SF ESTUARY
Wetlands
Regional
Monitoring
Program

WRMP Implementation Work Plan

March 2025 – March 2027

Version 3/18/25

Background

The Wetlands Regional Monitoring Program's (WRMP) mission is to deliver coordinated regional monitoring of the San Francisco Estuary's (Estuary) wetlands to:

1. Inform science-based decision-making for wetland restoration and adaptive management, and
2. Increase the cost-effectiveness of permit-driven monitoring associated with wetland restoration projects.

This document describes the scientific monitoring activity that the WRMP intends to conduct in March 2025 – March 2027 to meet the Program's mission under current funding from the U.S. Environmental Protection Agency (EPA) San Francisco Bay Program Office and the San Francisco Bay Restoration Authority (RA). Additionally, this document identifies monitoring logistics, including timing, frequency, and locations of data collection if it is available. The WRMP is co-managed by the San Francisco Estuary Institute (SFEI) and San Francisco Estuary Partnership (Estuary Partnership), and funding awards go to one or both organizations.

This 2025-2027 Implementation Work Plan is a subset of activities described in the WRMP Monitoring Plan, which provides a vision for the first 10 years of WRMP monitoring, 2023-2033. The details for data collection methods, analysis, or results monitoring covered by this 2025-27 Implementation Work Plan are described in the WRMP Standard Operating Procedures (SOPs) and are further refined in the subawardee contracts.

This document captures scientific monitoring activity to be conducted under the initial $10M funding for the WRMP to SFEI and the Estuary Partnership from the EPA San Francisco Bay Program Office. It also includes monitoring activities to be conducted under the recent $3M award to SFEI from the RA. All monitoring

described in this Implementation Work Plan is additional to the monitoring described in the 2024-25 Implementation Work Plan, which covered earlier funding from RA and other sources.

Summary of Funding for Monitoring Implementation, March 2025 - March 2027

US EPA San Francisco Bay Program Office

The U.S EPA San Francisco Bay Program Office has awarded $10M to the WRMP, split evenly between SFEI and the Estuary Partnership. These funds are for implementation of the WRMP, including data collection and analysis, program governance and administration, regulatory alignment, and communication of information. Of this, $2.03M has been allocated in the grant workplans for tasks related to data collection.

Restoration Authority

The RA has granted $3M to SFEI from July 2025-June 2028 for WRMP program management; data collection, analysis, and visualization; website design and maintenance; engagement and communications; and SFBRA dashboard updates. Of this, $1.48M has been allocated in the grant workplan for tasks related to data collection.

Monitoring To Be Conducted in March 2025 – March 2027

Based on the management questions developed by the WRMP Steering Committee that are detailed in the WRMP Program Plan, the WRMP Technical Advisory Committee (TAC) and staff developed the WRMP Monitoring Plan. The following monitoring activities are a subset of what is described in the Monitoring Plan and provide fundamental, baseline information from which the WRMP can build over time to answer the monitoring questions. These monitoring activities also advance tasks within the WRMP's strategic plans around aligning the program to meet regulatory needs, improving monitoring coordination across the Estuary (in the twelve counties around the San Francisco Bay (Bay) and Delta), and building strong local partnerships for wetland education and workforce development. Table 1 provides an overview of the monitoring activities and how they are funded.

Data Storage for Monitoring Data

The project stores data using EcoAtlas, a geospatial system integrating PostgreSQL databases, open-source mapping tools, and content management platforms, and the WRMP Data Catalog, a data storage and visualization webpage. Biophysical monitoring data, including CRAM assessments and hydrogeomorphic monitoring, is uploaded to the Data Catalog and the WRMP Geospatial Data Catalog, ensuring consistency and accessibility. All data follow Federal Geographic Data Committee (FGDC) metadata standards for clarity and usability in wetland restoration efforts. Additional details will be provided in the forthcoming WRMP Quality Assurance Project Plan, a document that is a required component of any EPA-funded data collection project.

Table 1. Summary of monitoring activities, expected cost, and funding source.

Monitoring Activity/Subcategory	**Expected Cost**	**Funding Source**
Establish and monitor horizontal/vertical control markers at Monitoring Network Sites; establish a record of locations	$75,000	EPA
Establish photo-point monitoring locations, collect data, and create a database for displaying and sharing information	$10,000	EPA
Baylands Habitat Map (BHM) 2025 – Mapping & Analysis	$655,000	RA
Obtain LiDAR data for the Lower Estuary	$300,000	RA
Establish vegetation monitoring transects and measure key vegetation parameters, marsh surface elevation, and marker horizons	$173,000	EPA
Conduct California Rapid Assessment Method (CRAM) surveys across Monitoring Network Sites and synthesize data	$525,000	RA
Establish water quality monitoring stations, including monitoring for suspended sediment	$196,000	EPA
Establish and monitor vegetation in the upland and mudflat transition zones		
Continue monitoring Surface Elevation Table-Marker Horizon (SET-MH) sites across the Estuary and install SET-MHs at four new sites	$80,000	EPA
Design and implement fish and fish habitat monitoring to include validation by deploying recommended sampling methods to encompass sites in the Monitoring Site Network	$1,500,000	EPA
Total	**$3,514,000**	EPA subtotal: $2,034,000 RA subtotal: $1,480,000

Monitoring per WRMP Workgroup Recommendations

The WRMP will monitor indicators across wetland types varying in their maturity and restoration phase. The network of Priority Monitoring Site Networks is composed of three types of tidal wetlands: Benchmark, Reference, and Project sites. Figure 1 shows the location of the Monitoring Site Networks. Funding available at the time of writing will cover monitoring in the primary network sites. Figure 2 shows the sampling locations that are known at the time of writing this Implementation Plan, including those for vegetation monitoring, sediment elevation tables (SET), and fish sampling. Some sampling plans are still under development, and there will be additional monitoring locations included and potential adjustments made due to field conditions.

SFEI will oversee the collection and analysis of WRMP biophysical monitoring data to improve the understanding of ambient environmental conditions in the Estuary, how wetlands are responding to regional stressors and anthropogenic impacts, and gauge the success of wetland restoration projects. WRMP staff will support managers and regulators by providing data to inform science-based management actions and decisions. Data collected and analyzed by SFEI, and its subawardees, will include regional baseline data, routine inventories and surveys describing the distribution, abundance, and condition of tidal wetlands in the region. Activities will include GIS-based imagery assessments, QA/QC of data collected, and analysis by subcontractors and SFEI staff. Raw data will be available via the WRMP Data Catalog and geospatial database, and information and will be synthesized and disseminated through technical reports, maps, presentations, and the WRMP website.

Data for the various monitoring elements will be collected based on the recommendations in the existing Standard Operating Procedures (SOPs) for Geospatial, Hydrogeomorphic, Vegetation, and Fish and Fish Habitat (FFH). As new monitoring is proposed through additional workgroups, data collection will follow SOPs developed for those efforts.

Figure 1. Map of study area for WRMP tidal wetlands monitoring.

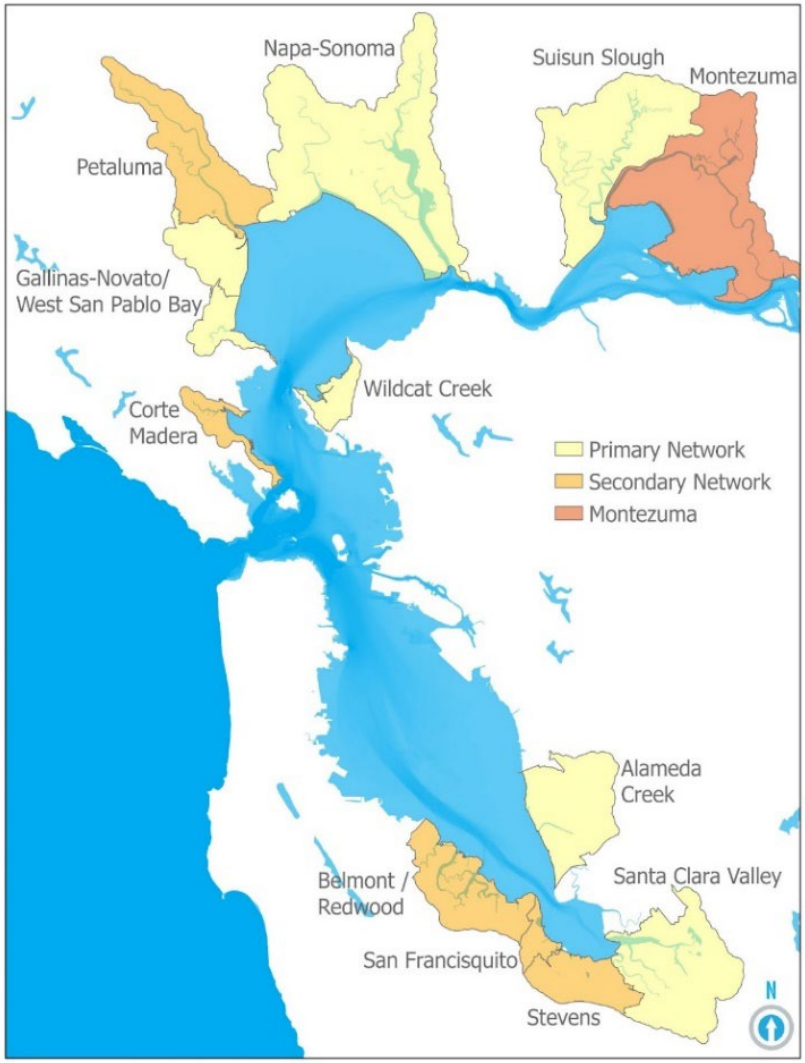
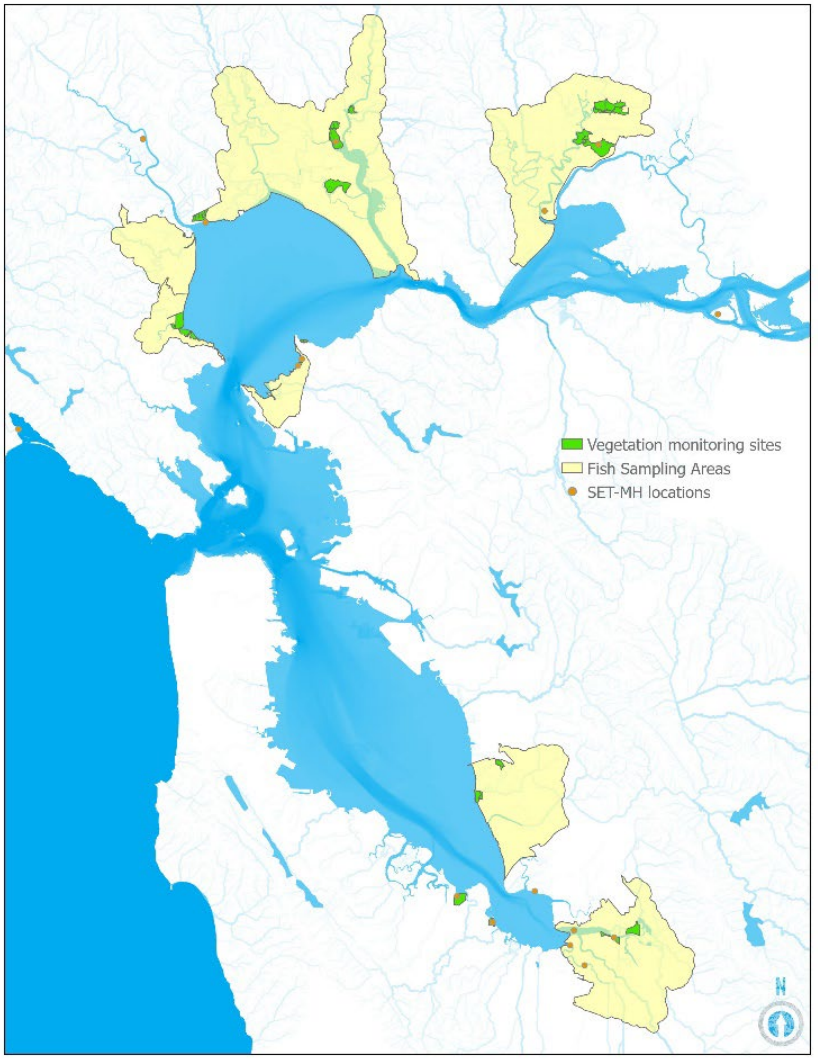


Figure 2. Map of known sampling locations.



In the 2025-2027 implementation period, the WRMP will:

- Horizontal/vertical control: Establish and monitor horizontal/vertical control markers and establish a permanent record of locations/positions.
- Photo-point monitoring: Establish long-term monitoring locations and a database structure for photo-point monitoring.
- LiDAR: Obtain LiDAR data for the Lower Estuary.
- Baylands Habitat Map: Create Baylands Habitat Map (BHM) 2025, generate map-based metrics, and analyze habitat changes over time.
- Vegetation Monitoring: Establish vegetation monitoring transects and measure key vegetation parameters, marsh surface elevation, and marker horizons.
- CRAM: Conduct California Rapid Assessment Method (CRAM) surveys at Monitoring Network Sites over time and develop regional assessments.
- Transition Zone Monitoring: Establish and monitor vegetation in the upland and mudflat transition zones at select Benchmark sites.
- Water Quality Monitoring: Establish a limited number of continuous water quality monitoring stations, including monitoring for suspended sediment.
- Surface Elevation Table-Marker Horizon (SET-MH) Monitoring: Continue monitoring of SET-MH sites and establish SET-MH stations at new sites.
- Fish and Fish Habitat (FFH): FFH monitoring by deploying recommended sampling methods to encompass sites in the Monitoring Site Networks.

Details for each monitoring element are highlighted below.

Establish and monitor horizontal/vertical control markers

Horizontal and vertical control are essential components of geodetic and surveying systems used to establish accurate and consistent reference frameworks for mapping and various geospatial applications. Existing local horizontal and vertical control points will be collated across the Estuary. Gaps in coverage will be identified and new control markers will be established in select areas following protocols to attain the required resolution and highest accuracy.

- **Scale of analyses/monitoring:** Estuary-wide collation of existing data; installation of new control markers at select sites
- **Frequency of analyses/monitoring:** Once
- **Duration of work:** Winter 2025 - Fall 2026
- **Cost:** $75,000
- **Information products:** Database of benchmark locations and information; online map of locations
- **WRMP Staff contact**: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Establish and monitor photo-point locations

Fixed photo point station locations will be distributed throughout a set of Project and Reference Sites at key areas of interest, which may include breach locations, areas expected to accrete rapidly, estuarine-terrestrial transition zones, the edges of tidal creeks, and related locations of expected geomorphic and vegetation change.

- **Scale of analyses/monitoring:** All Reference and Project sites where vegetation monitoring is occurring
- **Frequency of analyses/monitoring:** Once a year
- **Duration of work:** Annually
- **Cost:** $10,000
- **Information products:** Database of locations and photographs; online map of locations
- **WRMP Staff contact**: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Logistics to obtain LiDAR data for the Lower Estuary

LiDAR data will give the WRMP access to recent, high-resolution data of the region that provide information about topography and vegetation. LiDAR data will be used to create an elevation map and shoreline change mapping, among other products.

- **Scale of analyses/monitoring:** The lower estuary (San Pablo Bay, Central San Francisco Bay, and South San Francisco Bay)
- **Frequency of analyses/monitoring:** To be collected in Summer 2025; goal to repeat every 4-5 years
- **Duration of work:** June and/or July 2025
- **Cost:** $300,000 from RA; final cost is still in development, in partnership with many collaborators
- **Information products:** Archived and public records of Monitoring Sites Network data
- **WRMP Staff contact**: Pete Kauhanen (petek@sfei.org), Alex Braud (alexb@sfei.org)

Develop BHM 2025 and analyze map metrics and change over time

The BHM is a map of tidal marsh, tidal flats and diked baylands that is updated regularly to document changes in baylands distribution and abundance. The BHM is essential for wetland management and restoration, helping to characterize and quantify changes in baylands over time. BHM 2025 will be the second BHM map created as part of the WRMP and will quantify change to baylands over the five years.

- **Scale of analyses/monitoring:** Intertidal areas of the Lower San Francisco Estuary.
- **Frequency of analyses/monitoring:** 4-5 years, so one time during this Implementation Plan
- **Duration of work:** Summer 2025 through Winter 2026
- **Cost:** $655,000

- **Information products:** BHM 2025, spatial metrics derived from the map, and change analyses derived using previous mapping work
- **WRMP staff contact**: Pete Kauhanen (petek@sfei.org), Alex Braud (alexb@sfei.org)

Establish vegetation monitoring transects and measure key vegetation parameters, marsh surface elevation, and marker horizons

The WRMP will conduct long term site-level vegetation monitoring. Tracking changes in plant communities is critical to understanding the physical and biological characteristics of tidal wetlands at a regional scale and restoration site evolution over time. Site-level monitoring of vegetation cover allows additional tracking of species composition and abundance, tracking of invasive species, and validating and calibrating remotely sensed data. Furthermore, the vegetation within these habitats links crucial physical processes with dependent wildlife, playing a pivotal role in management.

- **Scale of analyses/monitoring:** Primary Monitoring Site Networks. Establish long-term vegetation transects at 18 sites. Establishment of additional feldspar marker horizon plots to monitor sediment deposition, and groundwater monitoring stations along a subset of transects.
- **Frequency of analyses/monitoring:** One round of monitoring during this Implementation Plan. Surveys will be repeated every 3-5 years at Benchmark and Reference sites and every 2-3 years at Project sites where restoration is ongoing.
- **Duration of work:** Transects established Winter 2024-2025; vegetation sampling Summer and Fall 2025
- **Cost:** $172,500
- **Information products:** Archived and public records of data, as well direct communication with landowners.
- **WRMP Staff contact**: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Logistics to conduct California Rapid Assessment Method (CRAM) surveys at Monitoring Network Sites

CRAM is a rapid assessment method for estuarine wetlands that scores various attributes of a wetland (physical, biotic, landscape setting, and hydrology) to develop an index of wetland condition. CRAM is an important tool for tracking wetland health and can be interpreted against already established patterns to understand quantitatively where a wetland's condition falls along the spectrum of wetlands in a region.

- **Scale of analyses/monitoring:** Primary Monitoring Site Networks
- **Frequency of analyses/monitoring:** CRAM assessments conducted one time annually; data analysis, QA/QC and report is ongoing
- **Duration of work:** Fieldwork in Summer/Fall of each year annually.
- **Cost:** $525,000
- **Information products:** Ecoatlas, WRMP website, archived and public records of data

- **WRMP Staff contact**: Sarah Pearce (sarahp@sfei.org), Sarah Lowe (sarahl@sfei.org)

Establish a limited number of continuous water quality monitoring stations

Expanded monitoring of water quality within tidal wetland complexes off the main stem of the Estuary is essential for improving models of sediment dynamics that drive much of the WRMP's regional-level mapping products. These monitoring stations provide fine-scale data on key drivers of wetland condition, function, and resilience to sea level rise.

- **Scale of analyses/monitoring:** Primary Monitoring Site Networks
- **Frequency of analyses/monitoring:** Monthly, continuous
- **Duration of work:** Following establishment, for the duration of this Implementation Plan
- **Cost:** $196,000 (split with transition zone monitoring under same subcontractor)
- **Information products:** Archived and public records of data, WRMP website
- **WRMP Staff contact**: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Establish vegetation monitoring transects along upland and channel transition zones

A series of short transects will be established along the boundaries of distinct tidal wetland plant assemblages called transition zones. This transition zone monitoring will encompass both upland/marsh edge and marsh/channel edge. These transects will be used in addition to the vegetation plot monitoring described above to better account for rare and uncommon species that are mainly found along these transition zones.

- **Scale of analyses/monitoring:** China Camp and Rush Ranch (Benchmark sites with upland transition zones)
- **Frequency of analyses/monitoring:** Every 3-5 years, one time during this Implementation Plan
- **Duration of work:** Upland transition zone established and monitored in Winter 2024/Spring 2025; channel transition zone established and monitored in Summer 2025
- **Cost:** $196,500 (split with water quality monitoring under same subcontractor)
- **Information products:** Archived and public records of data.
- **WRMP Staff contact**: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Logistics to continue monitoring Surface Elevation Table-Marker Horizon (SET-MH) sites established in 2023-2024

Sediment Elevation Tables - Marker Horizons (SET-MH) are a method to measure total elevation change and accretion; when multiple sites are monitored across a region, they provide information on accretion, elevation change, and shallow subsidence (compaction or expansion). This information will allow the WRMP to investigate questions on how elevations of marsh plans are changing and where tidal wetlands are able to keep up with sea level rise.

Scale of analyses/monitoring: One each in the Sonoma-Napa and Gallinas/Novato/West San Pablo Bay Primary Monitoring Site Networks (Figure 3)
Frequency of analyses/monitoring: Monitoring occurs twice annually; installation of new SET-MHs will occur in the Fall of each year
Duration of work: Yearly for duration of WRMP
Cost: $80,000
Information products: Archived and public records of data, WRMP website
WRMP Staff contact: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Fish and Fish Habitat Monitoring

FFH monitoring provides information on how habitats for assemblages of fish using tidal marsh ecosystems are changing over time, and how the distribution and abundance of key native species of fish are changing over time.

Scale of analyses/monitoring: Priority Monitoring Site Networks, and Secondary Monitoring Site Networks (where feasible). Up to 20 otter trawl samples per season per year within each of the 7 Priority Monitoring Site Networks. See Figure 2 for survey regions.
Frequency of analyses/monitoring: Seasonal sample sessions (Spring 2025, Summer 2025, Fall 2025, Winter 2025).
Duration of work: ongoing for duration of WRMP
Cost: $1,500,000
Information products: Archived and public records of data
WRMP Staff contact: Lisa Beers (lisab@sfei.org), Aviva Rossi (avivar@sfei.org)

Conclusion

In total, the WRMP plans to spend approximately $3.51M directly on data collection in 2025-27, based on current available funding and leveraging in-kind support from project partners. The WRMP Implementation Plan will be updated as the program secures additional funding.

References

WRMP. 2024a. San Francisco Estuary Wetlands Regional Monitoring Program: 2024 Monitoring Plan. Prepared by the WRMP Science Team, WRMP Technical Advisory Committee, and the San Francisco Estuary Institute. https://www.wrmp.org/resources/

WRMP. 2024b. Wetland Regional Monitoring Program Guidelines for Monitoring Fish and Fish Habitats. https://www.wrmp.org/resources