay region.	In progress *OPC, BCDC, Water Board, U.S. EPA, SCC*

Objective 2.4: Update State and Regional Policies

Federal and state agencies, regional organizations, and non-governmental partners should collaborate to improve federal, state, and regional policies. In addition, local agencies and organizations should review their own policies and plans to identify and reduce barriers to beneficial reuse in wetlands.

Index #	Action	Status & *Champion(s)*
2.4.1	Assess regional plans, policies, and regulations from state, federal, and regional agencies that may require updates to encourage beneficial reuse of sediment and soil.	In progress *BCDC, Water Board*
2.4.2	Assess San Francisco Bay Plan findings and policies regarding sediment supply and beneficial reuse to identify necessary improvements and propose amendments.	In progress *BCDC*
2.4.3	Examine the consequences of limited beneficial reuse at wetland restoration sites in combination with rising seas among federal, state, and local agencies, and organizations to develop community and political support.	In progress *U.S. EPA, USACE, and other partners*

Focus 3: Regional Planning and Evaluation

Issue Summary

The stakeholder process for this Action Plan indicated that there is limited information about the needs of planned and candidate restoration sites beyond those described for the LTMS Program in the 1990's. After the SWAP workshops, SFEI released its Baylands Resilience Metrics Web Map. This regional tool can be used along with other information to determine sediment needs at restoration sites and existing marshes. However, more information is needed to determine what it means for a restoration site to be "ready to receive" sediment and/or soil, and what actions are required to connect a sediment or soil source to a candidate restoration project.

Objective 3.1: Solidify Regional Priorities and Strategy

Much has been done to improve understanding of the conditions of existing marshes, subsided baylands, and restoration activities. Most recently, SFEI and the Wetlands Regional Monitoring Program (WRMP) updated the Baylands Habitat Map which is now publicly available and can be found at https://www.sfei.org/projects/baylands-change-basemap. This new map along with SFEI's Bay Resilience Framework can be used to further analyze the baylands' and restoration projects' need for sediment to create elevation capital and be adaptive to rising seas.

Index #	Action	Status & *Champion(s)*
3.1.1	Identify and evaluate active and candidate restoration sites and existing marshes to determine whether they need sediment from navigation channels, stream beds, and/or construction soil. Use EcoAtlas (https://www.ecoatlas.org/regions/ecoregion/bay-delta) and the SFEI Baylands Resilience Metrics to identify existing and new restoration sites and needs.	In progress *SFEI, Water Board, BCDC*
3.1.2	Prioritize restoration or existing marshes that need sediment/soil to ensure best possible use of available sediment/soil regionally and sub-regionally.	Not yet started
3.1.3	Identify and further explain site restoration limitations and needs associated with species, weather, transportation, and local permits and work to resolve them on a regional basis.	Not yet started

Objective 3.2: Assess Site Conditions for Beneficial Reuse

The existing conditions at restoration sites vary depending on the prior use of the site, which in the Bay Area ranges from former military bases to salt production to agricultural lands and more. These prior uses may influence the quality of the sediment or soil on the site. If the site has contamination issues, beneficially reusing sediment and soil on-site would improve the site. With this construct in mind, consideration can be given to whether beneficial reuse at challenged sites would be a net improvement and thereby reduce or eliminate the need for mitigation.

Index #	Action	Status & *Champion(s)*
3.2.1	Investigate and determine appropriate uses for sediment/soil with elevated levels of contaminants to ensure resulting site conditions would be satisfactory to all agencies and surface and groundwater would be unimpaired.	In progress *Water Board, BCDC*

PHOTO CREDIT: BCDC Staff

Objective 3.3: Foster Outreach and Advocacy

Many entities are not familiar with the benefits of beneficially reusing sediment and soil as a tool for sea level rise adaption and habitat restoration, nor with the challenges of transporting these resources to a site. Some local entities may have concerns that need to be addressed. Creating partnerships between local governments, construction firms, and communities can help the region better understand beneficial reuse for restoration and sea level rise adaptation, potentially leading to the increased availability of material sources. This work could make sediment and soil reuse in wetland projects more efficient and effective by facilitating permitting and transportation, resolving property ownership issues, and alleviating concerns about construction impacts.

Index #	Action	Status & *Champion(s)*
3.3.1	Develop an outreach strategy targeting sediment and soil source managers so they gain greater insight into the need for additional sediment or soil, site-specific demands, and resource quality and quantity.	Not yet started
3.3.2	Continue advocacy to and education of stakeholders and the public on the connection between beneficial reuse and flood protection, and the need to increase funding and beneficial reuse.	In progress *U.S. EPA, USACE, and other partners*
3.3.3	Provide education, support, and guidance to project proponents and local governments on permitting, transport, and restoration/adaptation methods that beneficially reuse sediment and soil.	Not yet started
3.3.4	Improve communication and coordination between restoration projects, local agencies, flood protection managers, and private dirt brokers to create feedback opportunities, better partnerships, and incentivize beneficial reuse of sediment and soil over use of landfills and aquatic disposal.	Not yet started

Focus 4. Regulations and Permitting

Issue Summary

The region's ability to source, transport, store, and place sediment and soil can be improved by developing actions to further coordinate and streamline regulatory and permitting processes. Through improvements to regulatory and permitting processes, agencies can address beneficial reuse projects in a consistent manner, allowing project proponents to plan their restoration with more certainty.

Objective 4.1: Evolve and Clarify Permitting Regulations and Practices

The actions under this objective encourage project proponents, permitting agencies, and the public to develop creative approaches and evolve processes and practices. Some entities may need to review how they currently interpret and apply their legal and regulatory authority; others may reconsider how they can work together to support successful wetland restoration projects requiring sediment and soil.

Index #	Action	Status & *Champion(s)*
4.1.1	Work with the restoration community to understand what is needed to simplify the permitting process to receive beneficially reused sediment and/or soil.	In process *BCDC, Water Board, SCC, USACE, U.S. EPA*
4.1.2	Support project proponents in understanding sediment supply, augmentation needs, and how to design sites to beneficially reuse sediment and soil. Develop guidance to support beneficial reuse in restoration site development and the permitting process.	Not yet started
4.1.3	Consider whether beneficial reuse of sediment and/or soil at wetland restoration sites can mitigate for dredging or flood protection project impacts.	In progress *National Oceanic and Atmospheric Administration (NOAA), USACE, Water Board, BCDC, CDFW*
4.1.4	Discuss among regulatory agencies appropriate characterization and review of stream maintenance sediment (chemical/contaminant analyses, soil grain size and type, geotechnical properties, etc.).	Not yet started

4.1.5	Improve efficiency of permitting and monitoring by ensuring permitting requirements are aligned across agencies to the extent possible.	In progress *LTMS, DMMO, WRMP, BRRIT USACE, NOAA, USFWS, CDFW, Water Board, BCDC*
4.1.6	Evaluate dredge placement methods, including hydraulic and clamshell methods, to determine whether improved beneficial reuse placement methods and outcomes are possible. Work with federal and state resources agencies to study and develop potential conditions for use of hydraulic dredges under appropriate circumstances.	In progress *USACE, Water Board, CDFW*
4.1.7	Develop water management methods in restoration project designs that may allow for beneficial reuse of sediment that minimizes site water discharge monitoring requirements.	Not yet started *Water Board, USACE, BCDC, restoration project proponents*
4.1.8	Determine the feasibility and appropriateness of requiring project proponents to input information about available sediment, soil, or restoration sites into a database, such as SediMatch, to improve visibility of available sediment and soil for beneficial reuse.	In progress *Water Board and BRRIT*

Focus 5. Pilot Projects

Issue Summary

Presently, the Bay Area relies heavily on a combination of placement strategies (i.e., mechanical equipment, pipeline transfer, and truck delivery) to supply subsided baylands with dredged sediment and/or soil. Sediment placement methods are selected according to the design and location of the restoration site and the material available. While these direct placement strategies are well-recognized and successful, particularly for providing large quantities of dredged sediment, the variability of depth and width of mudflats, the cost additional equipment, and need for additional site management has prevented them from being regionally applicable.

There is limited data on the effectiveness of direct and indirect placement strategies in the region. Within the past few years, few pilot studies tested the use of thin-layer and shallow-water placement strategies in the region, and more are needed. In other regions in the nation, pilot projects with varying conditions have provided valuable data and experience to build on.

Objective 5.1: Support Indirect Placement Pilot Projects

Indirect placement strategies utilize natural processes such as wind-wave action and currents to transport sediment onto wetland restoration sites. For flood protection programs, lowering levees adjacent to wetlands is equivalent to tidal indirect placement. This process would allow sediment-laden creek or river water to flow into a marsh, naturally spreading and building up sediment to create protection from sea level rise.

Other parts of the country have conducted and implemented some of these strategies with varying levels of success. The Bay Area has tested only one nearshore placement project, the shallow-water placement at Eden Landing Ecological Reserve in Hayward, and awaits monitoring results to determine the effectiveness of the method, and how to improve the approach.[16] This objective seeks to learn from other regions who have piloted such work and implement best practices in pilot projects that would likely succeed within our estuary, and to continue to support new pilot efforts regionally.

[16] BCDC issued major Permit No. 2003.007.00 on April 28, 2004, and six permit amendments thereafter, to the California Department of Fish and Wildlife (formerly known as the California Department of Fish and Game).

Index #	Action	Status & *Champion(s)*
5.1.1	Working with experts, including researchers, practitioners, and academics both inside and outside the region, identify indirect sediment placement methodologies and best practices used in other regions that are applicable to Bay system.	In progress *USACE and other partners*
5.1.2	Investigate novel technologies to increase sedimentation on wetlands using dredged and/or flood protection project materials. Create opportunities for partnerships between implementing entities, researchers, and regulatory agencies to increase regional knowledge and understanding.	In progress *SCC, RDMMP, RMP, USACE*
5.1.3	Conduct modeling studies to evaluate indirect placement strategies across diverse sites, seasons, and tidal cycles in the region. Identify optimal strategies for the region, and establish short, medium, and long-term success criteria for indirect placement projects.	In progress *USACE and other partners*
5.1.4	Create a central location for compiling data/information regarding indirect placement projects, methodologies, and best practices that is publicly available for shared learning. Ensure permitting agencies have access and are up to date on information regarding indirect and direct placement studies.	In progress *SCC*

PHOTO CREDIT: Karen Thorne, U.S. Geological Survey

Objective 5.2: Support Direct Placement Pilot Projects

Direct placement involves placing sediment and/or soil onto a restoration site or existing marsh using a variety of techniques, including mechanical equipment, pipeline transfer, spraying/rainbowing, and truck delivery. This objective supports pilot studies that evaluate the benefits and disadvantages of different direct placement strategies to fully understand their applicability and impact on restoration efforts. With a greater understanding of these alternate direct placement approaches, the region will be able to design and implement cost efficient and effective initiatives with wetland restoration partners that need more sediment.

Index #	Action	Status & *Champion(s)*
5.2.1	Working with experts, including researchers, practitioners, and academics both inside and outside the region, identify direct sediment placement methodologies and best practices used in other regions, as well as potential short, medium, and long-term success criteria, that are applicable to the Bay system.	Not yet started
5.2.2	Evaluate and address constraints for dredged sediment direct placement methods. Review the completed projects and consider appropriate application for different types of sediment sources. Use existing information to facilitate development of better pilot projects.	In progress *USACE, U.S .EPA, Water Board, BCDC*
5.2.3	Conduct thin-lift and other direct placement pilot projects at sites needing sediment augmentation based on site prioritization, regional data gap analysis and periodic modeling.	In progress *SCC*
5.2.4	Improve interagency coordination on 404(b)(1) guidance and project analysis.	In progress *USACE, U.S. EPA, Water Board, BCDC, SCC*
5.2.5	Identify appropriate work windows and/or conditions for sediment thin-layer placement to address consistently present species. Identify alternatives for cutting vegetation to the ground, such as controlled site flooding, for fully protected species avoidance when doing thin-lift placement.	Not yet started

Focus 6. Sediment and Soil Quality

Issue Summary

Understanding whether the sediment or soil proposed for use at a restoration site would impact the plants and animals that would inhabit it is critical for the ecological health of the region. Regulatory agencies use an ecological risk-based approach and require the testing of sediment and soil that is imported to understand presence of contaminants.

Testing protocols for dredged sediment are standardized throughout the region and applied through the DMMO. However, testing for soil and flood-control sediment is not standardized in the region, nor is there an entity like the DMMO that supports the testing and decision-making process. While some standardization has recently been completed for the Don Edwards National Wildlife Refuge, this updated information has not been well distributed in the region. Optimizing testing protocols across the region would lead to more efficient sediment and soil characterization and allow for faster and more consistent management decisions.

Objective 6.1: Evaluate and Coordinate Testing Requirements for Upland/Flood Control Soil and Sediment

Sediment and soil from upland sources, including watersheds and flood protection projects, may have different contaminants of concern than dredged sediment due to the historic and current human activities. Upland soil, typically from construction projects, is tested but there is some variability in the protocols used. Similarly, flood-control and streambed maintenance sediment assessments are not consistent across the region. Decision-making becomes more challenging when different methods of analysis are used for similar purposes, which leads to slower response times. Standardizing testing protocols and developing transparent decision trees can improve the ability to beneficially reuse sediment and soil.

Index #	Action	Status & *Champion(s)*
6.1.1	Standardize sampling and testing protocols, as well as the acceptance criteria and guidance for beneficial reuse of (1) streambed and/or flood-channel maintenance sediment, and (2) construction soil to improve placement decision-making.	In progress *Water Board, BCDC, flood protection agencies, restoration practitioners*
6.1.2	Emulate DMMO process to construct a "tier-testing" system for suitability determinations among agencies managing flood control, stream maintenance, and construction soil. Identify grain size thresholds of sediment/soil above which sediment quality tests could be waived (i.e., sand, gravel). Seek agency consensus and document the known guidance for the region.	In progress *Water Board*
6.1.3	Formalize coordination between the LTMS/DMMO and the BRRIT and restoration projects to expand support for beneficial reuse of sediment and soil with their expertise.	Not yet started
6.1.4	Improve communication when further clarification of a suitability determination is needed. If necessary, consider developing technical documents that highlight specific concerns regarding flood protection and construction soil suitability for beneficial reuse.	Not yet started

Objective 6.2: Improve Data Management and Use

There is a need for consistent and available data regarding sediment and soil quality around the region. The DMMO has a publicly available database that contains all dredged sediment quality data for projects from 2000 to the present day. Flood control and upland construction soil have no similar database. SediMatch is a geographic database that seeks to identify and match sites that need sediment and soil with those that have it available. A noted desire for SediMatch is for it to also provide sediment quality data so that it is easily accessible and connected to the source material. Other efforts such as the Wetlands Regional Monitoring Program (WRMP) is developing a publicly available database with monitoring data from benchmark, reference, and project site monitoring, and is another potential database that could store and share sediment and soil data.

Index #	Action	Status & *Champion(s)*
6.2.1	Develop or expand a centralized database to collect all sediment and soil characterization and suitability data, including leveraging existing sediment monitoring data where available. Note: All data on navigation dredged sediment can be found here: https://www.dmmosfbay.org	In progress *DMMO, WRMP*
6.2.2	Include restoration and enhancement projects monitoring data, including from beneficial reuse, in SediMatch, WRMP, and/or other existing efforts to inform conservation actions and reduce monitoring costs for projects.	Not yet started
6.2.3	Improve SediMatch by adding a haul distance calculations tool to help project proponents match restoration sites with construction and/or flood protection projects within appropriate haul distances. Incorporate vulnerable communities that maybe be impacted by trucking.	Not yet started

Focus 7. Coordination of Sediment and Soil Availability and Placement

Issue Summary

The disconnect between readiness of sites and availability of material has been an ongoing barrier to the beneficial reuse of sediment for some restoration projects. Both restoration sites and projects that generate sediment and soil operate under discrete timelines that are influenced by planning processes, construction schedules, environmental work windows, and permitting. A delay or change in any timeline can cause misalignment, resulting in sites missing out on sediment or soil that would have furthered restoration goals.

A potential solution to this issue is developing offsite temporary facilities, or stockpiles, to store sediment and soil for restoration projects. If well-managed stockpiling facilities were available, sediment availability would not necessarily need to align with restoration site timing. However, it is important to note that stockpiling would require "double handling" the material, which costs more than taking the material directly to the restoration site. Stockpile facilities should be located centrally to restoration sites and near sites where dredged sediment delivery is challenging. Currently, some limited stockpiling occurs from flood protection and stream maintenance projects, but the practices are not well known, accessible to multiple users, or connected to restoration sites. In addition, a strategy can be developed to focus on distributing sediment and soil more efficiently with respect to location and restoration sites.

Objective 7.1: Assess Land-Based Stockpiling Feasibility and Develop Management Procedures and Best Practices

There is no regional system of stockpiling soil and sediment on land for restoration projects. Challenges include the ownership and location of stockpiles, funding, site management, material quality management, and potential impacts on terrestrial habitat. Implementing a system of sediment and soil stockpiles throughout the region may help address the misaligned timing of available sediment/soil and the readiness and availability of restoration sites able to receive them.

Index #	Action	Status & *Champion(s)*
7.1.1	Evaluate the benefits and challenges of stockpiling available soil and sediment so that the timing of available materials may be decoupled from the need.	Not yet started
7.1.2	At the subregional level, identify available and potential stockpiling sites (both for construction and dredged materials) or a network of stockpiling sites near restoration sites for temporary, one-time, or long-term use. Prioritize areas that would minimize impacts to habitat, such as landfills or industrial sites. Investigate the potential for stockpiling at active and planned restoration sites. Consider documenting identified stockpiling sites in SediMatch.	Not yet started
7.1.3	Identify willing owners and operators/managers, including public agencies (public works, flood control agencies, and sanitary districts) of stockpile sites and collaborate with them on the development of "use incentives." Identify funding for purchasing or leasing sites.	Not yet started
7.1.4	Develop an adaptive process for construction soil providers that supports testing, screening, and hauling dirt to stockpile areas or restoration sites. Investigate, document (via guidance), and share successful model agreements, liability transfers, and best practices between soil providers and restoration sponsors.	Not yet started
7.1.5	Work with construction companies to identify best haul routes and practices, analyze hauling impacts associated with upland soil delivery to beneficial reuse sites (traffic, air quality, greenhouse gases, road conditions, recreational facilities, etc.), and evaluate appropriate haul distances from restoration site to source material.	Not yet started
7.1. 6	Create and document clear protocols and guidance for how stockpile sites should be encouraged to be managed and operated to ensure regulatory issues are addressed, permitting can occur efficiently, and habitat harm is minimized.	Not yet started
7.1.7	Assess feasibility of sorting and mixing stockpiles to improve management, quality, and use of sediment/soil. Develop a regional strategy and protocols to support implementation of materials mixing if determined feasible.	In progress *Water Board, BCDC, SBSP*

Objective 7.2: Improve Flood Protection Programming

Between 2010 and 2100, it is estimated that about 11 million metric tons of sediment and soil will be removed from Bay Area flood control channels (SFEI, Sediment for Survival). This estimated volume represents an underutilized resource that could be put to good use in nearby wetlands. Each stream reach is different, and more information about streambed sediment's physical, quantitative, and qualitative characteristics is needed.

Index #	Action	Status & *Champion(s)*
7.2.1	Coordinate with Bay Area Flood Protection Agencies Association (BAFPAA) to facilitate changes in practices and create opportunities to link beneficial reuse, flood protection, and channel realignment.	Not yet started
7.2.2	Work with USACE Civil Works flood protection team to better understand perceived or actual federal barriers of levee requirements that can limit opportunities to sediment delivery from creeks to marshes.	Not yet started
7.2.3	Assess appropriate actions in watersheds to identify potential sources of contamination within flood-control channels and determine whether there is potential for sediment/soil reuse.	In progress *Water Board, Bay RMP Sources, Loadings, and Pathways Workgroup*
7.2.4	To better predict potential watershed sediment supply for beneficial reuse, work with flood protection managers to (1) assess stream conditions using geomorphology, historic conditions, and information, including rate of accretion in high, low, and "normal" years, (2) assess and measure erosion control issues in upper watershed/source areas, and (3) populate Bay Area watershed models with existing and new data to inform beneficial reuse throughout the region.	In progress *SFEI, flood protection managers*
7.2.5	Create a coarse-grained sediment reuse strategy to address upper watershed flood protection maintenance needs.	In Progress *SFEI*

Focus 8. Costs and Funding

Issue Summary

Analysis and experience have established that aquatic disposal of sediment dredged for navigation is less expensive compared to the beneficial reuse of sediment because more equipment, staff, and energy are required, and some restoration sites charge a "tipping fee" to receive the sediment. Sediment dredged or excavated from flood channels and stream maintenance projects may also require additional funding due to haul distances to restoration sites. However, the reuse of excess construction soil is a cost-saving option for contractors because the landfills often charge for disposal.

Beneficial reuse of sediment and soil requires additional funding for restoration sites that may need added infrastructure to manage it on-site, or to defray the incremental costs over simple disposal. To seek and obtain additional funding, it is important to understand the additional costs, the difference between available funding and the need, and to explain the value of the benefits gained. Actions in this section evaluate different aspects of funding needed, benefits delivered, and strategies for obtaining additional funds.

Other important considerations include how the costs and benefits are evaluated, and whether current and future benefits such as flood water absorption, sea level rise protection, habitat creation, water quality improvements, and others are included in the evaluation. As these benefits are acknowledged and valued, additional funding sources and opportunities arise.

Objective 8.1: Address Funding Gaps

There are gaps in funding for beneficial reuse of sediment and soil when compared to sediment disposal. By examining more closely the costs of beneficial reuse, a better understanding of potential efficiencies may arise. A clear understanding of costs and the ability to clearly explain them may lead to resonance with potential funding sources and more successful advocacy.

Index #	Action	Status & *Champion(s)*
8.1.1	Analyze the funding necessary for sediment/soil suppliers and incorporate and control cost for suppliers. Analyze the cost of beneficial reuse to restoration projects. Identify where costs of beneficial reuse can potentially be reduced through coordination and efficiencies.	Not yet started
8.1.2	Identify potential funding sources, mechanisms, and federal, state, local, and private programs for beneficial reuse (dredging, flood and stream maintenance, construction).	In progress *SCC*
8.1.3	Identify potential incremental cost share partners (federal, state, private) in accordance with WRDA 2020, Section 125 and explore procurement of matching grants to fund placement of dredged sediment at beneficial reuse sites.	Not yet started
8.1.4	Provide a summary of BRU funding research to BCDC's Financing the Future Commissioner Working Group and discuss potential funding strategies.	Not yet started
8.1.5	Secure commitment to fund beneficial reuse through fact-based advocacy, lobbying, or education efforts.	In progress *SCC*
8.1.6	Create a San Francisco Bay regional fund for beneficial reuse. Incorporate and align with Bay Adapt and the Bay Area Regional Collaborative (BARC) agencies sea level rise Memorandum of Understanding (MOU) for funding strategies.	Not yet started *SCC*

Objective 8.2: Evaluate Costs and Benefits

There is currently a lack of understanding and documentation of the full value of the benefits of restoration and adaptation projects that reuse soil and sediment. Documentation is critical to support projects in requesting and receiving funding, as well as messaging to the public and legislators. A series of analyses would support different discussions and aspects of restoration and beneficial reuse.

Index #	Action	Status & *Champion(s)*
8.2.1	Evaluate thin-lift project costs by reviewing USACE and other entities estimates and actual costs for completed thin-lift projects.	Not yet started
8.2.2	Conduct a cost-benefit analysis of the loss of marsh compared to adapting it through management actions (short-term impacts, long-term gains), delays in vegetation establishment as sea levels rise, etc. Study and assess the net long-term habitat restoration and flood protection benefits gained from the temporary loss of species or habitat from sediment placement. Identify tradeoffs and benefits of proposed actions.	Not yet started
8.2.3	Reassess power supply and emission regulations for hydraulic offloading and truck/train delivery of sediment/soil (diesel/electric).	Not yet started
8.2.4	Evaluate whether wetland restoration and beneficial reuse can offset greenhouse gases and other emissions impacts over time.	In progress *BCDC*
8.2.5	Provide the cost-benefit analysis to key stakeholders and coalitions to increase support by local, state, and federal entities for beneficial reuse opportunities.	Not yet started

Action Prioritization and Next Steps

Key next steps to activate and implement this Action Plan include convening agencies and stakeholders to create an Action Plan implementation model (Action 1.1.1), and assessing the funding needs of increased beneficial reuse of sediment and soil and strategizing on potential funding models (beginning with Action 8.1.1).

Through the public comment process, BCDC heard a common request for action prioritization. The BCDC project team worked to sequence actions based on urgency, current plans to undertake actions as part of the SWAP, and necessary order of operations based on feasibility. The following page lays out this potential approach. Agencies and stakeholders that convene to lead implementation of the Plan's actions will likely assess and reprioritize the actions based on new information and regional needs as they proceed with the work.

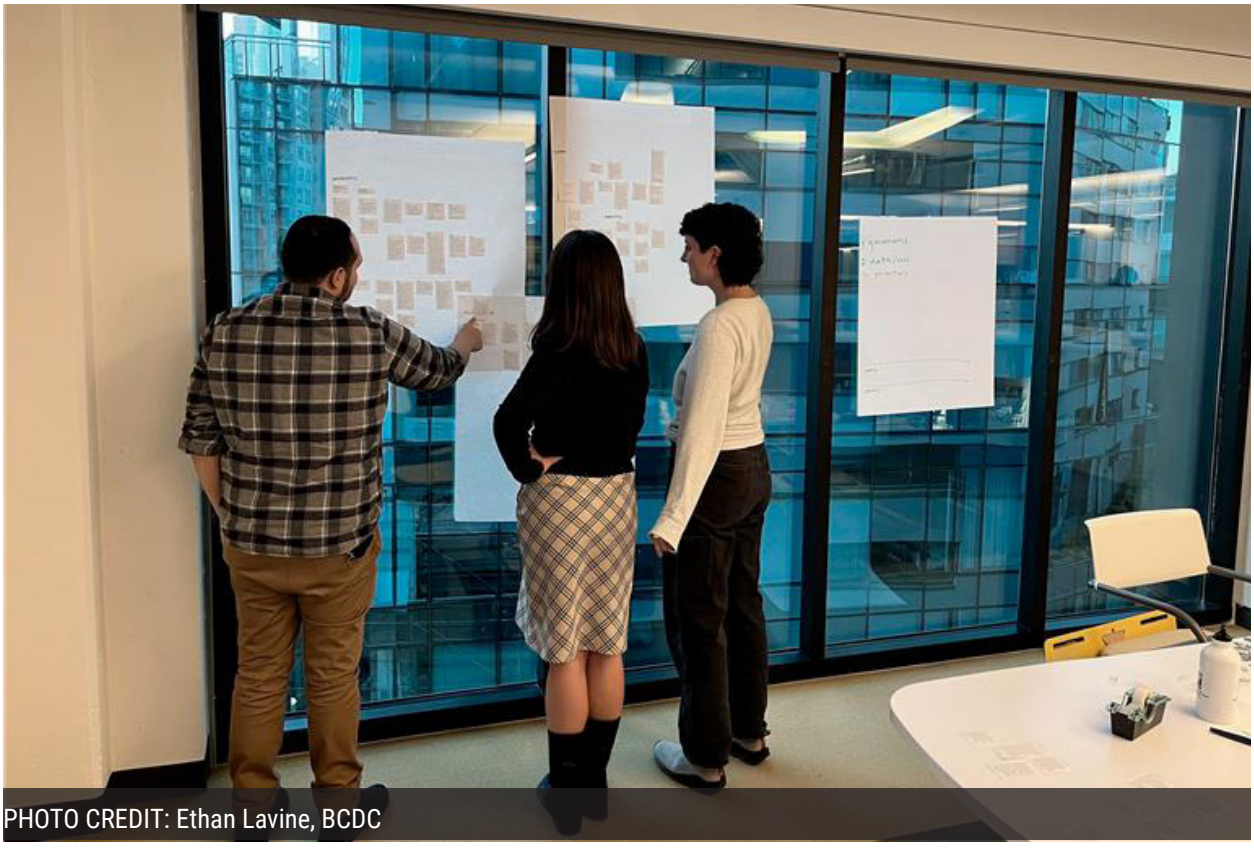
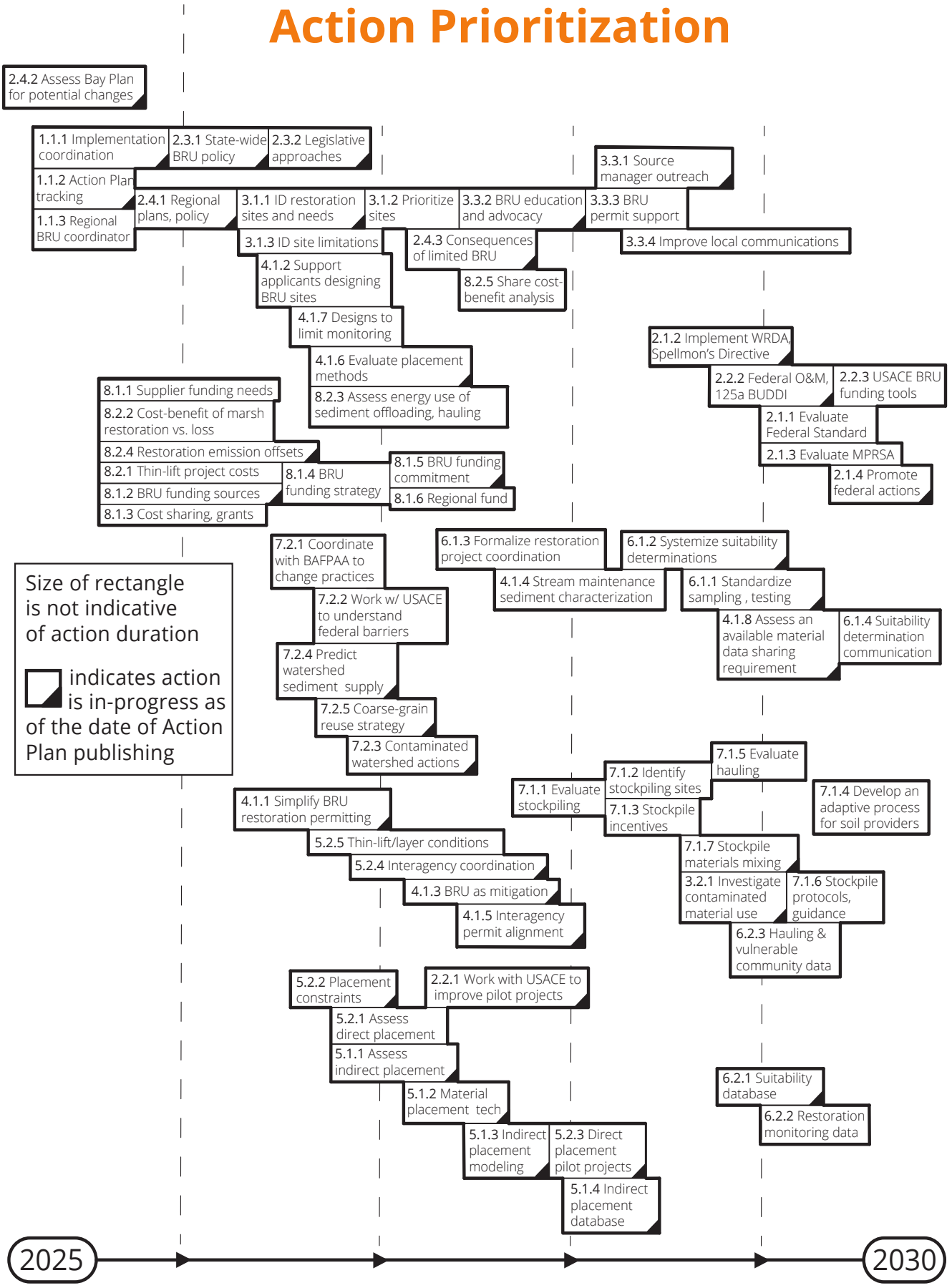


PHOTO CREDIT: Ethan Lavine, BCDC

Action Prioritization



PRIORITIZATION

Additional Topics for Future Discussion

Topics Not Included in This Action Plan

This Action Plan was developed through expert interviews, a stakeholder workshop, guidance from BCDC's Core Team and Sediment and Beneficial Reuse Commissioner Working Group, and the BCDC project team. Many actions were proposed during the workshop, but upon further evaluation, some were not within the scope of this Action Plan. To be included in the Action Plan, an action had to be focused on increasing beneficial reuse of sediment and soil, be potentially achievable in one to five years, have an identified or identifiable champion, and have regional support. Some actions were not included due to the acknowledged difficulty of practical implementation within a reasonable timeframe. Additionally, some actions may not have been included due to legal constraints that may make them infeasible at this time.

The following actions are not included in the Action Plan. Exclusion from the Action Plan does not preclude an entity from working on the proposed action or seeking partners; it is understood that these concepts may persist as discussion topics to be explored further.

Dam Removal

Dams stop the natural flow of sediment down a watershed and trap sediment in the reservoirs behind them. By removing dams and releasing the sediment trapped behind them, more sediment may be added back into the system.

Dam removals are multi-year and multi-million-dollar efforts that require significant study on how watersheds, flooding, water supply, and downstream impacts would be managed. While dams hold significant sources of sediment, they have not been assessed for the purpose of beneficial reuse of sediment in the Bay Area wetlands, nor is there a known mechanism for bringing the sediment to the wetlands. Entities with specific interest in dam removal can work towards these goals outside of this Action Plan.

Aquatic Storage or Transfer Facility

Having an in-water storage or transfer facility for dredged sediment would allow dredge scows to bottom-dump sediment into a large underwater basin to be stored and re-dredged when large volumes of sediment are available. This could economize the beneficial reuse of sediment but would also cost several million dollars to plan and undertake. In studying this potential project in the past, there were several concerns over impacts to listed species and essential fish habitat, as well as the destruction of a large area of previously undisturbed subtidal habitat. These issues remain, and like dam removal other entities may want to work on this issue outside of this Action Plan.

Expand the BRRIT

The Bay Restoration Regulatory Integration Team (BRITT) was designed to review restoration projects that meet the Measure AA guidelines, and therefore restoration projects that need dredged sediment could be included in its program review. The BRRIT currently has limited sediment and beneficial reuse expertise, but other actions regarding coordination on this issue are included. An expansion of the BRRIT to include new types of projects or additional personnel would be considered by the BRRIT Policy Management Committee and the funders of the BRRIT program. Recommendations can be made directly to the Policy Management Committee for consideration.

Update Endangered Species Act and Endangered Fish Habitat Regulatory Language

Currently there is nothing in either of these Acts that prevents beneficial reuse of sediment or soil in restoration projects. Therefore, this item is not included in the Action Plan.

Regional Sediment Management Plans by Subembayment

The development of a regional sediment management plan (RSMP) can contribute to increasing beneficial reuse of sediment and soil and has long been a goal of the region. BCDC created one for Central Bay that needs updating and has the beginnings of two additional plans. The effort to develop a subregional RSMP is more globally focused on management of human activities that affect sediment supply in the region and would involve a different focus than this Action Plan's focus of removing barriers to beneficial reuse. Actions that can lead to subembayment RSMPs include:

1. Develop specific management actions at the operational landscape unit scale
2. Study sources of shoaling and differences from year to year
3. Identify crossover with sand mining industry and regulatory groups
4. Coordinate closely among watershed and shoreline management agencies and shoreline and baylands restoration communities
5. Increase scientific understanding of sediment transport from entire bay and subembayments to discrete units for easier sediment management (the Regional Monitoring Program Sediment Workgroup is working on this currently)
6. Educate community on concept and connections, especially the scientific basis for this approach.

Net Site Improvement Protocol

Developing restoration site condition assessment protocols is not included in this Action Plan because the Clean Water Act does not allow for an impaired site to be partially impaired by placement of sediment with elevated levels of contamination. The Clean Water Act considers sites that do not pose an ecologic risk and restoration that achieves an unimpaired status.

Conclusion

This Action Plan, developed through the dedicated collaboration of BCDC's several partner agencies and diverse stakeholders, is an important step for the Bay Area toward more protected shorelines that respond to rising sea levels. This Action Plan is intended to guide subsequent actions by state, federal, and local agencies, the dredging community, stakeholders, and others to accelerate beneficial reuse for wetland restoration. The region will develop an implementation model to identify each action's leaders and monitor the Plan's progress. As a result, the important work to coordinate the region and implement this action plan will be ongoing.

PHOTO CREDIT: Jaime Lopez, BCDC

Appendix A: Background on Task Development Process

Process to Develop the Action Plan

Overview

In 2021, the Commission was awarded a Wetlands Development Program Grant from the U.S. EPA through a competitive process. Additional funding was provided by the Ocean Protection Council through an interagency agreement with the Commission. The project, called the Sediment for Wetland Adaptation Project, includes three phases: (1) a stakeholder process to create a beneficial reuse action plan and a coalition of stakeholders with agreed actions to support beneficial reuse of sediment/soil at wetland restoration sites; (2) a potential San Francisco Bay Plan Amendment proposal to address emerging sediment issues, including those addressing wetland and climate adaptation needs; and (3) a financing strategy to support beneficial reuse of sediment/soil.

As part of the first phase of the project, the Commission hired a consulting firm, The Catalyst Group, inc., to provide guidance, development, and facilitation for the workshop and the Action Plan.

Planning Meetings

Core Team. BCDC established a Core Team of partners for the Sediment for Wetland Adaptation Project. The Core Team included the San Francisco Bay Regional Water Quality Control Board, the San Francisco Estuary Institute, the San Francisco Bay Joint Venture, the California State Coastal Conservancy, and the U.S. Environmental Protection Agency.

The Core Team met monthly to review and discuss the activities associated with the EPA grant. The Catalyst Group provided updates and reviewed draft materials related to the issues, actions, agendas, and presentations, and discussed Core Team roles in workshop discussions. The Core Team members were important leaders in framing and guiding the workshop discussions.

Sediment and Beneficial Reuse Commissioner Working Group. BCDC staff initiated a series of meetings with a working group of Commissioners to establish an understanding of the science, policy, and current activities for dredging and beneficial reuse. The Working Group has met every two months since January 2023 and received informational briefings from experts and project updates at each meeting. This working group will continue to meet as the project proceeds into phase two, a potential Bay Plan Amendment proposal.

Stakeholder Interviews

The Catalyst Group interviewed 25 leaders involved with Bay Area sediment management and wetlands restoration. The Catalyst Group worked with the BCDC team to identify the important stakeholder categories, including restoration practitioners, watershed and flood protection managers, federal agencies, dredging project proponents and managers, estuary-scale collaborators and coordinators, and environmental advocacy groups. These interviews helped identify more than 40 issues and challenges associated with increasing

sediment and soil reuse in the Bay Area. These issues were summarized and organized in a matrix along with potential actions gathered from interviews and prior beneficial reuse discussions.

Workshop Plan Development

A two-day workshop was developed to bring together stakeholders from the sediment and soil management communities to discuss the issues and potential actions that could address the sediment challenge. The workshop plan, agenda, activities, and presentations were designed to feed into the Action Plan development.

Issue Papers

The BCDC team developed five issue papers to lay the groundwork for workshop participants. The topics include an overview of wetland restoration and sea level rise adaptation, sources of sediment and soil, placement methods, and challenged sediment (sediment that does not meet certain testing or placement standards). Catalyst reviewed these papers to improve the framing and presentation of beneficial reuse content for workshop participants.

Workshop

Agendas and Preparation

The Catalyst Group facilitated two stakeholder workshops on January 23 and February 13, 2024.

Workshop 1 focused on barriers and actions for sediment and soil sources, storage, and placement. The agenda for Workshop 1 was as follows:

- Review the Plan for the Day
- Review the Project Purpose, Framework, Action Plan
- Morning Breakouts – Sediment and Soil Sources
  - Construction Soil
  - Flood Management Sediment/Soil
  - Dredged Sediment
- Afternoon Breakouts – Storage and Placement
  - Direct Placement
  - Strategic/Indirect Placement
  - Restoration Site Availability/Readiness
- Summary and Close

During the morning breakout groups, Core Team members presented a brief overview of each potential source of sediment and soil and introduced 18 important issues with initial actions (5 to 7 issues per breakout group). Discussions regarding the issues with initial actions allowed the participants to review, clarify, and adjust the existing language to better reflect the steps necessary to address these obstacles.

The afternoon breakout groups followed a similar format and focused on the placement of sediment and soil, including direct and indirect placement, and site availability. Core Team members presented an overview of each placement topic and introduced 15 important issues for discussion. These issues were discussed by the participants, which allowed for the existing language to be reviewed and adjusted, so appropriate actions were implemented to resolve these matters.

Between the workshops, the BCDC team compiled the revised issues and actions, then grouped the actions into 10 categories for discussion at Workshop 2:

1. Policy
2. Process Improvements
3. Communication/Coordination/Education
4. Placement Sites
5. Costs and Funding
6. Testing Protocols
7. Stockpiles for Sediment and Soil
8. Species/Materials/Methods Concerns
9. Pilot Projects for Placement Methods
10. Data and Information

Workshop 2 was designed for further discussion and refinement of the actions identified in Workshop 1 to inform the content of the Action Plan. The agenda for Workshop 2 was as follows:

- Workshop 1 Review and Plan for the Day
- Source and Placement Action Pathways
  - Summary and Revisions since Workshop 1
  - Poster Board Activity to Prioritize Categories and Note Comments
- Governance Models, Coordination, and Coalition Building
  - Breakout Strategy Sessions – Governance
- Afternoon Breakout Strategy Sessions – Actions
- Funding Pathways Panel Discussion
- Summary and Close

The morning breakout activity included a poster session on the 10 action categories, during which participants reviewed the topics and actions, then later identified those most important to be included in the Action Plan. Furthermore, participants also added comments regarding the potential candidates for each action and offered additional feedback on the refinements. The most-voted categories were later discussed in afternoon breakout discussions.

Also in the morning session, Core Team members presented the coordination and implementation coordination needs for the SWAP Action Plan and examples from other programs. Participants then divided into two breakout discussions regarding how government agencies, non-governmental organizations, and businesses could organize to move the Action Plan forward.

The afternoon breakout groups reviewed and refined the following actions, which were listed as the most critical categories: (1) Policy, (2) Process Improvements, and (3) Communications, Coordination, and Education. Next, participants received a presentation on the steps necessary to develop the SWAP funding strategy. The workshop concluded with a moderated panel discussion regarding the funding needs and sources with representatives from the U.S. EPA, USACE, SCC, and SFBJV.

Workshop Comments

In total, 65 stakeholders participated in some portion of the two workshops (approximately 50 in each workshop). The BCDC team documented and organized all the submitted comments and discussion topics regarding issues (barriers and opportunities), actions, priorities, roles, implementation coordination, and funding. This input was synthesized and used to form the basis of this Action Plan.

Issues and Actions Management Framework

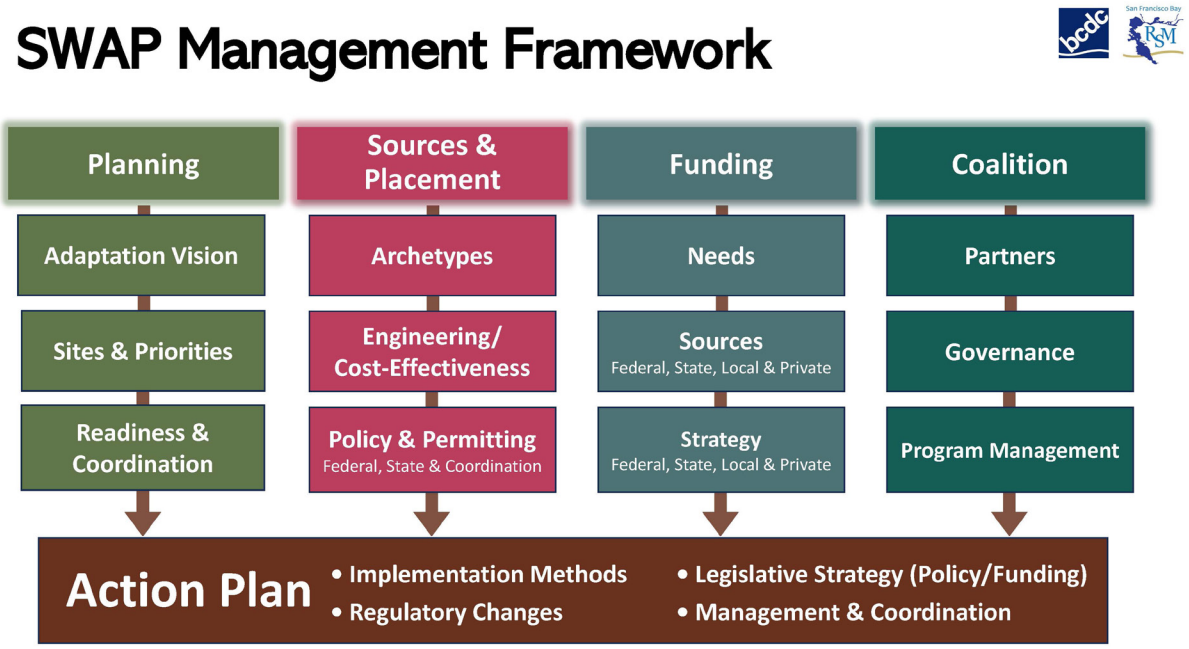
As noted during initial interviews, stakeholders are very interested in an action plan to advance the beneficial reuse of sediment and soil. Stakeholders confirmed this interest as they were highly engaged in workshop activities to clarify and develop the important opportunities, barriers, and actions for increasing beneficial reuse.

Beneficial reuse in San Francisco Bay, however, is a highly complex activity as it involves hundreds of potential sediment and soil sources; placement sites in various stages of development and readiness; dozens of intersecting state, regional, and local policies and regulations; complex governance and coordination needs; and the need for multiple stakeholder perspectives and interests to collaborate in addressing these many challenges. This complexity is reflected in the diversity of the 45 important issues identified (Workshop 1) and 128 actions developed (Workshop 2).

To address this complexity, The Catalyst Group developed a framework for asking all stakeholders to review the issues and actions appropriately, so the beneficial reuse of sediment and soil can proceed efficiently. The framework is organized in four "verticals:"

1. **Planning.** Regional planning issues and actions for beneficial reuse in San Francisco Bay, which include sediment availability, site prioritization, research, and future obstacles, were not addressed in the development of this SWAP: Action Plan.
2. **Sources and Placement.** Identifies the issues and actions related to expanding the availability of sediment, soil, and placement sites, and improving the coordination between sources and restoration locations.
3. **Costs and Funding.** Identifies the issues and actions related to increasing available funding for all beneficial reuse activities, specifically those that can reduce the cost differential between reuse and disposal.
4. **Governance and Regional Coordination.** Describes the issues and actions related to leading, coordinating, and implementing Action Plan items among organizations and stakeholders.

The following graphic represents the conceptual view of the issues and actions as originally conceived and, with further modifications, incorporated into this Action Plan.



Once the workshops were complete, BCDC staff worked with the Core Team and The Catalyst Group to refine the information, organize it, and draft the Action Plan. The draft Action Plan was released in November 2025, and public comments were sought. Fourteen individuals and/or entities provided comments, representing all areas of the programming described herein. Over 300 changes were reviewed, and most were incorporated into this final Action Plan, released in March 2025.

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