Environmental Assessment/
Environmental Impact Report
Administrative Final

Prepared for:

US Army Corps of Engineers ®
San Francisco District

CALIFORNIA
WATER BOARDS
San Francisco Bay

Prepared by:

SCOUT | Stantec
A MENTOR-PROTÉGÉ JOINT VENTURE

Project Name:

San Francisco Bay Federal Channels
Operation and Maintenance Dredging and Sediment Placement Activities, Dredging Years 2025-2034
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San Francisco Bay Federal Channels Operation and Maintenance Dredging and Sediment Placement Activities, Dredging Years 2025 – 2034

Prepared for

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ABBREVIATIONS

$\mu g/m^3$	micrograms per cubic meter
°F	degrees Fahrenheit
AAQS	ambient air quality standards
AB	Assembly Bill
APE	area of potential effects
Alt	alternative
AWOIS	Automated Wreck and Obstruction Information System
B	beneficial
BAAQMD	Bay Area Air Quality Management District
BART	Bay Area Rapid Transit
Basin Plan	Water Quality Control Plan for the San Francisco Basin
Bay Plan	San Francisco Bay Plan
BCDC	San Francisco Bay Conservation and Development Commission
BiOp	Biological Opinion
BMPs	best management practices
BRRIT	Bay Restoration Regulatory Integration Team
BUDM	beneficial use of dredged material
C.F.R.	Code of Federal Regulations
CAA	Clean Air Act
Cal/OSHA	California Division of Occupational Health and Safety
CARB	California Air Resources Board
CCA	California Coast Act
CCC	California Coastal Commission
CCMP	California Coastal Management Program

CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEC	contaminant of emerging concern
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
C.F.R	Code of Federal Regulations
CH_4	methane
CMA	Critical Maneuvering Area
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CRHR	California Register of Historical Resources
CSLC	California State Lands Commission
CSWO	Office of Coastal Survey Wrecks and Obstructions Database
Cullinan Ranch	Cullinan Ranch Restoration Project
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
CY	cubic yard
CY/day	cubic yards per day
CY/year	cubic yards per year
CZMA	Coastal Zone Management Act
dB	decibel
dBA	A-weighted decibels
DDT	dichloro-diphenyl-trichloroethane
Delta	Sacramento-San Joaquin River Delta
DGL	dredging guidance letter
DMMO	Dredged Material Management Office
DPS	Distinct Population Segment
EA	Environmental Assessment
EA/EIR	Joint Environmental Assessment/Environmental Impact Report
eDNA	environmental DNA
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ENC	electronic navigational charts
EO	Executive Order

ESA	Endangered Species Act (federal)
Estuary	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
ER	Engineering Regulation
ESUFMP	fisheries management plan
FMWT	Fall Midwater Trawl
FR	Federal Register
FY	fiscal year
GHG	greenhouse gas
gpm	gallons per minute
GWP	global warming potential
HAP	hazardous air pollutant
HMBP	hazardous materials business plan
ID	indefinite deferral
ITM	Inland Testing Manual
lbs/day	pounds per day
LTMS	Long Term Management Strategy for the Placement of Dredged Material in San Francisco Bay
LTS	less than significant
MARPOL	International Convention for the Prevention of Pollution from Ships
Master SAP	Master Sampling and Analysis Plan
MET	Modified Elutriate Test
MLD	Most Likely Descendant
MLLW	mean lower low water
mm	millimeter
MMPA	Marine Mammal Protection Act
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSC	San Francisco Harbor Main Ship Channel
MSL	mean sea level
MWRP	Montezuma Wetlands Restoration Project
N_2O	nitrous oxide
N/A	not applicable
NA	No Action Alternative
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NSCI	no significant cumulative impacts
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act

NI	no impact
NMFS	National Marine Fisheries Service
NOx	nitrogen oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOP	Notice of Preparation
NP	No Project Alternative
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRFI	no significant reasonably foreseeable impacts
NUAD	not suitable for unconfined aquatic disposal
O_3	ozone
O&M	operations and maintenance
OPA	Oil Pollution Act
OSHA	(federal) Occupational Safety and Health Administration
OTM	Ocean Testing Manual
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyl
PFMC	Pacific Fisheries Management Council
PM_{10}	particulate matter with a diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with a diameter of 2.5 micrometers or less
Porter-Cologne Act	Porter-Cologne Water Quality Control Act of 1969
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRC	California Public Resources Code
RCRA	Resource Conservation and Recovery Act
RDMMP	Regional Dredged Material Management Plan
Regional Water Board	San Francisco Bay Regional Water Quality Control Board
RMP	Regional Monitoring Program
RMS	root mean square
ROG	reactive organic gas
ROI	region of influence
SCC	California State Coastal Conservancy
SF-8	San Francisco Bar Channel Placement Site
SF-9	Carquinez Strait placement site

SF-10	San Pablo Bay placement site
SF-11	Alcatraz Island placement site
SF-16	Suisun Bay placement site
SF-17	Ocean Beach Demonstration Site
SF Bay	San Francisco Bay
SFBAAB	San Francisco Bay Area Air Basin
SF-DODS	San Francisco Deep Ocean Disposal Site
SFEI	San Francisco Estuary Institute
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLR	sea level rise
SO_2	sulfur dioxide
SPL	sound pressure level
State Water Board	State Water Resources Control Board
TBD	to be determined
TEU	Twenty-Foot Equivalent Unit
TMDL	Total Maximum Daily Loads
tpy	tons per year
UIHC	Upper Inner Harbor Channel
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Unified Program	Unified Hazardous Waste and Hazardous Materials Management Regulatory Program
UTM	Upland Testing Manual
Valley Water	Santa Clara Valley Water
VOC	volatile organic compounds
WDR	waste discharge requirements
WETA	San Francisco Bay Area Water Emergency Transportation Authority
WQC	water quality certification
WRDA	Water Resources Development Act

Executive Summary

The United States Army Corps of Engineers (USACE), San Francisco District proposes to continue maintenance dredging of the federal navigation channels in San Francisco Bay (SF Bay) to maintain their navigability. The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) will consider issuing a Clean Water Act (CWA) Section 401 Water Quality Certification (WQC) and Waste Discharge Requirements (WDR) pursuant to the State of California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act) for USACE's continued maintenance dredging operations in SF Bay. This authorization is referenced throughout this document as WQC/WDR. Dredging involves the excavation of accumulated sediment from the channel, as well as the transportation and placement of the sediment at a permitted location, consistent with permit conditions established by applicable regulatory agencies. Approximately 2 to 2.5 million cubic yards (CY) of maintenance dredge material is removed from the federal navigation channels each year. Sediment must be tested for suitability for placement at any site.

USACE and the Regional Water Board prepared this joint Environmental Assessment and Environmental Impact Report (EA/EIR) to address the environmental effects of implementing and permitting maintenance dredging of federal navigation channels in SF Bay and the associated placement of dredged material. See Figure ES-1 for the location of federally authorized dredging projects and placement sites in the study area; Table ES-1 lists placement location categories and examples.

This document is intended to fulfill USACE's National Environmental Policy Act (NEPA) compliance requirements for continuation of maintenance dredging in SF Bay over a roughly ten-year period beginning in dredging year 2025 and continuing through 2034, with the potential for projects to extend into early 2035[1]. It is also intended to fulfill the Regional Water Board's California Environmental Quality Act (CEQA) compliance requirements for issuance of a multiyear WQC/WDR to USACE governing dredge and fill activities. Additionally, for maintenance dredging projects involving the discharge of dredged or fill material into waters of the United States, this document provides the Section 404(b)(1) analysis for maintenance dredging in compliance with the CWA. Although USACE does not issue permits to itself, USACE must demonstrate compliance with Section 404 of the CWA.

This EA/EIR is prepared in accordance with NEPA, Section 404 of the CWA, and CEQA Guidelines. USACE is the NEPA lead agency, and the Regional Water Board is the CEQA lead agency.

The environmental impacts of maintenance dredging of the federal navigation channels for the previous ten-year dredging period, 2015 to 2024, were analyzed in the 2015 EA/EIR for maintenance dredging of the federal navigation channels in SF Bay (USACE and Regional Water Board 2015). This EA/EIR is an update of the 2015 EA/EIR, which is relied upon for background information and cited where relevant.

[1] Dredging year refers to the calendar year in which dredging is planned to begin. In some cases, dredging episodes associated with a dredging year can extend past the end of the calendar year.

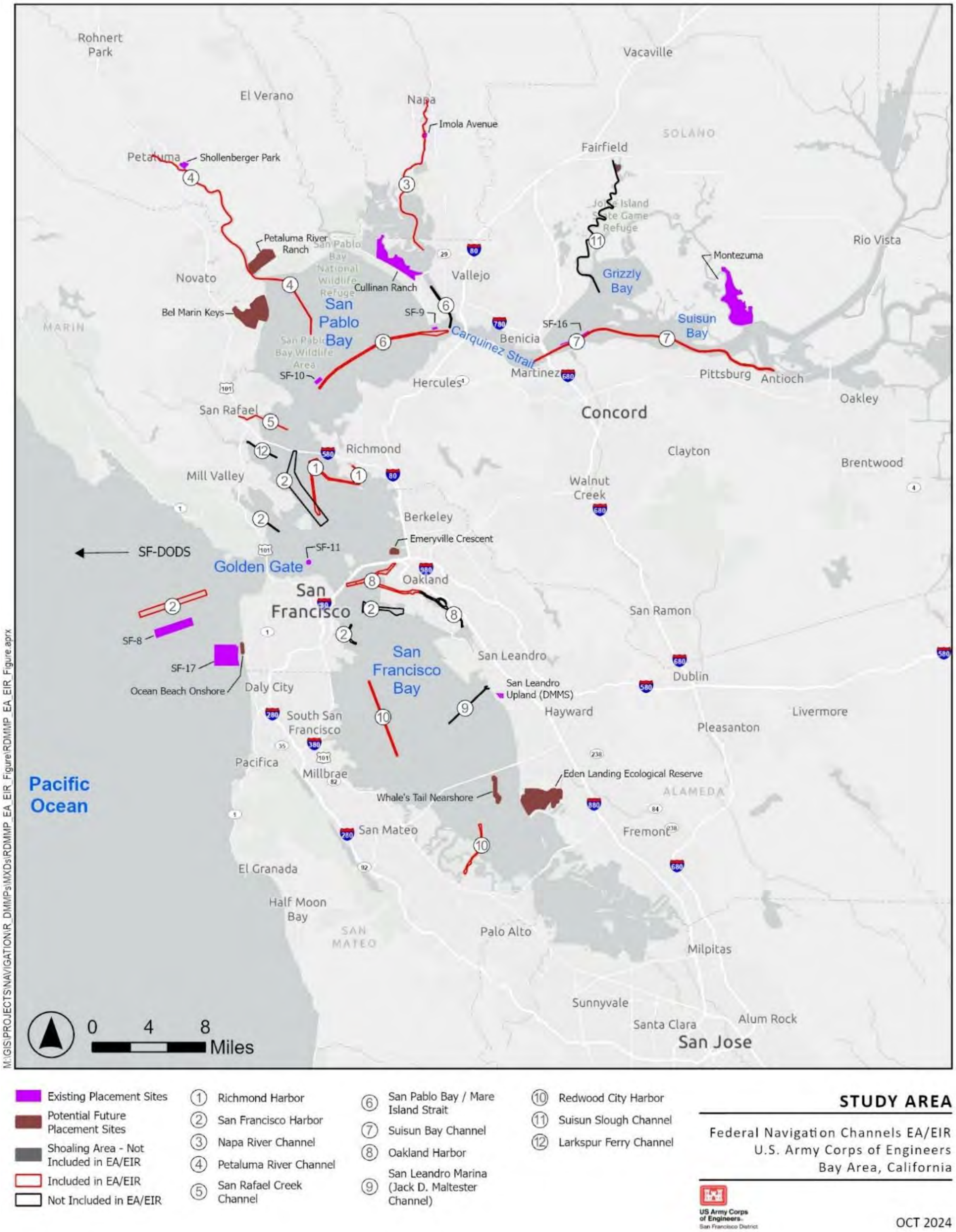

Figure ES-1. Authorized Dredging Projects and Placement Sites in the Study Area

Table ES-1. Placement Type Categories

Placement Type Category	Example Placement Location
Existing Beneficial Use Sites:	
Non-Aquatic Direct Placement Sites	Cullinan Ranch Restoration Project, Montezuma Wetlands Restoration Project
Nearshore Strategic Placement Sites	SF-17 (Ocean Beach Nearshore Placement Site)
Transitional Placement[2] Site	
Bar Channel Placement Sites	SF-8 (San Francisco Bar Channel Placement Site)
In-Bay Placement Sites	SF-9 (Carquinez Strait Placement Site), SF-10 (San Pablo Bay Placement Site), SF-11 (Alcatraz Placement Site), SF-16 (Suisun Bay Placement Site)
Upland (Sponsor-Provided) Sites	Shollenberger Park, Imola Avenue
Disposal	
Deep Ocean Disposal Site	SF-DODS
Possible Future Beneficial Use Placement Site	
Non-Aquatic Direct Placement Sites	Bel Marin Keys, Skaggs Island (Haire Ranch), Southern Eden Landing Ecological Reserve, Alviso Ponds (A8 Complex), Ocean Beach Onshore, Surfers Beach, Stinson Beach Onshore
Nearshore Strategic Placement Sites	Bel Marin Keys Nearshore (proximal to Petaluma River and Across the Flats Channel), Cogswell Marsh Nearshore (proximal to Oakland Inner and Outer Harbor and Redwood City Harbor Channels), Emeryville Crescent Nearshore (proximal to Oakland Outer Harbor Channel), Faber Tract (proximal to Redwood City Harbor Channel), Giant Marsh Nearshore (proximal to San Pablo Bay Pinole Shoal Channel), Ryer Island Nearshore (proximal to Suisun Bay Channel), Stege Marsh Nearshore (proximal to Richmond Inner Harbor Channel), Stinson Beach Nearshore (proximal to Main Ship Channel), Surfers Beach Nearshore (proximal to Main Ship Channel), Whale’s Tail Nearshore (proximal to Redwood City Harbor Channels) Water Column Seeding Sites: Arrowhead Marsh, Corte Madera Marsh, Faber Tract, Pond A6 (Knapp Tract), Ravenswood
Elevation Augmentation/Marsh Spraying Sites	Bothin Marsh, Sears Point

Key:
SF-8 = San Francisco Bar Channel placement Site
SF-9 = Carquinez Strait placement site
SF-10 = San Pablo Bay placement site
SF-11 = Alcatraz Island placement site
SF-16 = Suisun Bay placement site
SF-17 = Ocean Beach Demonstration Site
SF-DODS = San Francisco Deep Ocean Disposal Site

[2] Transitional placement is placement category defined by USACE as keeping sediment in the riverine or coastal system as a part of a management process or in a period of transition. See accompanying RDMMP planning document that discusses transitional placement in more detail in Section 2. Existing Placement Sites, and the August 2023 memorandum on Expanding BU of Dredged Material in the USACE (USACE 2023a, page 2).

Project Purpose, Need, and Objectives

USACE is authorized by Congress to maintain navigability of federal navigation channels. Accumulation of sediment that settles in these channels can impede navigability and present navigation safety hazards. Maintenance dredging removes this sediment and returns the channels to authorized depths. Accordingly, USACE's overall project purpose is to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation, which is achieved through continuing to dredge federal navigation channels in the SF Bay Area. This basic project purpose is to provide safe, reliable, and efficient waterborne transportation systems. The basic purpose is water dependent as defined by 40 C.F.R. Part 230 since it cannot be fulfilled outside of an aquatic environment. The purpose and need of the proposed action alternatives is to facilitate safe and efficient navigation in the federal navigation channels in San Francisco Bay through the placement of maintenance dredged material. Dredging will be consistent with navigation project authorizations and, to the maximum extent possible, the 20-Year Regional Dredged Material Management Plan (RDMMP), which is a companion document to this EA/EIR (USACE 2024a). The purpose of the RDMMP is to develop a comprehensive 20-year strategy that identifies the Federal Standard Base Plan[3] for the dredging of federal navigation projects and the placement of dredged material in the SF Bay Area. Where applicable, the project would be aligned with the goals of the Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) program, as described in the 1998 LTMS Final Environmental Impact Statement/EIR (USACE et al. 1998) and the 2001 Long Term Management Strategy for the Placement of Dredged Material in San Francisco Bay (LTMS) Management Plan (USACE et al. 2001). The NEPA document covers the implementation of the first 10 years of the RDMMP, after which additional NEPA may be pursued as necessary to address any potential future changes.

The Regional Water Board has authority under CWA Section 401 and the Porter-Cologne Act to issue permits that regulate dredge and fill activities. The Regional Water Board will review USACE's application for a WQC/WDR for continued maintenance dredging and placement of dredged material in the SF Bay Area. To issue a WQC/WDR to USACE, the Regional Water Board must analyze and disclose water quality conditions and other environmental impacts of the project; consider alternatives that would avoid or substantially reduce potentially significant impacts of the project as approved; adopt, or make a condition of approval, all feasible mitigation measures for potentially significant impacts within its authority; and demonstrate compliance with all applicable state water quality requirements.

The following objectives are detailed in accordance with CEQA requirements. Specific project objectives include:

- Provide safe, reliable, and efficient navigation through federal channels in SF Bay in a feasible manner.

[3] The Federal Standard is the least costly dredged material disposal or placement alternative(s) that is consistent with sound engineering practices and meets all federal environmental requirements, including those established under Section 404 of the Clean Water Act and Section 103 of the Marine Protection, Research, and Sanctuaries Act. For dredged material placement, USACE fully considers all practicable and reasonable alternatives on an equal basis, including the use of dredged material beneficially, to identify the Federal Standard (33 CFR Parts 335-338). "Base Plan" is an operational manifestation of the Federal Standard because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project (Source: USACE's ER 1105-2-103).

- Align, where applicable, with the goals of the LTMS program as described in the 1998 LTMS Final Environmental Impact Statement (EIS)/EIR and the 2001 LTMS Management Plan, within the constraints of the Federal Standard Base Plan.
- Increase the minimum amount of dredged material beneficially used[4] by USACE for wetland restoration and conservation within the constraints of the Federal Standard Base Plan.
- Conduct dredging in a manner that adequately protects the environment, including protection of listed species, essential fish habitat (EFH), and beneficial use of waters.[5]

Alternatives

This EA/EIR includes six alternatives for detailed evaluation: the NEPA No Action Alternative, the CEQA No Project Alternative, and four action alternatives. The NEPA No Action Alternative represents "'no change' from a current management direction or level of management intensity" (*Am. Rivers v. FERC*, 201 F.3d 1186, 1201 (9th Cir. 1999)). The CEQA No Project Alternative represents "the existing conditions at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" (CCR Title 14 Section 15126.6). Although the No Action and No Project alternatives are functionally the same, in this case they differ in that the No Action Alternative includes federally authorized elements, even if they were not being implemented at the time this document was prepared, whereas the No Project Alternative only considers actions currently being implemented. The Proposed Action (NEPA)/Proposed Project (CEQA) Alternative is a combination of multiple alternatives and is not described separately as a standalone alternative. Measures common to all alternatives, along with descriptions of each of the alternatives evaluated in this EA/EIR, are described below.

Maintenance dredging typically involves the following steps: 1) surveying a site to identify sediment accumulated (shoaled) above authorized project depth, then sampling and testing for sediment quality; 2) excavating shoaled sediment from the dredging site; 3) transporting dredged sediment via scows, hopper dredges, or pipeline to the designated placement site(s); and 4) placing and managing the dredged material at the designated site, or transfer to another permitted location for placement or use.

Measures Common to All Alternatives

All alternatives evaluated in this EA/EIR include two categories of dredging methods performed by USACE for maintenance dredging in SF Bay: hydraulic and mechanical dredging. In hydraulic dredging, hopper or cutterhead ships are typically used to remove sediment via suction through hydraulic pipelines. Hopper dredges store suctioned sediment on board for later placement. USACE mainly uses two federally owned hopper dredges for hopper dredging in the SF Bay Area: the *Essayons* and the *Yaquina*. Cutterhead-pipeline dredges use a pipeline to deposit suctioned sediment directly at placement sites. USACE mechanical dredging in SF Bay is typically conducted with clamshell dredgers. Clamshell dredgers use buckets, which are opened, dropped vertically to the dredging locations, and closed around

[4] Beneficial use or reuse is the reuse of dredged sediment for construction, levees, tidal wetland restoration or other projects.

[5] Beneficial uses of waters of the state "that may be protected against degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves." Wat. Code, sec. 13050, subd. (e). The Water Quality Control Plan for the San Francisco Bay Region designates beneficial uses of waters in the region.

sediment, which is then lifted and deposited on a scow or barge. Placement can occur via bottom-dumping from split-hull scows or hopper dredges, via a slurry (i.e., mixed water and sediment for mobilization) that is pumped off via a pipe offloader from scows or hopper dredges, or via direct delivery from cutterhead dredges to pipelines and transported by booster pumps, if necessary, to placement sites.

Existing placement sites include beneficial use sites - non-aquatic direct placement sites and nearshore strategic placement sites; transitional placement sites - San Francisco Bar Channel Placement Site (SF-8), in-Bay placement sites, and non-federal sponsor-provided upland sites; and the disposal site - San Francisco Deep Ocean Disposal Site (SF-DODS). Potential future beneficial use placement sites that may be authorized within the 10--year planning horizon for this document are described in the RDMMP. Use of these sites by USACE would require completion of supplemental environmental review under NEPA and/or CEQA, and environmental approvals from resource and regulatory agencies. Types of possible future beneficial use placement sites include non-aquatic direct placement sites, nearshore strategic placement sites, elevation augmentation/marsh spraying sites, and water column seeding sites.

Under all alternatives, dredging and placement would be conducted in accordance with the following measures:

- Dredging at each project location would be limited to the authorized depth, plus any allowable overdepth.
- Knockdowns (i.e., knocking down high spots or isolated shoals) may be performed in all locations except the San Francisco Harbor Main Ship Channel (MSC). The volume of material above project design depth to be knocked down is not anticipated to exceed 15,000 CY per year in each deep-draft channel. Knockdowns are subject to the same sediment testing requirements and approvals as full dredging episodes.
- No overflow would be discharged from any barge during transportation, except for spillage incidental to clamshell dredge operations.
- Overflow from hopper-type suction dredges would be limited to no longer than 15 minutes at the dredge site during any one excavation action (cut). Overflow would be unrestricted when dredging material is greater than 80 percent sand.
- Dredging would be conducted during the following time periods:
  - Between June 1 and November 30, to the extent feasible at Oakland Inner and Outer Harbor, Redwood City Harbor (Channels and San Bruno Shoal), Richmond Inner and Outer Harbor, MSC, San Pablo Bay (Pinole Shoal), Petaluma (River Channel and Across the Flats), and San Rafael Creek.
  - Only between August 1 and November 30 at Suisun Bay Channel/New York Slough, and Napa River.
  - Due to the priority hopper dredging in the Columbia River, it is expected that hopper dredging would only occur in June at Richmond Outer Harbor and Pinole Shoal, and that hopper dredging would occur between December and February for Oakland Harbor and Richmond Inner Harbor. However, there may be times when dredging these channels occurs in other months of the year.
- Dredging and placement activities would be consistent with the work window requirements set out by National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) in their Biological Opinions (BiOp) on the LTMS (USFWS 2004a; NMFS 2015).

- Dredging would stop immediately following any fuel or hazardous waste leaks or spills, and cleanup actions would be implemented.
- During dredging and placement activities, notes to mariners and navigational warning markers would be used as needed to prevent navigational hazards.
- Avoidance and minimization measures, as identified in LTMS BiOps (NMFS 1998, 2015; USFWS 1999, 2004a, 2004b, 2024, 2025) and EFH consultation (USACE and USEPA 2011) would be employed to reduce impacts to species and habitat.
- Avoidance and minimization measures for Cultural and Tribal Resources will include opportunistic monitoring when work is proposed in culturally sensitive areas identified through the archaeological sensitivity analysis, as well as adherence to inadvertent discovery protocols to evaluate findings and prevent further disturbance.

The following measures would be implemented for hydraulic dredging to protect longfin smelt and delta smelt:

- No dredging would occur in water ranging from 0 to 5 parts per thousand salinity between December 1 and June 30.
- At the beginning and end of each hopper load, pump priming, drag head clearing, and suction of water would be conducted within three feet of the seafloor.
- Hopper drag head suction pumps would be turned off when raising and lowering the drag arms from the seafloor when turning the dredge vessel.
- USACE would implement a worker education program for listed fish species that could be adversely impacted by dredging. The program would include a presentation to all workers on biology, general behavior, distribution, and habitat needs, sensitivity to human activities, legal protection status, and project-specific protective measures. Workers would also be provided with written materials containing this information.
- The drag head, cutterheads, and pipeline intakes will remain in contact with the sea floor during suction dredging.
- The drag head water intake doors will be kept closed to the maximum extent practicable in locations most vulnerable to entraining smelt. In circumstances when the doors need to be opened to alleviate clogging, the doors will be opened incrementally (i.e., the doors will be opened in small increments and tested to see if the clog is removed) to ensure that doors are not fully opened unnecessarily.
- USACE will develop and implement a pilot study to assess the potential for directing fish away from the hopper dredge during operations to reduce entrainment. The study likely will involve installing and operating fish deterrent equipment such as lights, sound speakers, and/or air jets that would trigger an avoidance response in fish and thus push them from the area of exposure and substantially reduce the risk of entrainment. Light and sound have been shown to trigger avoidance behavior in some fish species, though they may attract others (HDR 2015). There is no data on avoidance or attraction for longfin smelt. Consequently, the pilot study may include laboratory tests providing USFWS and California Department of Fish and Wildlife (CDFW) would allow for some individual longfin smelt be collected to be used for testing. The pilot study will be implemented for two years. If testing indicates that the measures are likely to reduce entrainment, then USACE will assess the feasibility of long-term implementation.

USACE has been testing both environmental DNA (eDNA) sampling and the use of an echosounder in conjunction with hopper dredging activities. From July 21 through July 31, 2023, during hopper dredging by the *Essayons* at Pinole Shoal Channel, six eDNA sampling events with three replicates per sample occurred. These samples later were assessed for the presence of longfin smelt. Despite being repeatedly observed during the physical entrainment monitoring aboard the *Essayons*, no longfin smelt were detected in the eDNA samples (ICF 2023). However, USACE also funded a study of new eDNA collection methodologies in wetlands, which found good detection probabilities of longfin smelt when sampling a large volume of water with a tow net and concentrating the eDNA (Bowen et al. 2024). Prior to dredging, eDNA samples could be collected from two potential dredging locations (likely Pinole Shoal Channel and Richmond Outer Harbor) using the newer methodology, tested the same day for the presence of longfin smelt, and then used to prioritize the order of dredging based on the presence or absence of longfin smelt. Similarly, echosounder data could be collected to assess the fish community in potential dredging locations, and prioritization for dredging could be based on those results. Results will be evaluated for the potential to inform measures for avoidance and minimization measures to fish or other species from dredging operations. If results show measures would cause detrimental impacts to species techniques would be revised. Regardless, under all alternatives, USACE would meet all federal environmental compliance requirements (e.g., CWA Section 404, Endangered Species Act, Marine Protection, Research, and Sanctuaries Act), including those federal requirements implemented by state agencies as applicable (e.g., CWA Section 401, Coastal Zone Management Act).

- USACE will conduct pacific herring spawn monitoring during all dredge events in potential spawning habitat between December 1 and March 15. USACE will contact CDFW and coordinate to secure a herring monitor to identify spawns. If observed, USACE will avoid the spawn area until hatch out is complete (14-21 days) and CDFW gives approval to restart.

- USACE will mitigate for take of listed species by taking the sediment dredged outside the work window to beneficial use or an equivalent volume in the following year as required by the NMFS' 2015 LTMS Amended Programmatic Biological Opinion.

No Action Alternative and No Project Alternative

Under NEPA, in cases where the project involves modification of an existing program or management plan, the No Action Alternative may be defined as no change from the current authorized program, or no change in management direction or intensity (*Am*. *Rivers v. FERC*, 201 F.3d 1186, 1201 (9th Cir. 1999)). The No Action Alternative includes activities that may not be necessarily implemented in the current program, but are authorized to occur, such as more frequent dredging.

Section 15126.6 (e)(3)(A) of the CEQA Guidelines states that "when the project is the revision of an existing land use or regulatory plan, policy or ongoing operation, the No Project Alternative will be the continuation of the existing plan, policy or operation into the future." Therefore, under CEQA, the No Project Alternative is a continuation of existing dredging activities. USACE would continue current maintenance dredging practices for the projects it maintains in SF Bay, and the Regional Water Board would consider issuing a WQC/WDR based on USACE's current dredging practices.

The No Action Alternative and No Project Alternative differ in that the No Action Alternative represents the current authorized dredging program, regardless of current implementation, given that past implementation is different than current implementation due to recent restrictions (Regional Water Board

2020) placed on hydraulic dredging in SF Bay. The No Project Alternative, in contrast, represents the current, ongoing dredging operation as implemented over the last permit period per CEQA Guidelines Section 15126.6(e)(3)(A). The No Action Alternative is used as the baseline alternative for NEPA. The No Project Alternative is the baseline under CEQA because it is the same as the existing physical setting (CEQA Guidelines Section 15126.6(e) (1)).

The No Action Alternative and No Project Alternative assumptions are the same in all aspects, except that the No Action Alternative includes all authorized activities, even if they were not implemented at the time this document was prepared. Alternatively, the No Project Alternative includes only dredging activities that were carried out during the previously authorized ten-year program. Specifically, the difference between the No Action Alternative and the No Project Alternative is the dredging frequency at Richmond Outer Harbor and the Pinole Shoal Channel portion of San Pablo Bay. Under the No Action Alternative, dredging is assumed to occur every year via hopper at these locations; under the No Project Alternative, dredging occurs every other year via hopper. In addition, there are a few project depths that are authorized but not currently maintained by USACE at those depths, namely, Richmond Inner Harbor, Richmond Outer Harbor, and Napa River.

The No Action Alternative would continue to execute the navigation dredging program in the same way as it has been done in the past 10 years, as authorized. This alternative would place approximately 0 percent of dredged sediment at non-aquatic beneficial use sites, approximately 45 to 55 percent at deep ocean disposal sites, approximately 30 to 40 percent at in-Bay sites, approximately 5 to 15 percent at ocean beneficial use sites, approximately 0 to 10 percent at ocean sites, and approximately 0 to 10 percent at upland (sponsor-provided) sites. This baseline condition was constructed based on the current navigation program, replicating how each channel would be dredged, how frequently each channel would be dredged, and where the sediment from each channel would be placed. A summary of the No Action Alternative/No Project Alternative and the other evaluated alternatives is provided in Table ES-2.

Action Alternatives

Four action alternatives were developed and evaluated by USACE through the RDMMP process and are described below. The RDMMP contains detailed information on the alternative development process.

Alternative 1, Beneficial Use: Diversion from Deep Ocean Disposal

This alternative proposes to implement the No Action Alternative, except that a federal project otherwise slated for ocean disposal at SF-DODS may be split between placement in-Bay and at a non-aquatic beneficial use site to achieve additional BUDM while maintaining the same cost. In taking this approach, at the Bay-wide programmatic level, this alternative proposes to increase placement of dredged sediment at non-aquatic beneficial use sites from approximately 0 percent (No Action Alternative/No Project Alternative) to 5 to 20 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 10 to 40 percent; and to increase in-Bay placement from approximately 30 to 40 percent to 35 to 55 percent at in-Bay sites annually[6]. The remaining placement category percentage ranges would remain the same as for the No Action Alternative/No Project

[6] Efforts will be made to beneficially use material, if feasible. If BU sites are not available or feasible, USACE will place material at the Federal Standard Base Plan site(s) assigned under the No Action Alternative.

Alternative. The percentages of material going to each category vary depending on the level of maintenance dredging required and the project being diverted from SF-DODS.

This alternative was constructed by identifying the opportunities to divert material from deep ocean disposal, i.e., which channels' previous Federal Standard Base Plan sites were SF-DODS under the No Action Alternative/No Project Alternative, including Oakland Inner and Outer Harbor and Richmond Inner Harbor. Based on the cost estimates developed through the RDMMP's cost engineering process, the optimal split for each channel between in-Bay placement and non-aquatic beneficial use placement was determined by matching the combined cost of the two placements with the cost of disposal at SF-DODS. Based on the volume to be placed at in-Bay and non-aquatic beneficial use sites from each channel, it was then determined which channel would be the more efficient split to pursue based on the current economic conditions, or whether pursuing both would be a viable option. The current cost estimates suggest that it is more effective to use Richmond Inner Harbor, which produces a higher percentage of beneficial use placement than Oakland (55 percent in-Bay to 45 percent non-aquatic beneficial use split for Richmond Inner Harbor, rather than 65 percent in-Bay to 35 percent beneficial use split for Oakland Inner and Outer Harbor). However, it is feasible that a different federal channel, such as Oakland, may be the source of the diversion in the future due to different economic and market conditions, equipment availability, technical feasibility, or environmental acceptability. Therefore, for the purposes of this EA/EIR, different potential scenarios for meeting the Federal Standard Base Plan may occur under Alternative 1 by using hopper dredging to increase placement at in-Bay/upland sites and to provide flexibility in achieving the split[7]. To mitigate for entrainment impacts to longfin smelt from the increase in hydraulic dredging, this alternative includes BUDM as a minimization measure to reduce the impacts to longfin smelt from hopper dredging. Alternative 1 has more BUDM than the No Action Alternative/No Project Alternative.

Alternative 2, Beneficial Use: Regional Optimization, Leverage Hopper Dredging

This alternative proposes to increase hopper dredging in the Bay to offset the increased cost of BUDM to achieve more beneficial use than Alternative 1 and the No Action Alternative/No Project Alternative. Hopper dredging can be increased to include Richmond Inner Harbor or Oakland Harbor or a mixture of both projects. Placement with a hopper dredge is usually limited to in-Bay as the government dredge, the *Essayons*, is unable to place material upland. Therefore, BUDM volume from another project using a clamshell or hydraulic dredge with pumpoff capability would be required. Ultimately, this alternative proposes to increase BUDM placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 20 to 30 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent; and to increase in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 50 to 60 percent. The other category percentage ranges remain the same as No Action Alternative/No Project Alternative. These percentages at the Bay-wide, programmatic level may vary depending on the level of maintenance dredging required and which channels are dredged hydraulically to be placed in-Bay. This alternative in the RDMMP identifies that Richmond Inner Harbor would be dredged hydraulically to allow most of Oakland Harbor to be placed at a non-aquatic beneficial use site. This is one example of how to execute the navigation program in line with the theme of this alternative. However, it is possible that hydraulic dredging could occur in other channels (e.g., Oakland Inner and Outer Harbor) in exchange for mechanical dredging in others for non-aquatic beneficial use (e.g., Richmond Inner and/or Outer Harbor)

[7] Hopper dredges can place sediment at non-aquatic BU or upland sites if the hopper dredge has pumpoff infrastructure.

to execute the program differently than above in the future due to different economic and market conditions, technical feasibility, or environmental acceptability.

This alternative was constructed by first identifying the least-cost dredging method and placement site combination for each channel. In most cases, the least-cost options were in-Bay sites, and the least-cost dredging methods were hydraulic dredging where technically feasible. However, since this would result in nearly all dredged sediment being placed at in-Bay sites, a cost effectiveness analysis was done to determine which channels should be diverted from in-Bay placement to non-aquatic beneficial use placement. This approach used the cost difference between each channel's beneficial use placement and least-cost placement site option and resulted in the selection of the most cost-effective channels to be diverted to non-aquatic beneficial use. BUDM placement was prioritized over ocean disposal as the diversion destination to maximize beneficial use and avoid ocean disposal. Importantly, this alternative also sought to achieve cost parity with the No Action Alternative/No Project Alternative, like Alternative 1, but at the regional scale. As such, the maximum volume of sediment was diverted to non-aquatic beneficial use that would keep the regional cost the same as the No Action Alternative/No Project Alternative. Doing so represents the regionally optimal approach (i.e., maximum BUDM, minimum ocean disposal, and equal cost to the No Action Alternative/No Project Alternative).

This breakdown is one example of how to execute this alternative at the regional scale. While some channels can achieve cost savings by placing dredged material at a different in-Bay site than its placement site under the No Action Alternative/No Project Alternative (e.g., San Pablo Bay [Pinole Shoal]), the bulk of the cost savings comes from Richmond Inner Harbor and a portion of Oakland Harbor, which would use hydraulic (hopper) dredging and would place dredged material at an in-Bay site. This contrasts with the No Action Alternative/No Project Alternative, in which both channels would be mechanically dredged and transported to SF-DODS for ocean disposal. This cost savings is then applied to other channels and reaches to cover the additional cost of taking dredged material to beneficial use sites (i.e., the most expensive option). The cost savings is applied to the majority (approximately 70 percent) of Oakland Harbor and a portion (approximately 20 percent) of Suisun Bay Channel. Suisun Bay Channel, while clean, can only send about 20 percent to beneficial use due to suitability concerns resulting from the historical Port Chicago explosion at the nearby Military Ocean Terminal Concord, and the possibility of unexploded ordnances in the sediment.

This EA/EIR evaluates hydraulic dredging in channels other than those listed in the example above in exchange for mechanical dredging in others for non-aquatic beneficial use, to provide flexibility to execute the program differently than above due to technical feasibility or environmental acceptability, or if the economic conditions change and other combinations become more cost-effective. This alternative includes BUDM, which will minimize potential longfin smelt population impacts from entrainment through habitat creation.

Alternative 3, Beneficial Use: Cost Share Opportunity

This alternative proposes building on Alternative 2 and taking more sediment to non-aquatic beneficial use sites within the Water Resources Development Act (WRDA) 2020 Section 125a threshold to more easily justify the cost share of the BUDM incremental cost for operations and maintenance (O&M) budgets. At the Bay-wide programmatic level, this alternative proposes to increase BUDM placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 35 to 45 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0-10 percent; and to increase in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 35 to 45 percent. The other category percentage ranges remain the same as the No Action Alternative/No Project Alternative. This alternative is not a candidate to be the Federal Standard Base Plan given it is not the least-cost alternative, but it is feasible with non-federal funding for 35 percent of the incremental cost above the Federal Standard Base Plan given that the benefits are qualitatively justified.

This alternative was built upon the regional optimization of Alternative 2, with the level of increased BUDM calculated as the 25 percent threshold identified in WRDA 2020 Section 125a, which is described as the point at which the federal share of the incremental cost share (i.e., 65 percent of the incremental cost) is 25 percent above the Federal Standard Base Plan cost (see section 1.1 Project Purpose, Needs, and Objectives for definition and description of the Federal Standard Base Plan). This authority delineates between simpler, qualitative articulation of benefits below the threshold, and more comprehensive, quantitative articulation of benefits above the threshold to justify the federal investment from the O&M budget on the incremental cost of beneficial use. The alternative, therefore, uses this 25 percent federal share of the incremental cost above the Federal Standard Base Plan to determine what level of BUDM can be justified using the simpler qualitative approach described above. This amount provides information on the approximate amount of additional BUDM volume that can be achieved in a relatively straightforward fashion. For more information, see the WRDA 2020 section of the RDMMP document (USACE 2024a). This alternative includes BUDM, which will minimize potential longfin smelt population impacts from entrainment through habitat creation.

Alternative 4, Beneficial Use: Maximized

This alternative proposes placing all suitable material at non-aquatic beneficial use sites, including a portion of sediment being placed at nearshore strategic placement beneficial use sites designed to leverage tidal and wave energy to transport sediment from shallow subtidal placement areas to existing intertidal mudflats and marshes. This alternative can also be executed with the volume of sediment placed at the nearshore strategic placement beneficial use sites being placed at non-aquatic beneficial use sites instead. At the Bay-wide programmatic level, this alternative proposes to increase BUDM placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 65 to 75 percent; to increase beneficial use nearshore strategic placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 5 to 15 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent; and to decrease in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent. The other category percentage ranges remain the same as the No Action Alternative/No Project Alternative. This alternative is not a candidate to be the Federal Standard Base Plan given it is not the least-cost alternative and would require non-federal funding for the full incremental cost above the Base Plan, or for 35 percent of the incremental cost given the benefits justify and quantitatively exceed the incremental cost under the WRDA 2020 Section 125a cost-sharing authority. Currently, no non-federal entity has expressed interest in such a programmatic-wide scale partnership. However, USACE remains open to the possibility should any non-federal entity express such interest or for any partnerships on a project-by-project or year-by-year basis.

This alternative was constructed based on maximizing the amount of suitable material for non-aquatic beneficial use and nearshore strategic placement beneficial use. All channels capable of supplying dredged material for beneficial use do so under this alternative, including placement of MSC sand directly on Ocean Beach for beach nourishment (see the Ocean Beach Onshore section of the RDMMP for more details). The alternative outlines the amount of beneficial use that would be achievable given the more comprehensive, quantitative articulation of benefits above the threshold to justify federal investment from the O&M budget on the incremental cost of BUDM placement. Additionally, should the federal investment not be deemed justified, it is still possible to execute this alternative if non-federal partners are willing to fund the full 100 percent of the incremental cost for BUDM placement above the Federal Standard Base Plan. For more information, see the WRDA 2020 section of the RDMMP.

Proposed Action/Proposed Project Alternative

The requirement for review under NEPA is triggered by a "major federal action." (42 U.S.C. § 4336e (10)). The Proposed (federal) Action described in this section would meet the purpose and need described in Chapter 1, which is to allow maintenance dredging of the federal navigation channels in SF Bay consistent with the goals and adopted plans of the LTMS, while adequately protecting the environment, including listed species.

Under CEQA, a detailed and stable project description is fundamental to the purpose of the study, which is to identify and analyze impacts from the Proposed Project. The CEQA Guidelines define the types of information that must be included in an EIR project description. The project description must include the specifics of the Proposed Project, the project site, and its surroundings, but does not need to include extensive detail beyond what is needed to evaluate environmental impacts (CEQA Guidelines Section 15124).

The Proposed Action/Proposed Project is the phased implementation of the USACE Federal Standard Base Plan alternatives–the No Project Alternative, Alternative 1, and Alternative 2. The No Project Alternative, Alternative 1 (diversion from ocean disposal), and Alternative 2 (regional optimization) are all least cost, while Alternative 3 (cost-share opportunity) and Alternative 4 (maximum BUDM) are progressively more expensive. Of the three least cost options that are candidates to be the Federal Standard Base Plan, the No Project Alternative results in the most ocean disposal and least BUDM, and Alternative 2 results in the most BUDM and the least ocean disposal. As described previously, Alternative 3 and Alternative 4 are not least cost and, therefore, they do not currently qualify to be the Federal Standard Base Plan. However, if non-federal funding becomes available or incremental cost-sharing opportunities present themselves, USACE will seek to implement Alternatives 3 or 4, when practicable.

Table ES-2 provides a detailed comparison of the dredging and dredged material placement differences across the navigation channels for each alternative. Figure ES-2 provides an overview of the differing dredged material disposal/placement details across alternatives. Figure ES-3 provides more detail on cost share scenarios for the percentage range of combined beneficial use of dredged material (BUDM) for each alternative; the red line indicates the least Federal Standard Base Plan threshold.

Table ES-2. Alternative Comparison by Federal Channel*

Dredging Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual volume over 10-year Cycle (CY)
Oakland: Inner and Outer Harbor								
No Action	SF-DODS[2]	Clamshell	N/A	1	10	750,000	1,225,000	750,000
No Project	SF-DODS[2]	Clamshell	N/A	1	10	750,000	1,225,000	750,000
1	SF-DODS[2]	Clamshell	N/A	1	10	750,000	1,225,000	750,000
2	Non-aquatic BU site SF-11[2]	Clamshell Hopper	Cutterhead Clamshell	1	10	525,000 225,000	860,00 365,000	525,000 225,000
3	Non-aquatic BU Site	Clamshell	Cutterhead	1	10	750,000	1,225,000	750,000
4	Non-aquatic BU site Strategic Placement Site	Clamshell Clamshell	Cutterhead Cutterhead	1	10	650,000 100,000	1,060,000 165,000	650,000 100,000
Redwood City Harbor: Channels								
No Action	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
No Project	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
1	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
2	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
3	SF-11[2] Non-aquatic BU Site	Clamshell Clamshell	N/A Cutterhead	1	10	100,000 80,000	360,000 290,000	100,000 80,000
4	Non-aquatic BU Site Strategic Placement Site	Clamshell Clamshell	Cutterhead Cutterhead	1	10	80,000 100,000	290,000 360,000	80,000 100,000
Redwood City Harbor: San Bruno Shoal								
No Action	SF-11[2]	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
No Project	SF-11[2]	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
1	SF-11[2]	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
2	SF-11[2]	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
3	SF-11[2]	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
4	Non-aquatic BU Site	Hopper	Clamshell	Infrequent	1	30,000	30,000	5,000
Richmond Inner Harbor								
No Action[3]	SF-DODS[2]	Clamshell	N/A	1	10	300,000	630,000	300,000
No Project[3]	SF-DODS[2]	Clamshell	N/A	1	10	300,000	630,000	300,000
1	SF-11[2] Non-aquatic BU Site	Clamshell Clamshell	Hopper Cutterhead	1	10	160,000 140,000	335,000 295,000	160,000 140,000
2	SF-11[2]	Hopper	Clamshell	1	10	300,000	630,000	300,000
3	SF-11[2] Non-aquatic BU Site	Hopper Clamshell	Clamshell Cutterhead	1	10	265,000 35,000	555,000 75,000	265,000 35,000
4	Non-aquatic BU site	Clamshell	Cutterhead	1	10	300,000	630,000	300,000
Richmond Outer Harbor								
No Action	SF-10 (SF-11 alternate)	Hopper	Clamshell	1	10	210,000	730,000	210,000
No Project	SF-10 (SF-11 alternate)	Hopper	Clamshell	2	5	250,000	730,000	125,000
1	SF-11[2]	Hopper	Clamshell	1	10	210,000	730,000	210,000
2	SF-10[2]	Hopper	Clamshell	1	10	210,000	730,000	210,000

Dredging Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual volume over 10-year Cycle (CY)
3	SF-10[2] Non-aquatic BU Site	Hopper Clamshell	Clamshell Cutterhead	1	10	195,000 15,000	680,000 50,000	195,000 15,000
4	Non-aquatic BU site	Clamshell	Cutterhead	1	10	210,000	730,000	210,000
San Francisco Main Ship Channel								
No Action	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
No Project	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
1	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
2	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
3	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
4	SF-17 Onshore BU Site	Hopper	N/A	1	10	260,000 85,000	465,000 150,000	260,000 85,000
San Pablo Bay (Pinole Shoal)								
No Action	SF-10[2]	Hopper	Clamshell	1	10	150,000	560,000	150,000
No Project	SF-10[2]	Hopper	Clamshell	2	5	190,000	560,000	95,000
1	SF-10[2]	Hopper	Clamshell	1[5]	10	150,000	560,000	150,000
2	SF-9[2]	Hopper	Clamshell	1[5]	10	150,000	560,000	150,000
3	SF-9[2] Non-aquatic BU Site	Hopper Clamshell	Clamshell N/A	1[5]	10	140,000 10,000	520,000 40,000	140,000 10,000
4	Non-aquatic BU Site	Clamshell	N/A	1[5]	10	150,000	560,000	150,000
Suisun Bay Channel and New York Slough								
No Action	SF-16[2]	Clamshell	N/A	1[6]	10	165,000	425,000	165,000
No Project	SF-16[2]	Clamshell	N/A	1[6]	10	165,000	425,000	165,000
1	SF-16[2]	Clamshell	N/A	1[6]	10	165,000	425,000	165,000
2	SF-16[2] Non-aquatic BU site	Clamshell	N/A	1[6]	10	115,000 50,000	295,000 130,000	115,000 50,000
3	SF-16[2] Non-aquatic BU site	Clamshell	N/A	1[6]	10	115,000 50,000	295,000 130,000	115,000 50,000
4	SF-16[2] Non-aquatic BU site	Clamshell	N/A	1[6]	10	115,000 50,000	295,000 130,000	115,000 50,000
Napa River								
No Action[4]	Upland (sponsor-provided) Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000
No Project[4]	Upland (sponsor-provided) Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000
1	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000
2	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000
3	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000

Dredging Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual volume over 10-year Cycle (CY)
4	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	6–11	2	110,000	165,000	20,000
Petaluma River: Across the Flats								
No Action	SF-10[2]	Clamshell	N/A	3	3	70,000	70,000	20,000
No Project	SF-10[2]	Clamshell	N/A	3	3	70,000	70,000	20,000
1	SF-10[2]	Clamshell	Cutterhead	3	3	70,000	70,000	20,000
2	SF-10[2]	Clamshell	Cutterhead	3	3	70,000	70,000	20,000
3	SF-10[2]	Clamshell	Cutterhead	3	3	70,000	70,000	20,000
4	SF-10[2], Non-aquatic BU Site	Clamshell	Cutterhead	3	3	70,000	70,000	20,000
Petaluma River Channel: River Channel								
No Action	Upland (sponsor-provided) Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
No Project	Upland (sponsor-provided) Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
1	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
2	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
3	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
4	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
San Rafael Creek								
No Action	SF-11[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000
No Project	SF-11[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000
1	SF-11[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000
2	SF-9[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000
3	SF-9[2] Non-aquatic BU Site	Clamshell Clamshell	N/A Cutterhead	4–6	3	65,000 45,000	165,000 115,000	20,000 15,000
4	Non-aquatic BU Site	Clamshell	Cutterhead	4–6	3	110,000	280,000	35,000

* The Proposed Action/Proposed Project is anticipated to be the No Project Alternative in the first year or two of implementation. This is expected to transition to Alternatives 1 and 2 in later years. Rows that are components of the Proposed Action/Proposed Alternative are highlighted in gray.

1 Placement sites can vary over the 10-year dredging cycle and are provided as one example of how this alternative can be executed.

2 If work is performed outside the National Marine Fisheries Services work windows, dredging and dredged material placement will comply with the NMFS Biological Opinion - Long Term Management Strategy For the Placement of Dredged Material in the San Francisco Bay Region Revised Incidental Take Statement (2015). This may include placing the material at a suitable beneficial use site or placing an equivalent volume of dredged material at a beneficial use site during the next dredging season

3 For the No Project Alternative, Richmond Inner Harbor would continue to be dredged to depth of -38 feet mean lower low water (MLLW). Richmond Inner Harbor is authorized to be dredged to -41 feet MLLW (No Action assumption); however, due to lack of federal interest, USACE consistently maintains the depth of the channel at -38 feet MLLW.

4 Under the No Project Alternative, Lower Napa River Channel and Upper Napa River Channel would be dredged to -9 feet MLLW, rather than the authorized depths of -15 feet and -10 feet, respectively (No Action assumptions).

5 Includes as-needed advance maintenance dredging.

6 Includes as-needed emergency dredging episodes of no more than three emergency dredging episodes consisting of less than 30,000 CY each per year.

Key:
BU = beneficial use
CY = cubic yard
SF-8 San Francisco Bar Channel Placement Site
SF-9 Carquinez Strait placement site
SF-10 San Pablo Bay placement site
SF-11 Alcatraz Island placement site
SF-16 Suisun Bay placement site
SF-17 Ocean Beach Demonstration Site

Table ES-3. Estimated Potential Placement Volume Summary for Alternatives*

Placement Location[1]	No Action Minimum Volume (CY/year)	No Action Average Volume (CY/year)	No Action Maximum Volume (CY/year)[2]	No Project Minimum Volume (CY/year)	No Project Average Volume (CY/year)	No Project Maximum Volume (CY/year)[2]	Alternative 1 Minimum Volume (CY/year)	Alternative 1 Average Volume (CY/year)	Alternative 1 Maximum Volume (CY/year)[2]	Alternative 2 Minimum Volume (CY/year)	Alternative 2 Average Volume (CY/year)	Alternative 2 Maximum Volume (CY/year)[2]	Alternative 3 Minimum Volume (CY/year)	Alternative 3 Average Volume (CY/year)	Alternative 3 Maximum Volume (CY/year)[2]	Alternative 4 Minimum Volume (CY/year)	Alternative 4 Average Volume (CY/year)	Alternative 4 Maximum Volume (CY/year)[2]
Existing Beneficial Use Site																		
Non-Aquatic Direct Placement Sites	0	0	0	0	0	0	112,850	135,420	451,400	451,400	609,390	677,100	789,950	970,510	1,015,650	1,467,050	1,602,470	1,692,750
Nearshore Strategic Placement Site - SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550	105,850	254,040	317,550	112,850	270,840	338,550	112,850	270,840	338,550	112,850	270,840	338,550	112,850	270,840	338,550
Transitional Placement Sites																		
SF-8, San Francisco Bar Channel Placement Site	0	90,280	225,700	0	84,680	211,700	0	90,280	225,700	0	90,280	225,700	0	90,280	225,700	0	0	225,700
In-Bay Placement Sites	677,100	789,950	902,800	635,100	740,950	846,800	789,950	947,940	1,241,350	1,128,500	1,263,920	1,354,200	789,950	902,800	1,015,650	0	135,420	225,700
Upland (Sponsor-Provided) Sites	0	22,570	225,700	0	21,170	211,700	0	22,570	225,700	0	22,570	225,700	0	22,570	225,700	0	22,570	225,700
Deep Ocean Disposal Site	1,015,650	1,083,360	1,241,350	952,650	1,016,160	1,164,350	225,700	789,950	902,800	0	0	225,700	0	0	225,700	0	0	225,700
Potential Future Beneficial Use Placement Sites[3]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112,850	203,130	338,550

[1] See Section 1.5.2.2 for description of placement sites.
[2] Maximum placement volumes would not be realized across placement locations concurrently.
[3] Potential Future BU Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites, and Water Column Seeding Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.
Key: CY = cubic yard

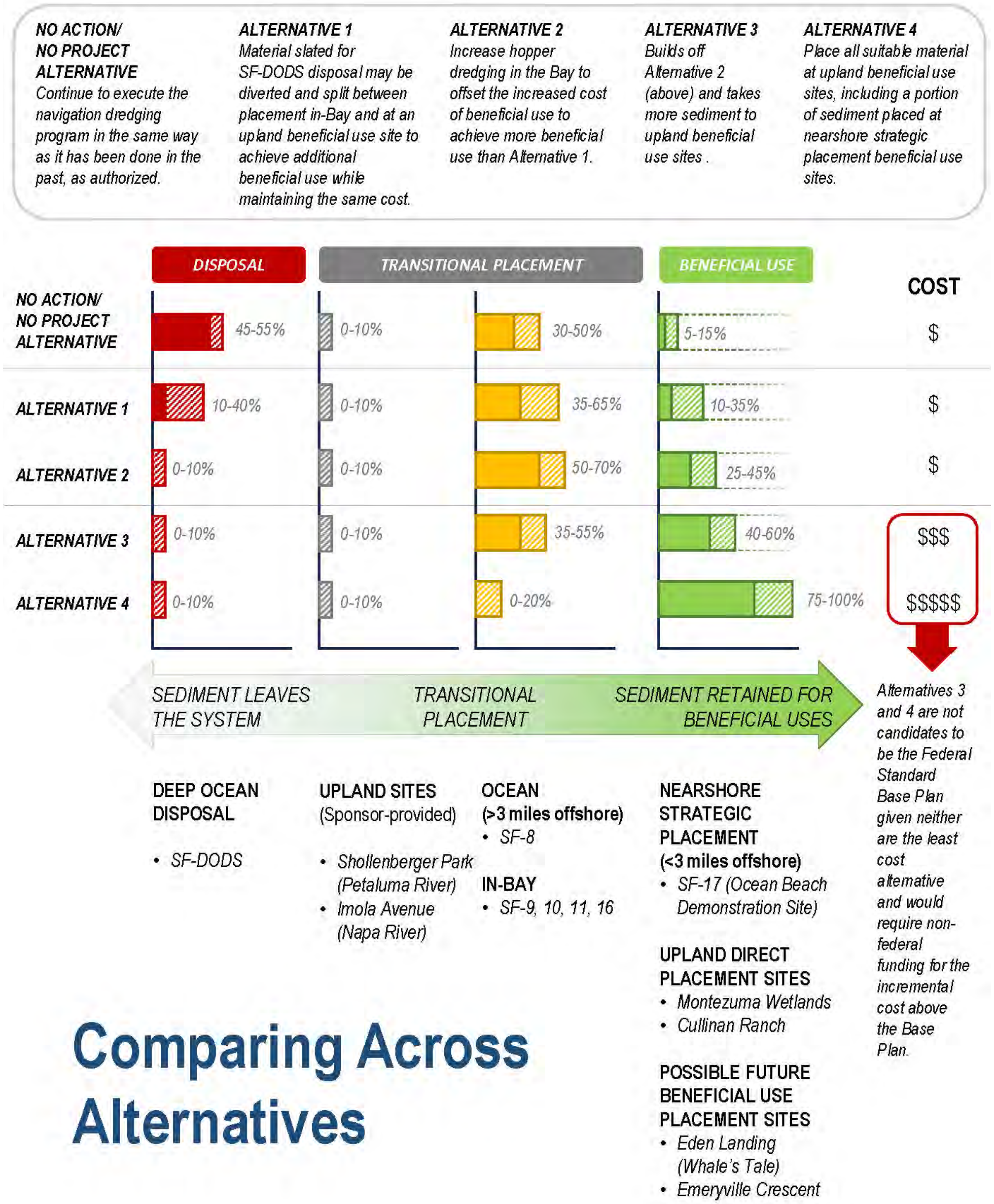

Figure ES-2. Comparison of Dredged Material Disposal and Placement Across Alternatives

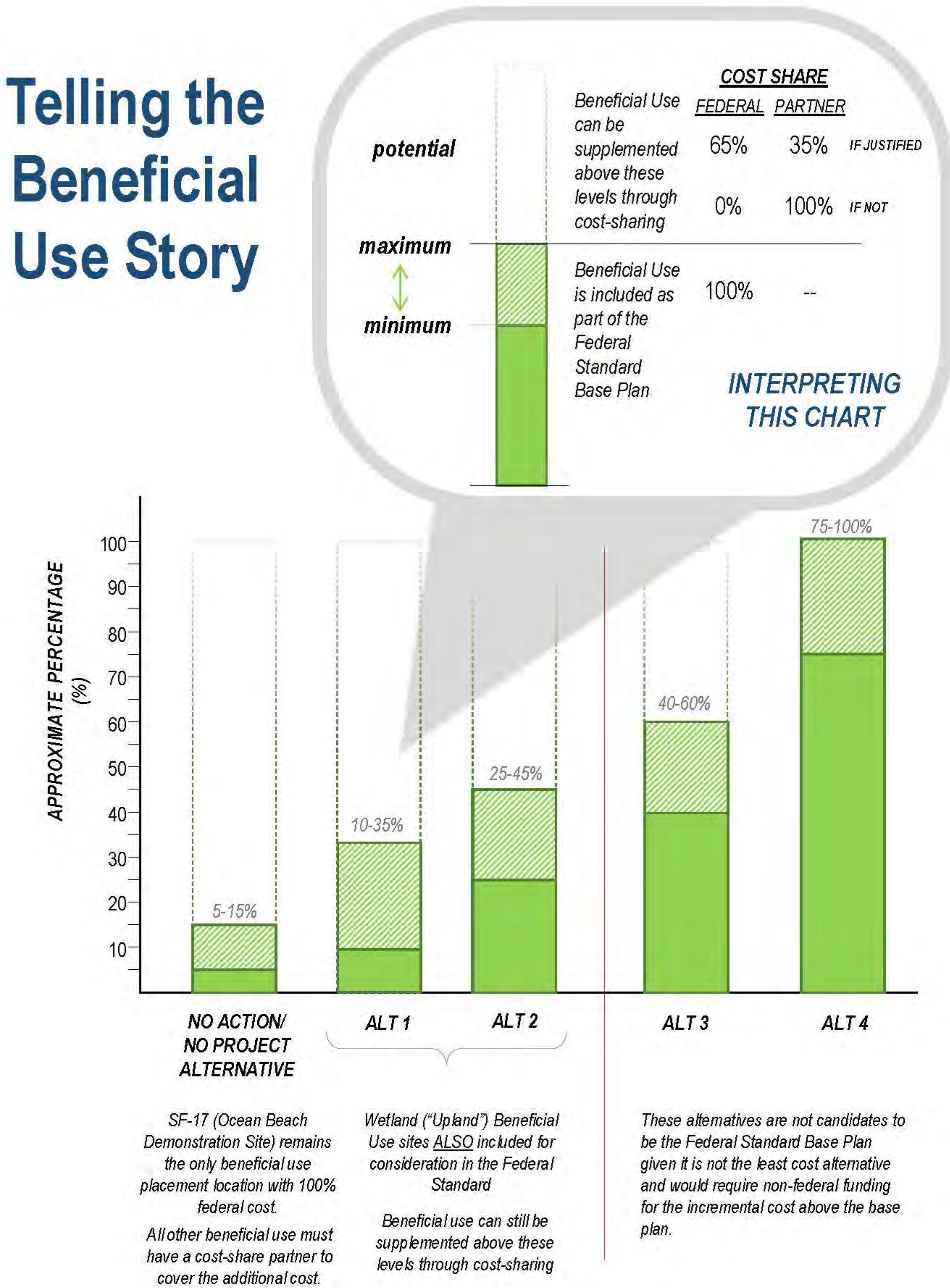

Figure ES-3. Summary of Alternatives and Example of Cost-sharing Mechanism Described in All Alternatives.

The proposed phased implementation of the Proposed Action/Proposed Project is:

- 2025, No Project Alternative: Continuing the No Project Alternative allows USACE the time necessary to appropriately plan for and implement the changes required for Alternatives 1 and eventually 2.
- 2026–2027, Alternative 1: The earliest USACE would be able to implement Alternative 1 would be in 2026.
- 2027–2034, Alternative 2: The earliest USACE would be able to implement Alternative 2 would be in 2027. This time is necessary to allow USACE to work to expand the capacity of its hopper dredges, including utilizing the West Coast Hopper Dredging contract.

The potential environmental impacts associated with each of the alternatives that compose the Proposed Action/Proposed Project are analyzed in Chapter 3 of this EA/EIR. The impacts of the phased Proposed Action/Proposed Project as a whole are also addressed in Chapter 3.

The implementation schedule and associated mitigation measures for the Proposed Action/Proposed Project must be approved by the Regional Water Board through the issuance of the WQC/WDR.

Environmental Effects

Table ES-3 at the end of the Executive Summary outlines the potential environmental impact pathways analyzed (Potential Impact Pathway column); proposed avoidance, minimization, and mitigation measures (Mitigation Measure column); and the federal and state (NEPA and CEQA) effect determinations for each proposed alternative, taking into account proposed mitigation. Detailed effects analyses and assessment of environmental impacts are provided in Chapter 3.

Evaluation of Alternatives

The type and degree of environmental impacts among all the alternatives are similar. Differences in impacts are related to 1) the proportion and location of hopper dredge use versus mechanical dredge use under each alternative, and 2) the extent of BUDM, and 3) the amount of dredged sediment placed at sites and retained within the SF Bay region which may facilitate the creation and/or restoration wetland habitats along and around SF Bay by providing suitable soil material.

Per CEQA Guidelines [Section 15126.6(e)(2)], if the environmentally superior alternative is the No Project Alternative, then the EIR must also identify an environmentally superior alternative among the other alternatives. The action alternatives presented in this document would have less adverse environmental impacts than the No Action Alternative and No Project Alternative and more environmentally beneficial effects through increased BUDM for restoration of habitat for listed species. For these reasons, the environmentally superior alternative is not the No Project Alternative. Alternative 4, Beneficial Use-Maximized, proposes placing all suitable material at non-aquatic beneficial use sites. Therefore, Alternative 4, Beneficial Use-Maximized is considered to be the environmentally superior alternative under CEQA. However, as described above, Alternative 4 is not a Federal Standard Base Plan alternative. Of the Federal Standard Base Plan alternatives evaluated in the EA/EIR, Alternative 2, Beneficial Use-Regional Optimization, Leverage Hopper Dredging, is considered the environmentally superior alternative due to the extent of BUDM placement and amount of dredged sediment placed at sites and retained within the SF Bay region which may facilitate the creation and/or restoration wetland habitats along and around SF Bay by providing suitable soil material.

Coordination and Consultation

Public and agency participation has occurred as a part of the environmental review process, pursuant to the requirements of NEPA and CEQA. Tribal outreach has also occurred in accordance with federal and state requirements.

Consistent with CEQA for preparation of an EIR, the Regional Water Board submitted a Notice of Preparation (NOP) to the California State Clearinghouse on February 13, 2024, to alert potentially interested parties of the project, and to invite participation in the environmental review process. The NOP was also posted to the USACE and Regional Water Board websites and distributed through the LTMS, RDMMP, and the Regional Water Board's CEQA email listservs. The NOP included the project description and a figure of the study area. The NOP also announced the scoping period and public scoping meeting.

The scoping period ran from February 13, 2024, through March 14, 2024, and a hybrid (in-person/virtual) scoping meeting was held on March 5, 2024. The purpose of the scoping meeting was to solicit public comments on the scope of the EA/EIR and provide a brief overview of the proposed alternatives to the public. There were 21 participants at the meeting.

Additional public and agency coordination has occurred through the RDMMP development process. The RDMMP website, https://spn.usace.afpims.mil/Missions/Projects-and-Programs/Regional-Dredge-Material-Management-Plan, provides a history and overview of the public meetings and outreach that have taken place over the past ten-year dredging cycle that informed the development, refinement, and subsequent analysis of the alternatives analyzed in this document. Activities included nine RDMMP meetings and outreach events between July 2019 to March 2024 (SFEI 2024), numerous presentations at public meetings to solicit feedback, an interagency working group led by USACE, in partnership with the San Francisco Estuary Institute (SFEI), to solicit expert technical advice and decision support to USACE on gap analysis studies.

In compliance with the U.S. Army Corps of Engineers (USACE) Tribal Consultation Policy, Assembly Bill (AB) 52, and other applicable laws and regulations, consultation with Native American Tribes regarding the management plan began in January 2024. USACE and the Regional Water Quality Control Board initiated outreach by contacting all tribes within the San Francisco District's Area of Responsibility (AOR) via email and also consulted with tribes identified by the Native American Heritage Commission (NAHC) as being in the Project area.

As part of this process, a Sacred Lands File (SLF) search was conducted through the NAHC in March 2024. The results indicated the presence of sacred lands in multiple counties, including Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. Tribes identified through this search were notified and invited to provide comments on the project.

Introduction

To date, USACE's San Francisco District and the Regional Water Board have conducted one-on-one tribal consultation meetings with the Federated Indians of Graton Rancheria, the Confederated Villages of Lisjan Nation, and the Tamien Nation. Additionally, both the Confederated Villages of Lisjan Nation and the Amah Mutsun Tribal Band have submitted written comments. Input received through these consultations was carefully reviewed and used to inform the development of culturally appropriate protection measures in the management plan. These measures were designed to avoid or minimize potential impacts to tribal cultural resources and ensure the respectful treatment of sites with historical and cultural significance. The tribal consultation process remains ongoing, and feedback from tribal representatives will continue to guide project planning and implementation.

In effort to ensure this project does not disproportionately impact communities with environmental justice concerns in the SF Bay region, environmental justice community representatives were invited to participate in a virtual public meeting prior to the public review period for this EA/EIR to receive information and for USACE and the Regional Water Board to address any specific concerns or questions. The meeting was held October 15, 2024, at 4:00 p.m.

This Final EA/EIR considered comments received from the public review period, Appendix H contains public comments and responses and a summary of insignificant changes.

Table ES-4. Summary of Net Impacts and Findings for Alternatives

Potential Impact Pathway	Mitigation Measures[1]	No Action	No Project	Proposed Action/ Proposed Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Air Quality, Climate Change, and Greenhouse Gas Emissions								
Impact AQ-1: Potential violation of any air quality standard or contribute substantially to an existing or projected air quality violation.	No Mitigation Measures	Less than significant (LTS)	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact AQ-2: Potential conflict with or Obstruction of Implementation of an Applicable Air Quality Plan.	No Mitigation Measures	LTS	LTS	NEPA: Beneficial (B) CEQA: No impact (NI)[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]
Impact AQ-3: Potential for exposure of Sensitive Receptors to Substantial Pollutant Concentrations.	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact AQ-4: Potential to Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact AQ-5: Result in Cumulative Impacts on Regional Air Quality	No Mitigation Measures	No reasonably foreseeable impacts (NRFI)	No cumulatively considerable impacts (NCCI) NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Biological Resources								
Impact BI-1: Potential Effects on Fish and Benthic Invertebrate Survival Caused by Entrainment	BI1-1: Compensatory Mitigation—*No Project*	LTS	Significant; reduced to LTS with BI-1-1 Mitigation Measure	NEPA: LTS CEQA: Significant; reduced to LTS with BI1-1 Mitigation Measure	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-2: Potential Adverse Effects of Increased Turbidity Caused by Dredging and Material Placement on Special Status Species, Critical Habitat and Commercially Valuable Marine Species	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-3: Potential Effects on Fish and Marine Mammals Caused by Noise from Dredging Activities	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-4: Potential Effects of Maintenance Dredging and Material Placement on Benthic Habitat	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-5: Potential Effects Caused by Non-aquatic beneficial use of Dredged Material Placement	No Mitigation Measures	B	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-6: Potential Effects Caused by the Resuspension of Contaminated Sediments	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact B7: Potential Interference of Migratory Passage for fish and marine mammals	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-8: Potential Effects of Dredging Activities on Roosting, Nesting, and Foraging Avian Species	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-9: Potential Disturbance of EFH and "Special Aquatic Sites" Including Eelgrass Beds and Mudflats	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact BI-10: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Biological Resources	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI

Potential Impact Pathway	Mitigation Measures[1]	No Action	No Project	Proposed Action/ Proposed Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cultural and Tribal Resources								
Impact CT-1: Substantial Adverse Change to a Historical Resource or Disturb Unique Archaeological Resources	No Mitigation Measures[2]	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact CT-2: Potential to Disturb Human Remains, including those Interred Outside of Formal Cemeteries	No Mitigation Measures[2]	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact CT-3: Potential Impacts to Native American Sacred Sites or Religious Ceremonies	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact CT-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Historical Resources	No Mitigation Measures[2]	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Geology, Soils, and Sediment Quality								
Impact GE-1: Potential for Dredging, Transport, and Placement Activities to Result in Substantial Soil Erosion	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact GE-2: Potential for Dredging, Transport, and Placement Activities to Substantially Degrade Sediment Quality	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact GE-3: Potential for Dredging, Transport, and Placement Activities to Result in Substantial in-Bay Sediment Mounding	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact GE-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Soil Erosion, Sediment Quality and Sediment Mounding	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Hazards and Hazardous Materials								
Impact HM-1: Potential Public or Environmental Exposure from the Transport, Use, and Disposal of Hazardous Materials	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact HM-2: Potential Impacts to Implementation of an Adopted Emergency Response Plan	No Mitigation Measures	B	LTS	NEPA: B CEQA: LTS	NEPA: B CEQA: NI*	NEPA: B CEQA: NI*	NEPA: B CEQA: NI*	NEPA: B CEQA: NI*
Impact HM-3 Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hazards and Hazardous Materials	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Hydrology and Water Quality								
Impact HY-1: Potential to Substantially Degrade Water Quality through Alteration of Water Temperature, Salinity, pH, and Dissolved Oxygen	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact HY-2: Potential to Substantially Degrade Water Quality Because of Increased Turbidity	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact HY-3: Potential to Substantially Degrade Water Quality from Mobilization of Contaminated Sediments or Release of Hazardous Materials	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact HY-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hydrology or Water Quality	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Land Use and Planning								

Potential Impact Pathway	Mitigation Measures[1]	No Action	No Project	Proposed Action/ Proposed Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact LU-1: Potential Conflict with Applicable Plans and Policies	No Mitigation Measures	No Impact	No Impact	NEPA: No Impact CEQA: No impact	NEPA: B CEQA: No impact	NEPA: B CEQA: No impact	NEPA: B CEQA: No impact	NEPA: B CEQA: No impact
Impact LU-2: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Land Use	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI
Transportation and Traffic								
Impact TR-1: Potential to Disrupt or Impede Marine Navigation	No Mitigation Measures	LTS	LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS	NEPA: LTS CEQA: LTS
Impact TR-2: Potential to Create Navigational Safety Risks	No Mitigation Measures	B	NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]	NEPA: B CEQA: NI[2]
Impact TR-3: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Transportation and Traffic	No Mitigation Measures	NRFI	NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI	NEPA: NRFI CEQA: NCCI

[1] Standard practices and avoidance and minimization measures, as identified in LTMS BiOp (NMFS 1998, 2015; USFWS 1999, 2004a, 2004b, 2024, 2025) and EFH Consultation (USACE and USEPA 2011) would be employed under all alternative to reduce impacts to species and habitat.
[2] Impacts would be similar under NEPA and CEQA; however, CEQA does not permit beneficial impact determinations.
[3] Potential impacts to cultural resources would be minimized and/or avoided by implementation of a cultural resources monitoring program and inadvertent archaeological discovery and treatment of human remains protocols.

Key: B = beneficial
CEQA = California Environmental Quality Act
EFH = Essential Fish Habitat
LTS = Less than significant
NEPA = National Environmental Policy Act
NI = No impact
NCCI = No cumulatively considerable impacts
NRFI = No reasonably foreseeable impacts, for NEPA purposes, only analysis of how reasonably foreseeable projects would result in reasonably foreseeable considerable impacts need to be considered.

1.0 Introduction

The United States Army Corps of Engineers (USACE) San Francisco District proposes to continue maintenance dredging of the federal navigation channels in San Francisco Bay (SF Bay) to maintain their navigability. The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) will consider issuing a Clean Water Act (CWA) Section 401 Water Quality Certification (WQC) and Waste Discharge Requirements (WDR) pursuant to the State of California's Porter-Cologne Water Quality Control Act (Porter-Cologne Act) for USACE's continued maintenance dredging operations in SF Bay. This authorization is referenced throughout this document as WQC/WDR. Dredging involves the excavation of accumulated sediment from the channel, as well as the transportation and placement of the sediment at a permitted location, consistent with permit conditions established by applicable regulatory agencies. Approximately 2 to 2.5 million CY of maintenance dredge material is removed from the federal navigation channels each year. Sediment must be tested for suitability for placement at any site.

USACE and the Regional Water Board prepared this joint Environmental Assessment and Environmental Impact Report (EA/EIR) to address the environmental effects of implementing and permitting maintenance dredging of federal navigation channels in SF Bay and the associated placement of dredged material.

This document is intended to fulfill USACE's National Environmental Policy Act (NEPA) compliance requirements for continuation of maintenance dredging in SF Bay over a roughly ten-year period beginning in dredging year 2025 and continuing through 2034, with the potential for projects to extend into early 2035[8]. It is also intended to fulfill the Regional Water Board's California Environmental Quality Act (CEQA) compliance requirements for issuance of a multiyear WQC/WDR to USACE governing dredge and fill activities. Additionally, for maintenance dredging projects involving the discharge of dredged or fill material into waters of the United States, Appendix A of this document provides the Section 404(b)(1) analysis for maintenance dredging in compliance with the CWA. Although USACE does not issue permits to itself, USACE must demonstrate compliance with Section 404 of the CWA. The NEPA document covers the implementation of the first 10 years of the RDMMP, after which additional NEPA may be pursued as necessary to address any potential future changes.

This EA/EIR is prepared in accordance with NEPA, Section 404 of the CWA, and CEQA law and guidelines. USACE is the NEPA lead agency, and the Regional Water Board is the CEQA lead agency. The Proposed Action/Proposed Project and alternatives are described in Chapter 2.

The environmental impacts of maintenance dredging of the federal navigation channels for the previous ten-year dredging period, 2015 to 2024, were analyzed in the 2015 EA/EIR for maintenance dredging of the federal navigation channels in SF Bay (USACE and Regional Water Board 2015). This EA/EIR is an update of the 2015 EA/EIR, which is relied upon for background information and cited where relevant.

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[8] Dredging year refers to the calendar year in which dredging is planned to begin. In some cases, dredging episodes associated with a dredging year can extend past the end of the calendar year.

1.1 Basic and Overall Project Purpose, Need, and Objectives

USACE is mandated by Congress to maintain navigability of federal navigation channels. Accumulation of sediment that settles in these channels can impede navigability and present navigation safety hazards. Maintenance dredging removes this sediment and returns the channels to authorized depths. Accordingly, USACE's overall project purpose is to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation, which is achieved through continuing to dredge federal navigation channels in the SF Bay Area. The purpose and need of the proposed action alternatives is to facilitate safe and efficient navigation in the federal navigation channels in San Francisco Bay through the placement of maintenance dredged material. Dredging will be consistent with navigation project authorizations and, to the maximum extent possible, the 20-year Regional Dredged Material Management Plan (RDMMP), which is a companion document to this EA/EIR (USACE 2024a). The purpose of the RDMMP is to develop a comprehensive 20-year strategy that identifies the Federal Standard Base Plan[9] for the dredging of federal navigation projects and the placement of dredged material in the SF Bay Area. Where applicable, the project would be aligned with the goals of the Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) program, as described in the 1998 LTMS Final Environmental Impact Statement/EIR (USACE et al. 1998) and the 2001 Long Term Management Strategy for the Placement of Dredged Material in San Francisco Bay (LTMS) Management Plan (USACE et al. 2001).

The Regional Water Board has authority under the CWA Section 401 and the Porter-Cologne Act to issue permits that regulate dredge and fill activities. The Regional Water Board will review USACE's application for a WQC/WDR for continued maintenance dredging and placement of dredged material in the SF Bay Area. To issue a WQC/WDR to USACE, the Regional Water Board must analyze and disclose water quality conditions and other environmental impacts of the project; consider alternatives that would avoid or substantially reduce potentially significant impacts of the project as approved; adopt, or make a condition of approval, all feasible mitigation measures for potentially significant impacts within its authority; and demonstrate compliance with all applicable state water quality requirements.

The following project objectives are detailed in accordance with CEQA requirements:

- Provide safe, reliable, and efficient navigation through federal channels in SF Bay in a feasible manner.
- Align, where applicable, with the goals of the LTMS program as described in the 1998 LTMS Final EIS/EIR and the 2001 LTMS Management Plan (refer to Section 1.2.1), within the constraints of the Federal Standard Base Plan.

[9] The Federal Standard is the least costly dredged material disposal or placement alternative(s) that is consistent with sound engineering practices and meets all federal environmental requirements, including those established under Section 404 of the Clean Water Act and Section 103 of the Marine Protection, Research, and Sanctuaries Act. For dredged material placement, USACE fully considers all practicable and reasonable alternatives on an equal basis, including the use of dredged material beneficially, to identify the Federal Standard (33 CFR Parts 335-338). "Base Plan" is an operational manifestation of the Federal Standard because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project (Source: USACE's ER 1105-2-103).

- Increase the minimum amount of dredged material beneficially used[10] by USACE for wetland restoration and conservation within the constraints of the Federal Standard Base Plan.
- Conduct dredging in a manner that adequately protects the environment, including protection of listed species, essential fish habitat (EFH), and beneficial uses of waters.[11]

1.2 Relationship to Other Plans and Policies

USACE's maintenance dredging and dredged material placement must comply with the regulations set forth in 33 C.F.R. Part 335-338, which define the "Federal Standard." The Base Plan, or Federal Standard Base Plan, is the operational manifestation of the Federal Standard. Other plans and policies related to dredged material management in SF Bay are described in the following sections.

1.2.1 LTMS Planning Context

The LTMS program was formed in the 1990s in response to the public's growing concern over the potential direct, indirect, and cumulative effects of dredging and dredged material placement activities on San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Estuary) (USACE et al. 2013). The LTMS is designed to develop technically feasible, economically prudent, and environmentally acceptable long-term solutions to the placement of dredged material over a fifty-year period. It specifically addresses maintenance dredging and is not intended to address new dredging or sand mining. The primary goals of the LTMS include managing dredging and placement in an economically and environmentally sound manner, maximizing the use of dredged material for beneficial reuse,[12] and developing a coordinated permit application review process for dredging and placement.

The LTMS program has reduced in-Bay placement of dredged sediment, creating a goal of 1.25 million CY per year maximum (with an additional 250,000 CY contingency volume, as needed), improved Bay water quality, and reduced other adverse impacts of dredged material placement (USACE et al. 2013, 2018). During a 12-year review of the LTMS completed in 2013, LTMS agencies suggested assessing potential program modifications, including changes or flexibility to in-Bay placement volume limits, encouraging more and new kinds of beneficial reuse. More information can be found in the 20-year RDMMP companion document to this EA/EIR (USACE 2024a). The average in-Bay placement of dredged material from 2019-2021 was 802,216 CY.

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10 Beneficial use or reuse is the use or reuse of dredged sediment for construction, levees, tidal wetland restoration or other projects.

11 Beneficial uses of waters of the state "that may be protected against degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Wat. Code, sec. 13050, subd. (e)). The Water Quality Control Plan for the San Francisco Bay region designates beneficial uses of waters in the region.

12 USACE typically uses the terminology "beneficial use;" "beneficial reuse" is applied here to be consistent with LTMS language.

1.2.1.1 LTMS Program Relationship to Regulatory Requirements

The LTMS program relationship with the San Francisco Bay Plan, Water Quality Control Plan for the San Francisco Bay Basin, and the Clean Water Act are discussed in the following sections.

San Francisco Bay Plan

The San Francisco Bay Conservation and Development Commission (BCDC) regulates dredging and dredged material placement in SF Bay under authority of the State of California's McAteer-Petris Act of 1965. BCDC completed and adopted the SF Bay Plan (Bay Plan) in 1968 to comply with the provisions of the McAteer-Petris Act, which mandated its study of the SF Bay (BCDC 2020). The Bay Plan dredging policies were amended to adopt the LTMS findings, including reducing in-Bay disposal[13] and maximizing beneficial use of dredged material (BUDM) with the goal of limiting in-Bay placement volumes to a maximum of one million CY per year. The Bay Plan was amended in 2000 and included a policy for BCDC to continue to participate in the LTMS, the Dredged Material Management Office (DMMO), and other initiatives conducting research on Bay sediment movement, the effects of dredging and disposal/placement on Bay natural resources, alternatives to in-Bay aquatic disposal, and funding additional costs of transporting dredged material to upland and ocean disposal sites (BCDC 2020). BCDC is also the state coastal management agency under the federal Coastal Zone Management Act (CZMA) for the SF Bay segment of the California coastal zone, and Suisun Marsh Preservation Act and the Suisun Marsh Protection Plan; it is responsible for the implementation of federal consistency provisions of the CZMA (BCDC 2020).

Water Quality Control Plan for the San Francisco Bay Basin

The Water Quality Control Plan for the San Francisco Basin (Basin Plan)[14] is a key document used by the Regional Water Board for the regulation of in-Bay dredging. In 2008, the Basin Plan was amended to identify the LTMS strategy as the key process for addressing dredging operations in SF Bay, and for achieving the LTMS goals (USACE and Regional Water Board 2015). The Regional Water Board periodically updates the Basin Plan by amendment, which must then be approved by the State Water Resources Control Board (State Water Board). The current Basin Plan includes amendments approved by the State Water Board through April 17, 2024. The Basin Plan generally follows the same policies as the LTMS and has a goal of reducing in-Bay placement[15] volumes to about 1.25 million CY per year (Regional Water Board 2024).

Clean Water Act

USACE, the US Environmental Protection Agency (USEPA) and the Regional Water Board regulate placement of dredged material in SF Bay pursuant to the CWA through the LTMS as described in the

[13] Note that while the BCDC and its Bay Plan consider in-Bay, unconfined, aquatic placement of dredged material to be "disposal," USACE classifies this as "placement" of dredged material, in accordance with the agency definition of transitional placement: "Transitional placement is keeping sediment in the riverine or coastal system as a part of a management process or in a period of transition. Generally, this material will be managed or dredged again and is considered neither beneficial use nor disposal" (USACE 2023a, page 2).

[14] The Basin Plan can be found at the Regional Water Board's website at https://www.waterboards.ca.gov/sanfranciscobay/basin_planning.html.

[15] See Footnote 8. Similar to BCDC's Bay Plan, the Regional Water Board and its Basin Plan use the terminology "disposal" rather than USACE's use of "placement."

2015 EA/EIR (USACE and Regional Water Board 2015). See Section 1.6.1.3 for additional discussion of CWA. There have been no new developments in the relationship between the LTMS program and the CWA since the publication of the 2015 EA/EIR (USACE and Regional Water Board 2015).

1.2.2 Management of Dredged Material

A variety of federal and state permits regulate and authorize the discharge of dredged material in the open ocean, enclosed coastal waters, upland sites, or for beneficial use. USACE and USEPA jointly regulate the discharge of dredged material into waters of the United States and the transportation of dredged material for the purpose of placement in ocean waters pursuant to Section 404 of the CWA, and the Marine Protection, Research, and Sanctuaries Act (MPRSA). Pursuant to the consistency provisions of the CZMA, BCDC has authority over dredging and disposal of dredged material in the Bay. Pursuant to Section 401 of the CWA and the Porter-Cologne Water Quality Control Act (Porter-Cologne Act), the Regional Water Board has authority over dredging and disposal of dredged material in the Bay.

1.2.2.1 Dredged Material Management Office

The DMMO was formed in 1996 to establish a consolidated and comprehensive approach to eliminate redundancy and delays in the dredged material placement permitting process. The DMMO is a joint program comprised of USACE, USEPA, BCDC, Regional Water Board, and the California State Lands Commission (CSLC). Participating agencies include the California Department of Fish and Wildlife (CDFW), the National Marine Fisheries Service (NMFS), and the United States Fish and Wildlife Service (USFWS) (USACE et al. 2018). The DMMO established a joint agency process for the review and approval of sediment quality sampling and analysis plans, sediment sampling results, dredged material placement suitability determinations, and dredging project permit applications. The DMMO also coordinates the implementation of programmatic requirements such as species consultations, alternative placement site development, record keeping, and production of annual reports (DMMO 2022).

1.2.2.2 Testing Requirements for Placement and Beneficial Use of Dredged Material

USACE conducts sediment testing prior to dredging and placement at ocean, in-Bay or beneficial use sites. Material is tested for physical and chemical attributes to ensure compliance with relevant environmental laws and regulations to minimize environmental degradation. Requirements for the type and extent of testing are generally site specific, varying based on sediment characteristics and the type of placement site. The DMMO oversees testing plans and results.

Sediment testing is conducted in accordance with a tiered sampling framework for projects ranging from low to high potential impacts. Testing requirements increase from Tier I up to Tier IV. The terms Tier I, Tier II, Tier III, and Tier IV are defined in the Ocean Testing Manual (OTM) (USACE and USEPA 1991), Inland Testing Manual (ITM) (USACE and USEPA 1998), and Upland Testing Manual (UTM) (USACE 2003).

The term Tier I is an evaluation system used by the DMMO to determine the suitability of sediment for unconfined aquatic placement without additional testing, or minimal confirmatory testing. This determination is granted when the existing sediment data are sufficient for regulatory agencies to determine placement suitability. Criteria that may deem a Tier 1 exclusion appropriate include:

Introduction

1. The dredged material has been fully characterized to Tier III requirements in the last three to five years; or
2. The dredged material is composed predominantly of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larger than silt, and the material is found in areas of high current or wave energy; or
3. The dredged material is for beach nourishment or restoration and is composed predominantly of sand, gravel, or shell with particle sizes compatible with material on the receiving beaches; or
4. When:
   a) The material proposed for dumping is substantially the same as the substrate at the proposed site; and
   b) The proposed dredging site is far removed (by distance or depth) from known existing and historical sources of pollution to provide reasonable assurance that such material has not been contaminated by such pollution.

Tier II testing typically requires physical and chemical analysis such as total solids, total organic carbon, grain size, metals, butyltins, pesticides, polychlorinated biphenyls (PCB), and polycyclic aromatic hydrocarbons. Tier III testing may require biological evaluations, such as water column toxicity, benthic toxicity, and benthic bioaccumulation tests, in addition to physical and chemical analysis. Tier IV testing requires more comprehensive, case-specific evaluations.

Additional testing requirements may include confirmatory grain-size analysis, and the Modified Elutriate Test. Confirmatory grain-size analysis is a physical analysis of sediment grain size, total organic carbon, and total solids. The Modified Elutriate Test is designed to measure and predict the release of contaminants from sediment into the water column and any toxicity associated with decant water that could be discharged from upland placement sites to adjacent surface waters.

Screening level guidelines for beneficial use of sediments for wetland restoration differ for cover material and foundation material. Cover material is a class of material that is not expected to pose a threat to water quality or the aquatic environment, even in places where the material is in direct contact with surface waters or aquatic organisms and is suitable for unconfined aquatic disposal. Wetland foundation material is not of a quality that constitutes a hazardous or listed waste but has a potential for biological effects if directly exposed to organisms. Wetland foundation material is not expected to be a threat to water quality when an adequate amount of cover material is used to reduce the risk of foundation material coming into contact with the aquatic environment. The amount of cover material needed to adequately reduce this risk depends on site-specific characteristics. Placement of dredged sediment at beneficial use sites is also often governed by acceptance criteria included in project-specific biological opinions (BiOps) and WDRs.

A detailed description of sediment testing guidelines for BUDM may be found in the Regional Water Board’s Beneficial Reuse of Dredged Material: Sediment Screening and Testing Guidelines (Regional Water Board 2019a).

1.2.3 Overdepth and Advance Maintenance Dredging

Congress authorizes maximum depths and widths, or authorized dimensions, to which USACE navigation channels may be constructed and maintained. However, USACE does not always maintain channels to their authorized depth and often maintains channels at shallower depths. Overdepth dredging is dredging that occurs outside the required authorized dimensions prism, including side slopes to “compensate for physical conditions and inaccuracies in the dredging process and allow for efficient dredging practices” (USACE 2006, page 2). At times, USACE conducts advance maintenance dredging, or dredging to a specified depth and/or width beyond the authorized channel dimensions in critical and fast-shoaling areas to avoid frequent re-dredging and to ensure the reliability and least overall cost of operating and maintaining the project authorized dimensions (Tavolaro et al. 2007).

Overdepth and advance maintenance dredging are part of USACE's maintenance dredging program and are not considered deepening. In both overdepth and advance maintenance dredging, material is fully characterized in pre-dredge sediment testing. Overdepth and advance maintenance dredging differ in that:

- Overdepth dredging typically extends to a maximum of 2 feet beyond the historically maintained depth for the dredged area, per Engineering Regulation [ER] 1130-2-520 (USACE 1996).
- Advance maintenance dredging extends to a specified depth and/or width beyond the previously dredged channel dimensions in critical and fast-shoaling areas to avoid high spots which require frequent dredging. The purpose is to ensure the reliability and least overall cost of operating and maintaining the channel’s design dimensions.
- Advance maintenance dredging was analyzed in the previous EA/EIR (USACE and Regional Water Board 2015) and conducted under Regional Water Board authorizations R2-2015-0023 (Regional Water Board 2015) and R2-2020-0011 (Regional Water Board 2020).

1.2.4 Beneficial Use of Dredged Material Guidance

In consideration of dredged material as a resource, BUDM initiatives embrace the concept that dredged material can be used in a manner that will benefit society and the natural environment (USEPA and USACE 2007). There is a long history of BUDM initiatives in SF Bay dating back to the formation of the LTMS program in 1990 to work together to maximize beneficial reuse of dredged sediment and minimize disposal in the Bay and at the San Francisco Deep Ocean Disposal Site (SF-DODS). USACE, the Regional Water Board, and other LTMS agencies recognize that BUDM is a necessary component of the dredged material management process, especially in light of anticipated sea level rise (SLR) expected in SF Bay by 2100 (Regional Water Board 2019b). One of the challenges has historically been paying for the more expensive option of BUDM, hence new USACE and Regional Water Board policies related to BUDM.

In January 2023, Chief of Engineers and Commanding General of USACE, Lieutenant General Scott A. Spellmon, issued a “Beneficial Use of Dredged Material Command Philosophy Notice,” which outlined the USACE-wide goal of beneficially using at least 70 percent of its dredged material by 2030 (70/30 goal). This ambitious goal, directed by USACE’s top leader, reflects a shifting landscape where dredged material is recognized as a resource and BUDM is prioritized. The intent of the Command Philosophy

Notice was to encourage innovation, planning, and categorization of dredged material for beneficial use. On August 28, 2023, USACE issued a detailed memorandum outlining its program to identify new opportunities for BUDM and expand the BUDM. USACE recognizes the term “beneficial use,” but the term “beneficial reuse” has been adopted by many agencies and stakeholders around SF Bay and the terms can be used interchangeably. This memorandum clarified and built upon the earlier “Command Philosophy Notice” issued by Lieutenant General Spellmon. It should be noted that the beneficial uses outlined in the August 28, 2023, memorandum are broader and more innovative than the beneficial uses previously considered in the LTMS program, and include such uses as agricultural, construction, and remediation-related uses (USACE 2023a).

In 2019, the Regional Water Board published findings concerning the BUDM to maximize “nature-based solutions” to protect vulnerable shorelines from SLR. Details of these findings, which will likely be incorporated into the Basin Plan during the ten-year life span of the project, are presented in a project report from the Wetland Policy Climate Change Update Project, Wetlands Fill Policy Challenges and Future Regulatory Options: Findings and Recommendations (Regional Water Board 2019b).

The Water Resources Development Act (WRDA) of 2020 included a new authorization to address challenges associated with paying for potentially more expensive options due to incorporating BUDM in navigation projects. Section 125a of WRDA 2020 (116th Congress 2nd Session H.R. 7575) specifies the incremental cost above the Federal Standard, or Base Plan, for BUDM can be cost-shared at 65 percent federal/35 percent non-federal given the benefits justify the additional cost. This justification is different depending on the cost magnitude. If the federal portion (i.e., the 65 percent of the incremental cost) is less than 25 percent above the Federal Standard Base Plan cost, the benefits simply need to be listed qualitatively to justify spending federal money on the BUDM. If the federal portion (i.e., the 65 percent of the incremental cost) is greater than 25 percent above the Federal Standard Base Plan cost, the benefits must be listed quantitatively and shown to exceed the incremental cost. Please refer to Section 1.1, above, for the definition of the Federal Standard.

1.3 Federal Maintenance Dredging Budget and Economics

The Estuary is one of the nation’s critical maritime thoroughfares, supporting international trade, commercial and recreational fishing, and other recreation activities. For over a century, navigational channels were created, deepened, and maintained by dredging to enable ships to navigate safely into and out of ports, harbors, and marinas without running aground. Dredging the region’s channels, ports and associated docking, and berthing and other facilities will continue to be necessary to maintain adequate depths for vessels to maneuver in a safe and efficient manner.

SF Bay is home to four publicly owned and operated maritime ports: the Port of Oakland, the Port of San Francisco, the Port of Richmond, and the Port of Redwood City, and one privately owned and operated port, the Port of Benicia. The Port of Oakland accounts for 99 percent of the containerized cargo moving through Northern California, with an average annual volume throughput of 2.4 million twenty-foot equivalent units (TEU) of containerized cargo during the period between 2014 to 2022 (Port of Oakland 2024); it was ranked the eighth busiest port in the United States in terms of TEUs (US Department of Transportation [USDOT] 2024a). Navigational dredging facilitated an estimated $80.3 billion dollars of economic output at the Oakland Seaport in 2021 from direct revenue, direct and indirect job growth, and tax revenue (Martin Associates 2021). In addition to containerized cargo and commodities, SF Bay is home to five refineries, which collectively employ 26,686 Bay Area residents and contribute over three billion dollars annually to the state and local tax base of the region (Sedgwick et al. 2019). The federally maintained shipping channels also help support privately operated ferry transportation, cruise terminals, and numerous public and private recreational marinas.

As mandated by Congress, USACE is responsible for providing safe, reliable, and efficient waterborne transportation for the movement of commerce, national security needs, and recreation. This applies to federal navigational channels, harbors, and waterways. Successfully accomplishing this mission, which requires maintaining the federal channels to their authorized depths, is critical to the region's maritime trade and to its regional and national economies.

Policy, guidance, and procedures for development of dredged material plans and the establishment of the Federal Standard Base Plan are provided in Section E-15 of the Planning Guidance Notebook (ER 1105-2-100). Recent USACE guidance requiring annual RDMMP updates with 5-year time horizons has also been promulgated in accordance with Section 125 of the WRDA 2020.

To identify the Federal Standard, USACE considers all practicable and reasonable alternatives on an equal basis, including the BUDM (33 C.F.R. Parts 335-338). "Base Plan" is an operational description of the Federal Standard because it defines the disposal or placement costs that are assigned to the "navigational purpose" of the project, per USACE's ER 1105-2-103. Once the Federal Standard Base Plan has been determined, site-specific factors lead to the identification of potential dredged material management alternatives. As required by USACE ER 1105-2-100, a Base Plan must be identified that represents the least-cost, environmentally acceptable, and technically feasible dredged material management alternative.

USACE has a three-year budget process for its O&M program: Year 1 - USACE develops budget; Year 2 - Congress reviews and appropriates the budget; Year 3 - USACE spends the Year 1 budget appropriated by Congress. For context, in the spring of 2024, USACE was developing its Fiscal Year (FY) 2026 budget, Congress was reviewing the FY 2025 budget, and USACE was spending the FY 2024 budget. Congress has focused appropriation of funding on the highest value projects. Increasing federal fiscal constraints make maintaining the Bay federal navigation channels to their authorized depths more challenging for USACE. To maximize the effectiveness of its reduced budget nationally (i.e., to complete more dredging with appropriated funds), USACE has attempted to increase the use of government-owned hopper dredges in its fleet, as opposed to increasing the use of commercial hopper and clamshell dredges. USACE mainly uses two federally-owned hopper dredges in the SF Bay Area: the *Essayons* and the *Yaquina*. Whether dredging is needed at a given site is dependent on shoaling; whether dredging is executed is dependent on funding. Shoaling is not constant. Different areas of SF Bay will experience sedimentation at different rates, and sedimentation in any one area will be different from year to year. Similarly, costs and funding for USACE's maintenance dredging program may vary annually.

Every dredging project has different challenges that can affect cost and schedule. Typical issues that can affect cost and schedule for any dredging project include design depth, project volume, dredging equipment type, dredge timing, local constraints (such as the ability to work 24 hours per day), weather, competition issues (including equipment availability), regulatory constraints, distance to disposal or placement sites, and any offloading or placement site costs. A host of other project-specific issues may also be relevant, including, but not limited to, whether sediment rehandling would be involved, any special dredging techniques or equipment that may be needed (e.g., for sediment of concern or when dredging adjacent to sensitive resources), whether or not compensatory mitigation is required (such as when eelgrass is present or take of special-status species would occur), or if contractors demand a premium for last-minute projects (USACE et al. 2013). Budget availability often affects how early in the dredging window a project can start. Therefore, although USACE's maintenance program includes prescribed dredging cycles for each channel, it is difficult to predict the frequency of dredging for all projects.

1.4 Project Location

In SF Bay, the study area spans the shoreline and marine areas of the following 9 counties: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco (Figure 1-1). The geographic scope of the study area comprises the estuarine waters of the SF Bay region, portions of the Sacramento-San Joaquin River Delta (Delta) west of Sherman Island. Outside the Golden Gate, the study area includes SF-DODS, the San Francisco Bar Channel Placement Site (SF-8), and the nearshore zone off Ocean Beach, as well as the waters used by vessels en route to these sites. Detailed descriptions of the environmental setting are presented in each of the resource area discussions presented in Chapter 3 of this document.

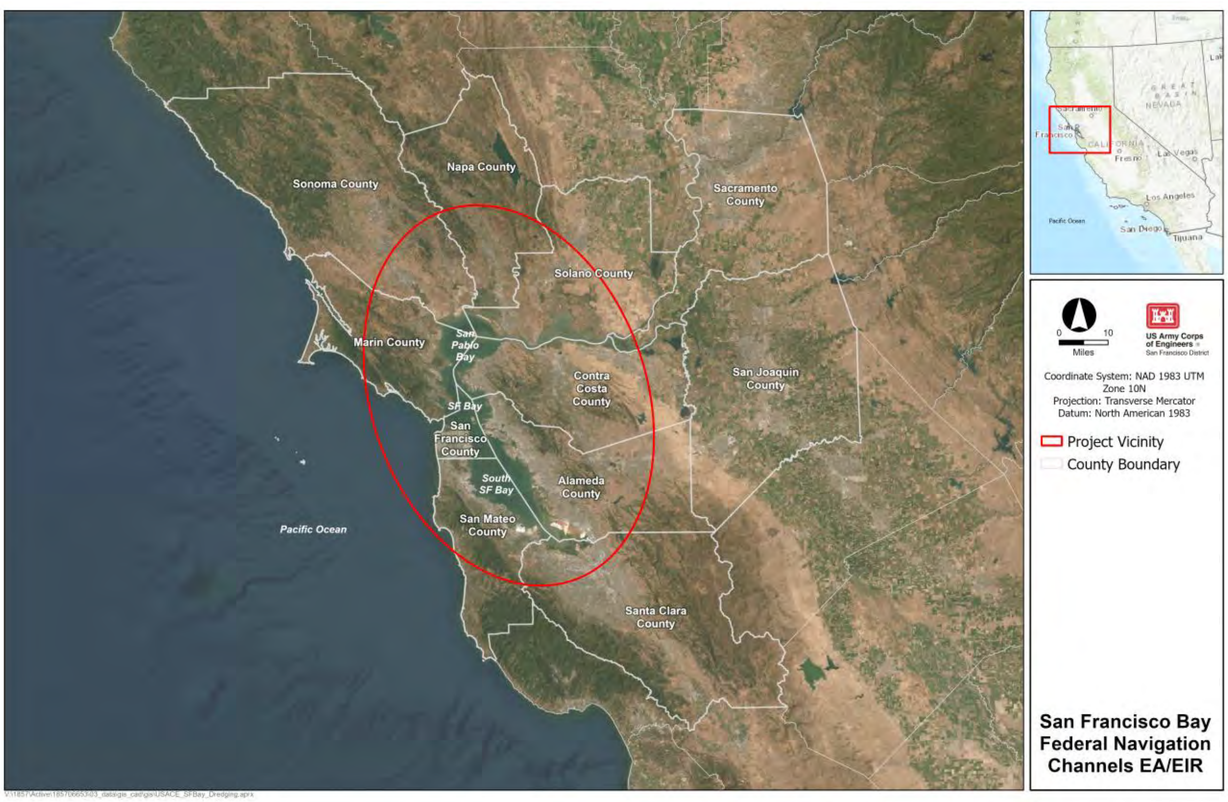

Figure 1-1. Regional Context for San Francisco Bay Federal Channels Operation and Maintenance Dredging and Sediment Placement Activities

1.5 Overview of Federal Navigation Channels Maintenance Dredging

Federal operations and maintenance (O&M) dredging in SF Bay involves the continuation of historically authorized maintenance dredging of the federal navigation channels in SF Bay to remove sediment and return the channels to authorized (or otherwise appropriate) depths to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for the movement of commerce, national security needs, and recreation (Figure 1-2). Where practicable, the project would be aligned with the goals of the LTMS in the SF Bay Region program, as described in the 1998 LTMS Final Environmental Impact Statement/EIR (USACE et al. 1998) and the 2001 LTMS Management Plan (USACE et al. 2001).

1.5.1 Regional Dredged Material Management Plan

To the maximum extent possible, dredging will be consistent with navigation project authorizations and the 20-year RDMMP, a companion document to this EA/EIR. In addition to identifying the Federal Standard Base Plan, a main goal of the 20-year RDMMP is to maximize BUDM opportunities, in line with command philosophy and District priorities, which may improve natural infrastructure by restoring critical ecosystem habitat; enhancing flood protection; and increasing regional resiliency to storm surges (USACE 2024a). Additionally, the RDMMP sets a foundation for a cooperative permitting framework that reduces redundancy and unnecessary delays in permit processing.

1.5.2 Location and Description of Federal Navigation Channels and Placement Sites

USACE maintains 12 federal navigation channels in SF Bay (Figure 1-2). Approximately 2 to 2.5 million CY of maintenance dredge material is removed from the federal navigation channels each year. Oakland Harbor, Redwood City Harbor, Richmond Harbor, San Francisco Harbor (MSC only, no in-Bay Sites), San Pablo Bay/Mare Island Strait, and Suisun Bay Channel, are all dredged annually or semi-annually. Napa River Channel, Petaluma River Channel, and San Rafael Creek Channel are dredged on cycles between four to seven years, as necessary. Suisun Slough Channel and San Leandro Marina (Jack D. Maltester Channel) are authorized but dredged much less frequently; these will not be dredged during the planning horizon of this EA/EIR and are not included in the evaluation.

Table 1-1 provides the authorized dimensions, type of dredge equipment commonly used, dredging cycle (i.e., frequency of dredging), last fiscal year the project was dredged, and the historic dredged material placement site for each project. Authorized dimensions are the depth and width of the channel authorized by Congress to be constructed and maintained by USACE, while regulatory dimensions refer to channel dimensions at a project location that would continue to be limited to the design. Detailed descriptions of the proposed dredging actions for each of the federally authorized ship channels are presented below. Table 1-2 lists dredged material placement type categories with example placement locations.

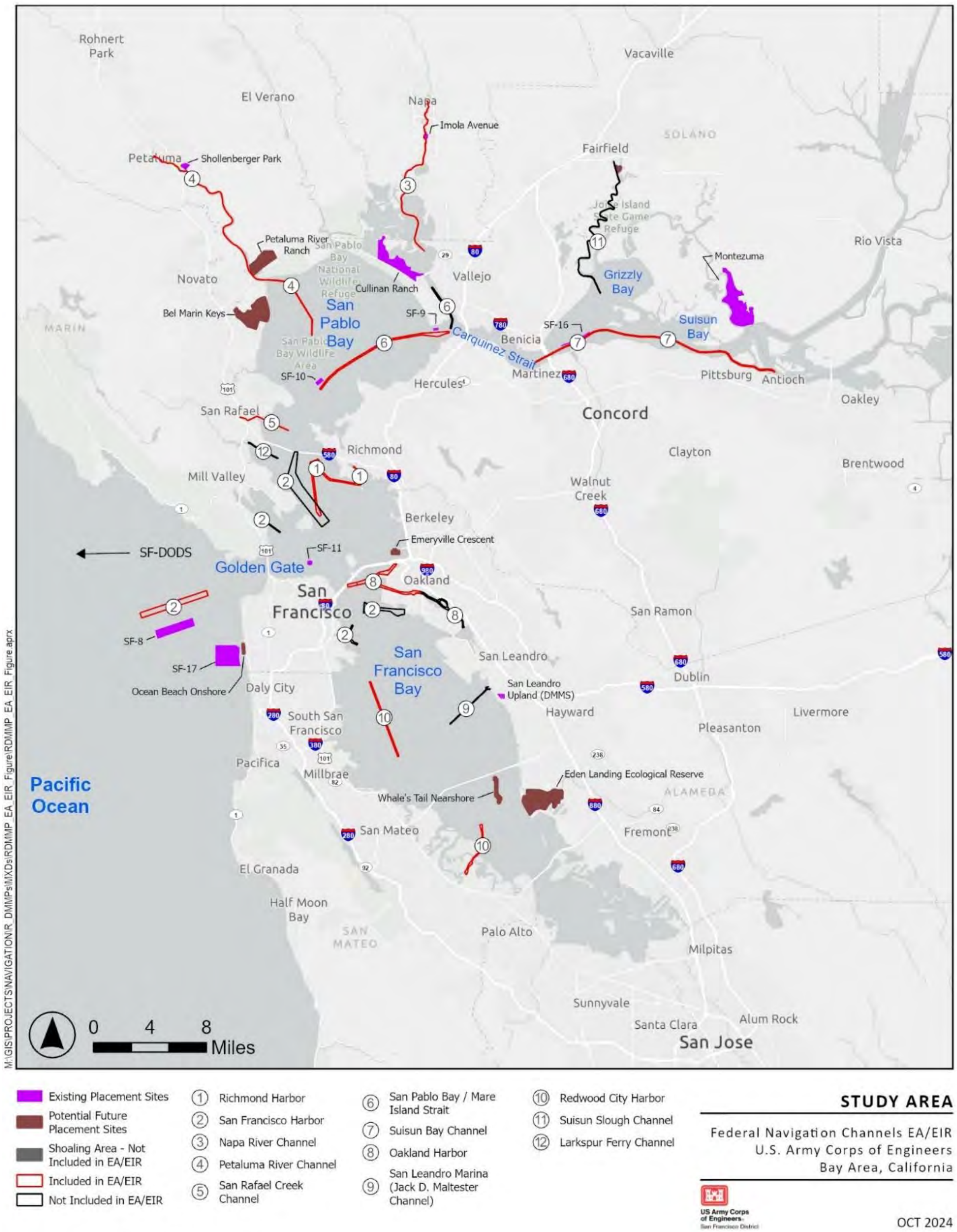

Figure 1-2. Authorized Dredging Projects and Placement Sites in the Study Area

Table 1-1. Current USACE-Maintained Federal Navigation Channels in San Francisco Bay

Dredge Location	Authorized Depth (feet below Mean Lower Low Water)[1]	Length (feet)	Width (feet)	Area (acres)	Dredge Type	Dredging Recurrence (years)	Last Dredged (Fiscal Year)[2]	Historical Placement Site10
Oakland Harbor								
Entrance Channel (Outer Harbor)	50	3,600	1,050	87	Clamshell	1	2024	SF-DODS, SF-11 (prior to 1999), MWRP, Cullinan Ranch, Winter Island, Hamilton Wetlands Restoration Project[3]
Oakland Inner Harbor	50	21,100	600 - 950	402	Clamshell	1	2024	SF-11, SF-DODS, MWRP, Cullinan Ranch
Oakland Outer Harbor	50	16,720	600 - 1000	374	Clamshell	1	2024	SF-11, SF-DODS, MWRP Cullinan Ranch
Brooklyn Basin South Channel	35	14,380	600	187	-	-	-	-
Brooklyn Basin North Channel	25	4,900	450	54	-	-	-	-
Tidal Canal	18	8,760	300	63	-	-	-	-
Redwood City Harbor								
Entrance Channel	30	15,500	300 – 410	132	Clamshell	1	2024	SF-11, MWRP, Cullinan Ranch
Outer Turning Basin	30	2,200	400 - 900	35	Clamshell	1	2024	SF-11, MWRP, Cullinan Ranch
Connecting Channel	30	1,300	400	12	Clamshell	1	2024	SF-11, MWRP
Inner Turning Basin	30	1,849	400-900	30	Clamshell	1	2024	SF-11, MWRP, SF-DODS
Inner Channel	30	7,000	150	24	Clamshell	1	2024	SF-11, MWRP
San Bruno Shoal	30	30,000	500	344	Clamshell//Hopper	1	2005	SF-10/SF-11
Richmond Harbor								
Southampton Shoal	45	17,179	600	277	Hopper	2	2024	SF-11, SF-10
Outer Harbor at Long Wharf	45	4,920	600	341	Hopper	2	2024	SF-11, SF-10
Inner Harbor Entrance Channel	41[4]	20,000	600	459	Clamshell	1	2024	SF-DODS, Cullinan Ranch, MWRP
Inner Harbor Approach Channel	41[4]	8,000	730	101	Clamshell	1	2024	SF-DODS, Cullinan Ranch, MWRP
Santa Fe Channel	30	2,420	200	11	Clamshell	12	1999	SF-DODS
Point San Pablo Channel	20	2,000	150	7	Clamshell	ID	-	SF-DODS
San Francisco Harbor								
MSC (Bar Channel)	55	16,000	2,000	735	Hopper	1	2024	SF-8, Ocean Beach Demonstration Site (SF-17)
Marinship Channel (Richardson Bay)	20	11,120	300	110	-	ID	1982	
Alameda Point Navigation Channel	37	15,430	1,000	588	-	ID	1994	
North Ship Channel	45	31,230	3,900	2,402	-	ID	-	SF-8, SF-11
West Richmond Channel	45	-	-	-	-	ID	-	
Islais Creek Shoal	40	8,890	500	137	-	ID	1977	
Presidio Shoal[5]	40	Varying widths and lengths	Varying widths and lengths	-	-	-	-	
Black Point Shoal[5]	40	Varying widths and lengths	Varying widths and lengths	-	-	-	-	
Alcatraz Shoal[5]	40	Varying widths and lengths	Varying widths and lengths	-	-	-	-	
Point Knox Shoal[5]	35	Varying widths and lengths	Varying widths and lengths	-	-	-	-	

Dredge Location	Authorized Depth (feet below Mean Lower Low Water)[1]	Length (feet)	Width (feet)	Area (acres)	Dredge Type	Dredging Recurrence (years)	Last Dredged (Fiscal Year)[2]	Historical Placement Site10
San Pablo Bay/Mare Island Strait								
Pinole Shoal*	35	40,000	600	799	Hopper	2	2023	SF-10, SF-9 SF-8
Mare Island Strait	35	17,750	600		Clamshell/Hopper	ID	1994	
Suisun Bay Channel								
Main Channel (including Bulls Head Reach[6])	35	73,300	350	575	Clamshell	1	2024	SF-16, MWRP, Cullinan Ranch
New York Slough	35	23,170	400	212	Clamshell	1	2024	
South Sea Island Channel	25	5,600	250	32	Hopper	Infrequent	1994	SF-16, SF-9
Napa River Channel								
Lower Napa River Channel (Mare Island Strait Causeway to Asylum Slough)	15[7]	84,480	100	194	Cutterhead-Pipeline/Clamshell	6–11	1999	Imola, or other upland (sponsor-provided) placement site
Upper Napa River Channel (Asylum Slough to Third Street)	10[8]	16,800	75	34	Cutterhead-Pipeline/Clamshell	6–11	2022	Imola, or other upland (sponsor-provided) placement site
Petaluma River Channel								
Across the Flats	8	25,000	200	115	Clamshell	4–7	2020	SF-10
River Channel	8	21,760 (n) 54,370 (s)	100	52 (n) 125 (s)	Clamshell, Cutterhead-Pipeline	4–7	2020	Shollenberger, beneficial use in 2024
San Rafael Creek Channel								
Across the Flats	8	10,000	100	23	Clamshell	7	2022	SF-10, SF-11, SF-DODS
Inner Canal Channel	6	8,900	60	12	Clamshell	4	2022	SF-10, SF-11, SF-DODS, Winter Island
Turning Basin	6	200	100	0.5	Clamshell	4	2022	SF-10, SF-11, SF-DODS
San Leandro Marina (Jack D. Maltester Channel)								
Main Access Channel	8	18,550	200	80	Cutterhead-Pipeline	4–7	2009	Upland
Interior Access Channel	8	1,860	125	6	Cutterhead-Pipeline	4–7	2009	Upland
Suisun Slough Channel								
Suisun Slough Channel	8	80,290	200	257	Clamshell	ID	1991	Upland
Larkspur Ferry Channel								
Larkspur Ferry Channel[9]	13	12,580	230	70	Clamshell	4–7	2022	SF-10, SF-11

Note: Shaded rows are dredge project location that will not be dredged by USACE in the planning horizon of this EA/EIR

1 Some federally authorized channels are not maintained to their authorized depth. See individual notes
2 Last dredging period only includes the past 10 years.
3 Winter Island was a one-time placement site due to unavailability of Montezuma Wetlands Restoration Project.
4 Richmond Inner Harbor Channel is authorized to -41 feet MLLW, but, maintained to -38 feet MLLW.
5 Shoal location where rocks were removed.
6 USACE recently requested authority approval to increase advance maintenance dredging at Bulls Head Reach from -37 to -39 feet starting in fiscal year 25.
7 Lower Napa River Channel is authorized to -15 feet MLLW, but is maintained at -9 feet MLLW.
8 Upper Napa River Channel is authorized to -10 feet MLLW, but is maintained at -9 feet MLLW.
9 USACE last dredged Larkspur Ferry Channel in 2003 pursuant to the Continuing Authorities Program, Section 107 of the Rivers and Harbors Act of 1960, as directed by Congress in WRDA 1986 and 1999. Since that time, the project has been maintained by the non-federal sponsor, Golden Gate Bridge Highway and Transportation District[10] Beneficial use sites have been used for placement in the past to mitigate for work occurring outside of the NMFS work window (see Section 2.3.1.5).
* In addition to O&M dredging, sea trial dredging will occur in some years at Pinole Shoal. Each episode would generate between 10,500 and 12,000 CY of material. See Sea Trial section below for more information.

Key:
- = Information not available
Cullinan Ranch = Cullinan Ranch Restoration Project
ID = indefinite deferral
MLLW = Mean Lower Low Water
MWRP = Montezuma Wetlands Restoration Project
MSC = Main Ship Channel
SF-8 = San Francisco Bar Channel Placement Site
SF-9 = Carquinez Strait placement site
SF-10 = San Pablo Bay placement site
SF-11 = Alcatraz Island placement site
SF-16 = Suisun Bay placement site
SF-17 = Ocean Beach Demonstration Site

Table 1-2. Dredge Material Placement Type Categories

Placement Type Category	Example Placement Location
Existing Beneficial Use Sites	
Non-Aquatic Direct Placement Sites	Cullinan Ranch Restoration Project, Montezuma Wetlands Restoration Project
Nearshore Strategic Placement Site	SF-17 (Ocean Beach Nearshore Placement Site)
Transitional Placement Sites	
Bar Channel Placement Site	SF-8 (San Francisco Bar Channel Placement Site)
In-Bay Placement Sites	SF-9 (Carquinez Strait Placement Site), SF-10 (San Pablo Bay Placement Site), SF-11 (Alcatraz Placement Site), SF-16 (Suisun Bay Placement Site)
Upland (Sponsor-Provided) Sites	Shollenberger Park, Imola Avenue
Deep Ocean Disposal Site	SF-DODS
Possible Future Beneficial Use Placement Site	
Non-Aquatic Direct Placement Sites	Bel Marin Keys, Skaggs Island (Haire Ranch), Southern Eden Landing Ecological Reserve, Alviso Ponds (A8 Complex), Ocean Beach Onshore, Surfers Beach, Stinson Beach Onshore
Nearshore Strategic Placement Sites	Bel Marin Keys Nearshore (proximal to Petaluma River and Across the Flats Channel), Cogswell Marsh Nearshore (proximal to Oakland Inner and Outer Harbor and Redwood City Harbor Channels), Emeryville Crescent Nearshore (proximal to Oakland Outer Harbor Channel), Faber Tract (proximal to Redwood City Harbor Channel), Giant Marsh Nearshore (proximal to San Pablo Bay Pinole Shoal Channel), Ryer Island Nearshore (proximal to Suisun Bay Channel), Stege Marsh Nearshore (proximal to Richmond Inner Harbor Channel), Stinson Beach Nearshore (proximal to MSC), Surfers Beach Nearshore (proximal to MSC), Whale’s Tail Nearshore (proximal to Redwood City Harbor Channels) Water Column Seeding Sites: Arrowhead Marsh, Corte Madera Marsh, Faber Tract, Pond A6 (Knapp Tract), Ravenswood
Elevation Augmentation/Marsh Spraying Sites	Bothin Marsh, Sears Point

Key: MSC = Main Ship Channel
SF-8 = San Francisco Bar Channel placement site
SF-9 = Carquinez Strait placement site
SF-10 = San Pablo Bay placement site
SF-11 = Alcatraz Island placement site
SF-16 = Suisun Bay placement site
SF-17 = Ocean Beach demonstration site

1.5.2.1 Description of USACE-Managed Federal Navigation Channels

USACE-maintained federal navigation channels in SF Bay are described in the following sections. See Figure 1-2 for channel locations; channel detail figures are provided in the subsections below. Figures 1-3 to 1-11 depict the locations of the authorized dredging channels included in the study area. These channel detail figures also depict placement sites, which are described in Section 1.5.2.2.

Oakland Harbor

Oakland Harbor includes the Entrance Channel, Outer Harbor Channel, Inner Harbor Channel, Brooklyn Basin South Channel, Brooklyn Basin North Channel, and Tidal Canal. Oakland Harbor (Figure 1-3) is in the City of Oakland, on the eastern shore of Central SF Bay immediately south of the San Francisco-Oakland Bay Bridge. Construction of, improvements to, and maintenance dredging of the federal project were accomplished pursuant to the following authorities: the Rivers and Harbors Act of 1910; Rivers and Harbors Appropriations Act of 1917; Rivers and Harbors Act of 1927; Rivers and Harbors Act of 1930; Rivers and Harbor Acts of 1945; Rivers and Harbors Act of 1962; and the WRDA of 1986. Deepening of the Entrance Channel, Outer Harbor Channel, and Inner Harbor Channel to 50 feet below mean lower low water (MLLW) was completed early in 2010. The Port of Oakland is the non-federal sponsor for the Oakland Harbor project.

The Entrance Channel, Outer Harbor Channel, and Inner Harbor Channel are typically dredged annually using clamshell-bucket equipment; these areas were last dredged in 2024. Dredged material from Oakland Harbor has typically been less than 80 percent sand. Prior to 1999, all dredged material from Oakland Harbor was placed at SF-11; since 1999, it has been placed at SF-DODS and SF-11, with BUDM site placement occurring to mitigate for impacts to salmonids when work must occur outside the NMFS work window (see Section 2.3.1.5). Dredge material from Oakland Harbor was also recently placed at non-aquatic direct placement sites, Cullinan Ranch Restoration Project (Cullinan Ranch) and Montezuma Wetlands Restoration Project (MWRP), for tidal wetland restoration. Some material has also been taken to Winter Island and Hamilton Wetlands Restoration Project for work not related to USACE O&M dredging or mitigation; these sites are no longer being used.

The Brooklyn Basin and Tidal Canal portion of this authorized project is not anticipated to be dredged within the planning horizon and therefore is not addressed in this EA/EIR.

Figure 1-3. Dredge Locations and Material Placement Areas for Oakland Harbor

Redwood City Harbor

The Port of Redwood City (Figure 1-4) is approximately 18 nautical miles south of San Francisco on the western side of South SF Bay. It provides deep-draft access to the mid-Peninsula and San Jose metropolitan areas. Redwood City Harbor is situated within the confines of Redwood Creek, and consists of the harbor Entrance Channel, the Outer Turning Basin, Connecting Channel, the Inner Turning Basin, and Inner Channel, along with San Bruno Shoal. The Inner Channel mainly supports recreational craft, and is currently not maintained by the federal government. The federal channels were authorized the Rivers and Harbors Acts of 1884, 1902, 1910, 1930, 1945, and 1950. The Port of Redwood City is the non-federal project sponsor.

Redwood City Harbor was last deepened in 1962. Project maintenance provides for dredging of the channels and turning basins, which range in width from 300 feet to 900 feet, to 30 feet below MLLW. The Entrance Channel, Outer Turning Basin, Connecting Channel, and Inner Turning Basin were historically dredged every one to two years using clamshell-bucket equipment. As of 2024, they are dredged annually; these areas were last dredged in 2024. San Bruno Shoal is dredged using a hopper dredge at 10-year intervals or greater and was last dredged in 2005. Dredged material from Redwood City Harbor channels has typically been less than 80 percent sand and has primarily been placed at SF-11 and SF-10. Though it has not been recently used, the Federal Standard Base Plan for San Bruno Shoal material is identified as SF-DODS. When work must occur outside the NMFS work window, Redwood City Harbor Channel sediment is placed at beneficial use sites to mitigate for impacts to salmonids (see Section 2.3.1.5).

Figure 1-4. Dredge Locations and Material Placement Areas for Redwood City Harbor

Richmond Harbor

Richmond Harbor (Figure 1-5) consists of the Inner Harbor and Outer Harbor. Construction of the federal channel in Richmond Inner Harbor was authorized by the Rivers and Harbors Act of 1917, as amended. Construction of the Outer Harbor was authorized under the Rivers and Harbors Act of 1935, as amended. The Port of Richmond is the non-federal sponsor for the Richmond Harbor Project.

Richmond Outer Harbor is on the eastern side of Central SF Bay within the boundaries of Contra Costa County, with the exception of the Southampton Shoal Channel, which is predominately in San Francisco County (Figure 1-5). Project maintenance provides for annual dredging of the Outer Harbor Channel 600 feet wide to a depth of 45 feet below (MLLW), from Southampton Shoal in Central SF Bay to the Richmond Long Wharf, including the maneuvering area. Richmond Outer Harbor was last deepened in 1965 to 45 feet below MLLW. Richmond Outer Harbor provides deep-draft navigation access to the Richmond Long Wharf and Port of Richmond marine terminals. Deep-draft tankers use the harbor for loading and offloading petroleum products at the Chevron Long Wharf facility. Last dredged in 2024, Richmond Outer Harbor is typically dredged with a hopper dredge, although bucket-clamshell equipment has been used on occasion. Dredged material from the Outer Harbor has typically been less than 80 percent sand and placed at SF-10, with the Alcatraz Island placement site (SF-11) being used as an alternate placement location.

The Richmond Inner Harbor (Figure 1-5) is on the eastern side of Central SF Bay within the boundaries of Contra Costa County. The Inner Harbor consists of the Inner Harbor Entrance Channel, Inner Harbor Approach Channel, and the Santa Fe Channel. Project maintenance provides for annual dredging of the Inner Harbor Entrance Channel 600 feet wide to 38 feet below MLLW to Point Richmond; the Inner Harbor Approach Channel 500 feet wide to 38 feet below MLLW to a 1,260-foot-diameter turning basin at Point Potrero, and then 850 feet wide to 38 feet below MLLW to the Santa Fe Channel; and the Santa Fe Channel, which is 200 feet wide and 30 feet below MLLW. Richmond Inner Harbor was last deepened to 38 feet below MLLW in 1998. The current depth of the entire Inner Harbor is 38 feet below MLLW, with an allowable overdepth of two feet; the Inner Harbor has not previously been dredged to - nor is it maintained at - its federally authorized depth of 41 feet below MLLW. The Inner Harbor Channel provides commercial navigation access to privately owned and City of Richmond-owned marine terminals, including the Point Potrero Marine Terminal. Richmond Inner Harbor, except for the Santa Fe Channel, is typically dredged annually using clamshell-bucket equipment. Richmond Inner Harbor was last dredged in 2024, except for the Santa Fe Channel, which has not been dredged since 1999. Since 2014, dredged material from the Inner Harbor has typically been less than 80 percent sand and placed at SF-DODS, MWRP, and Cullinan Ranch (USACE 2024b).

Figure 1-5. Dredge Locations and Material Placement Areas for Richmond Harbor

Material from some parts of the Upper Inner Harbor Channel (UIHC), which includes the Santa Fe Channel, may exceed the screening criteria for in-Bay placement and upland use due to elevated levels of pesticides, metals, polycyclic aromatic hydrocarbons (PAH), dioxins, and furans. These contaminants are related to the adjacent United Heckathorn Superfund Site and other legacy industrial activities along the shoreline. USACE currently dredges only to Station 217+02, which stops just short of the Santa Fe Channel. Based on the results of sediment chemistry, bioassay and bioaccumulation testing performed in 2018, material from the UIHC and the Santa Fe Channel did not meet the screening criteria for placement in unconfined aquatic in-Bay sites, including SF-11. Material from some portions of the UIHC could be used as foundation material for the MWRP. All the material from the UIHC met the sediment chemistry, bioassay, and bioaccumulation screening criteria for disposal at SF-DODS (USACE 2018).

San Francisco Harbor

San Francisco Harbor (Figure 1-6) consists of a deep-draft navigation channel (MSC or Bar Channel) immediately offshore SF Bay on the San Francisco Bar; and in-Bay components. Construction of a federal channel on the San Francisco Bar was authorized by the Rivers and Harbors Act of 1935, as amended, Pub. L. No. 74-409, 49 Stat. 1028 (August 30, 1935). The Main Ship Channel (MSC) was last deepened in 1974. Current project depth is 55 feet below MLLW, with an allowable overdepth of two feet. As a regional multi-user channel, the MSC does not have a non-federal sponsor.

The MSC (Figure 1-6) is approximately five miles west of the Golden Gate Bridge and extends across the arc-shaped, submerged San Francisco Bar in the Gulf of the Farallones. It is approximately 16,000 feet long and 2,000 feet wide. The MSC is the only deep-draft ocean entrance to SF Bay and is used by all ocean-going shippers to SF Bay and inland ports. It is typically dredged annually and was last dredged in May and June 2024. The MSC must be dredged with a hopper dredge because it is the only type of dredge that can safely operate at this channel due to the combination of depth and open-sea wave conditions. Even with the hopper dredge, weather conditions can present safety concerns and preempt dredging of the MSC. Dredged material from the MSC is greater than 80 percent sand and has been placed at SF-8 and at the Ocean Beach Nearshore Placement site (SF-17), also known as the Ocean Beach Demonstration Site.

In-Bay components of San Francisco Harbor include Marinship Channel in Richardson Bay, Alameda Point Navigation Channel, Berkeley Marina Channel, Northship Channel, West Richmond Channel, and several shoal areas (Figure 1-6). These areas are not anticipated to be dredged within the planning horizon, and therefore are not addressed in this EA/EIR.

Introduction

Figure 1-6. Dredge Locations and Material Placement Areas for San Francisco Harbor

San Pablo Bay (Pinole Shoal)/Mare Island Strait

The San Pablo Bay and Mare Island Strait project consists of the Pinole Shoal Channel and Mare Island Strait. The Pinole Shoal Channel (Figure 1-7) is in Contra Costa County, in southern San Pablo Bay. The federal Pinole Shoal Channel was authorized by the Rivers and Harbors Act of 1917, as amended. As a regional multi-user channel, the Pinole Shoal project does not have a non-federal sponsor.

Pinole Shoal Channel provides deep-draft navigation in and through San Pablo Bay. Shipping operations out of the Port of Stockton, Port of Sacramento, Suisun Bay, San Pablo Bay, and Carquinez Strait make the channel a significant waterway. In addition to being a major link in the navigation system to the inland ports of Sacramento and Stockton, the Pinole Shoal Channel allows deep-draft access to several oil refineries adjacent in the vicinity of Carquinez Strait. Pinole Shoal Channel is used for commercial traffic, including deep-draft, merchant, and oil tanker vessels. It also provides navigational access for recreational boaters to many marinas and small individual docks.

The San Pablo Bay project provides for maintenance dredging of both Pinole Shoal and Mare Island Strait. The Pinole Shoal portion is a 600-foot-wide channel to a depth of 35 feet below MLLW, which is approximately 11 miles long, in San Pablo Bay across Pinole Shoal with a maneuvering area adjacent to Oleum Pier at the mouth of Carquinez Strait (i.e., the Pinole Shoal Channel). The Mare Island Strait portion in composed of a 600-foot-wide channel to 30 feet below MLLW through Mare Island Strait, flaring to a turning basin generally 1,000 feet wide, from former Dike Number 6 to within 75 feet south of the causeway between Mare Island and Vallejo; and a channel to 30 feet below MLLW up the Napa River, except at the northerly end, at the City of Vallejo Marina, where the project depth is 26 feet below MLLW. The Mare Island Strait portion of this authorized project is not anticipated to be dredged within the planning horizon, and therefore is not addressed in this EA/EIR.

The Pinole Shoal Channel is typically dredged with a hopper dredge; however, bucket-clamshell equipment has occasionally been used to dredge the channel. Pinole Shoal Channel was last dredged in 2023. The sediment composition of dredged material from Pinole Shoal Channel varies along the channel, with the eastern and western ends of the channel typically being sandy. Dredged material from Pinole Shoal Channel is typically placed at SF-10, and also has been placed in small amounts at SF-8 and SF-9. When work must occur outside the NMFS work window, sediment is placed at a beneficial use site to mitigate for impacts to salmonids (see Section 2.3.1.5).

The channel is authorized for a depth of 45 feet below MLLW but is only maintained to a depth of 35 feet below MLLW plus two feet of allowable overdepth (i.e., total maintained depth of 37 feet below MLLW). In 2009 and 2010, USACE conducted two feet of advance maintenance in areas that tended to aggressively shoal. This included the southern edge of the channel, between buoy markers 10 and 12; and further east along the northern edge of the channel, starting at buoy marker 11 to just east of buoy 13. The extent of the advance maintenance dredging in these two areas was 200 feet wide and two feet deep.

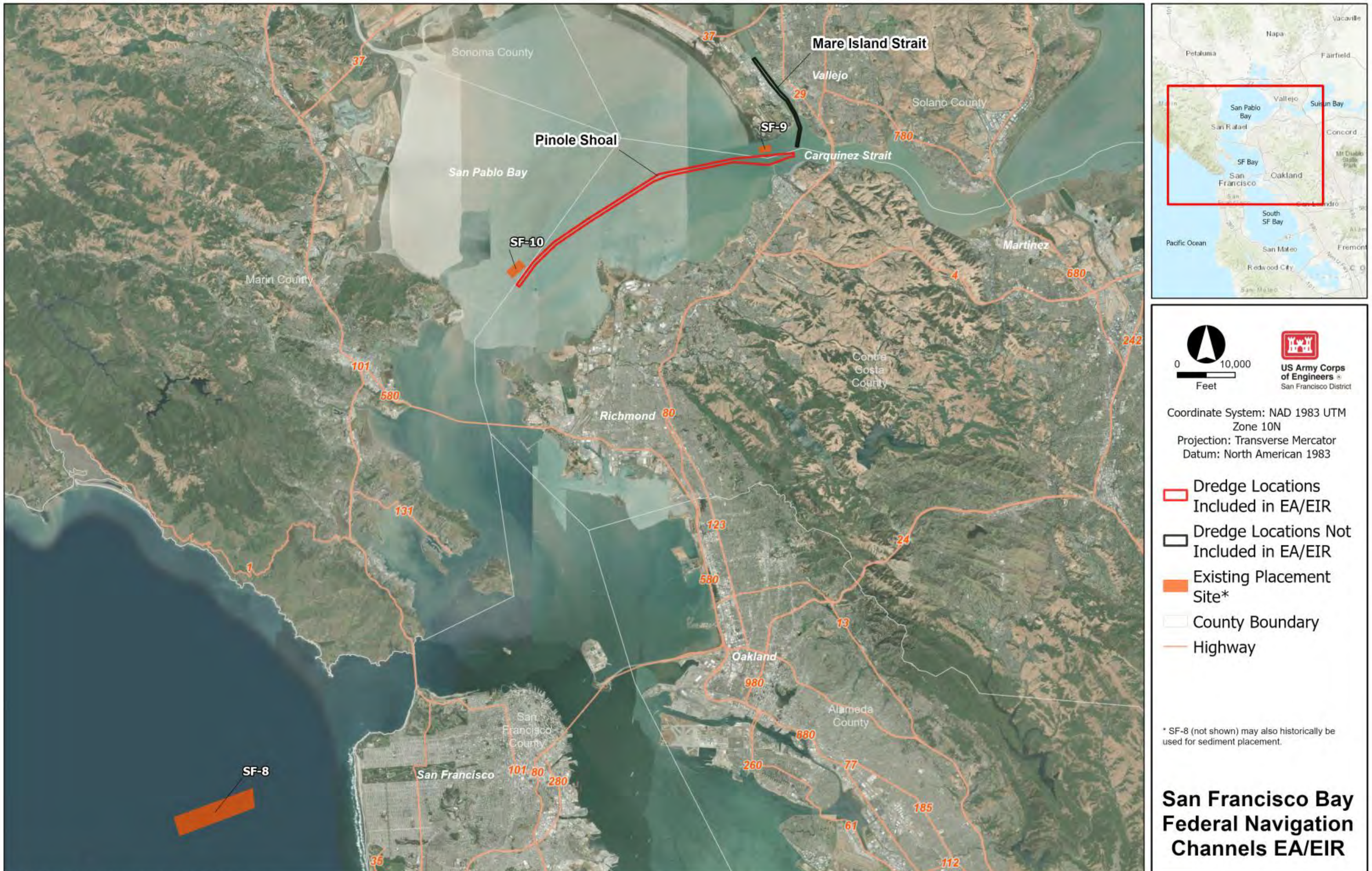

Figure 1-7. Dredge Locations and Material Placement Areas for San Pablo Bay and Mare Island Strait

Beginning in 2011, the lower end of Pinole Shoal Channel was slightly realigned to the north. The realigned channel experiences substantially less shoaling than the old alignment, and thus requires less dredging. Since the realignment of the channel, advance maintenance dredging has not been required.

Suisun Bay

Suisun Bay Channel consists of Bulls Head Reach, Suisun Bay Main Channel, New York Slough, and the South Seal Island Channel. The Suisun Bay Channel (Figure 1-8) is in Suisun Bay, 30 miles northeast of San Francisco, in the counties of Contra Costa and Solano. The Rivers and Harbors Act of 1919 authorized the construction of a federal channel in Suisun Bay. Construction of the New York Slough Channel was authorized by the Rivers and Harbors Act of 1927, as amended. Suisun Bay Channel was deepened to 35 feet below MLLW in 1960; Bulls Head Reach and New York Slough were deepened to 35 feet below MLLW in 1968. Contra Costa County is the non-federal project sponsor.

This channel is an integral part of the SF Bay to Stockton project, providing deep-draft access to the Pacific Ocean from the inland ports of Stockton and Sacramento. The 300-foot-wide Main Channel runs 25,000 feet along the southern shore of Suisun Bay through Point Edith and Middle Ground Shoals to the mouth of New York Slough at Pittsburg. It includes Bulls Head Reach, which extends from the Benicia Bridge to the Avon Pier. New York Slough stretches from Pittsburg to Antioch, approximately four miles. The Suisun Bay Channel and New York Slough are maintained to a depth of 35 feet below MLLW. The Main Channel and New York Slough are typically dredged annually using clamshell-bucket equipment and were last dredged in 2024. Dredged material from Suisun Bay Channel has typically been greater than 80 percent sand and has been placed at the Suisun Bay placement site (SF-16) and occasionally the Carquinez Strait placement site (SF-9).

At Bulls Head Reach, past maintenance has included dredging up to four feet of advance maintenance material to accommodate rapid shoaling. Because of the variable shoaling rate at this location, this practice is reviewed annually to determine if it remains effective. In the case of Bulls Head Reach Shoal, USACE typically elects to perform advance maintenance every year because that area shoals faster than the annual dredging cycle, and it is essential for USACE to maintain the utility of the channel as long as possible before needing to address any shoaling issues outside of the work window. In recent years, advance maintenance at Bulls Head Reach has reduced USACE’s critical dredging episodes outside of the work window. When work must occur outside the NMFS work window, sediment is placed at beneficial use site to mitigate for impacts to salmonids (see Section 2.3.1.5)

As of 2023, USACE Suisun Bay Main Channel material upstream of Station 200+00 must be disposed at Suisun Bay placement site (SF-16). This material must stay within proximity of the channel because of the non-zero chance of containing remnants from the Port Chicago explosion on July 17, 1944.

The South Seal Island portion of this project is not anticipated to be dredged within the planning horizon; it therefore is not addressed in this EA/EIR.

Figure 1-8. Dredge Locations and Material Placement Areas for Suisun Bay Channel

Napa River

The Napa River Channel consists of a downstream reach from Mare Island Strait Causeway to Asylum Slough, and an upstream reach from Asylum Slough to Third Street (Figure 1-9). The channel is a shallow-draft, predominately light commercial and recreational channel. The Rivers and Harbors Acts of August 30, 1935, and July 24, 1946, authorized construction and maintenance of the navigation channel in the Napa River. The Napa County Flood Control and Water Conservation District is the non-federal sponsor for the Napa River project.

Project maintenance provides for dredging of the Napa River Channel to a depth of 15 feet below MLLW from Mare Island Strait Causeway to Asylum Slough, and to a depth of 10 feet below MLLW to the head of navigation at the Third Street Bridge in the City of Napa; the channels were deepened to these depths in 1952. The project is approximately 100 feet wide and 16 miles long. Dredging has historically been conducted using a hydraulic cutterhead dredge or clamshell. Dredged material from the Napa River has typically been less than 80 percent sand and placed at the upland (sponsor-provided) sites. The Napa River is on a six-year dredging cycle. The Upper Napa River was last dredged in 2022 and the Lower Napa River in 1999. Both the Napa River Channel and Lower Napa River Channel, and Upper Napa River Channel are maintained at -9ft.

Petaluma River

The Petaluma River Channel (Figure 1-10) consists of two segments: one known as Across the Flats starting in San Pablo Bay and going up to the mouth of the river; and another in the River Channel. The Petaluma River Channel was authorized by the Rivers and Harbors Act of 1930, as amended. The Petaluma River (Figure 1-10) is in Sonoma and Marin counties, California, on San Pablo Bay. The City of Petaluma is the non-federal sponsor for the Petaluma River project.

Project maintenance provides for dredging the channel 200 feet wide to a depth of 8 feet below MLLW for the Across the Flats segment, and 100 feet wide to eight feet below MLLW thereafter to Western Avenue in Petaluma (River Channel), including a turning basin 300 to 400 feet wide to eight feet below MLLW. Both segments were initially dredged to a depth of eight feet below MLLW in 1933. Dredging has been conducted using clamshell-bucket equipment for Across the Flats, and a hydraulic cutterhead or clamshell-bucket dredge for the upriver channel. Dredged material from Across the Flats has typically been less than 80 percent sand and placed at the San Pablo Bay placement site (SF-10). When work must occur outside the NMFS work window at Across the Flats, sediment is placed at beneficial use site to mitigate for impacts to salmonids (see Section 2.3.1.5). Dredged material from the River Channel has typically been less than 80 percent sand, and has been placed at upland (sponsor-provided) sites. The Across the Flats Channel is on a three-year dredging cycle, and the River Channel is on a four-year dredging cycle. The Petaluma River Channel, and Across the Flats have not been dredged since 2020.

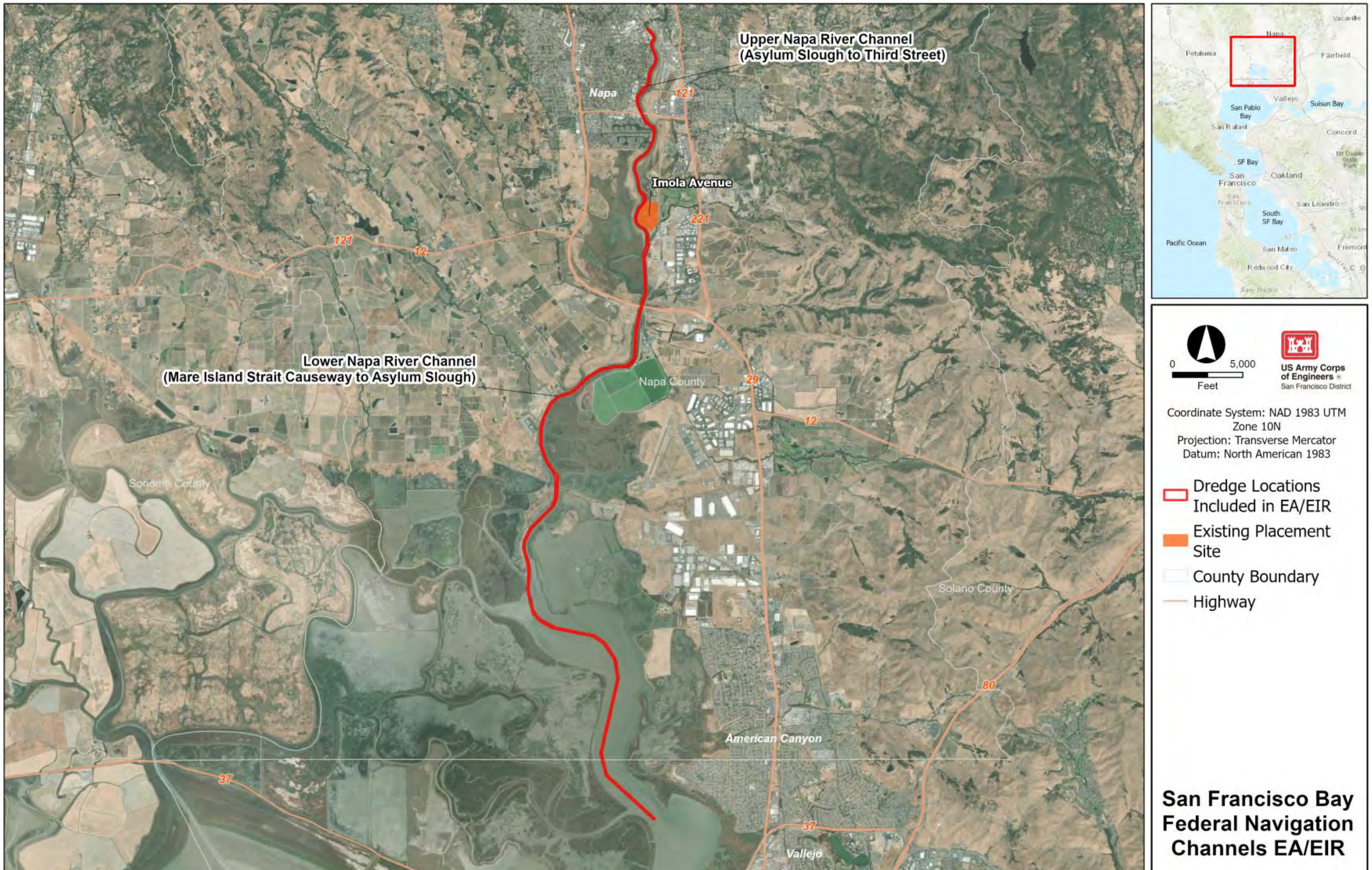

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Figure 1-9. Dredge Locations and Material Placement Areas for Napa River Channel

Figure 1-10. Dredge Locations and Material Placement Areas for Petaluma River Channel

San Rafael Creek

San Rafael Creek Channel (Figure 1-11) consists of the Across the Flats Channel, Inner Canal Channel, and a 200-foot-wide turning basin near the western terminus of the Inner Canal Channel. San Rafael Creek is north of SF Bay in Marin County. This project is a shallow-draft, predominately light commercial and recreational channel. The existing federal project for the construction and maintenance of the Across the Flats Channel, the Inner Canal Channel, and the turning basin was authorized by the Rivers and Harbors Act of March 2, 1919. The channels were deepened in 1925. The City of San Rafael is the non-federal project sponsor.

Project maintenance provides for dredging the Across the Flats Channel in SF Bay to the mouth of San Rafael Creek to a depth of eight feet below MLLW (plus two feet of allowable overdepth); and six feet below MLLW (plus two feet of allowable overdepth) for the Inner Canal Channel to the head of navigation at the Grand Street Bridge in the City of San Rafael. On average, Across the Flats is dredged every seven years, and the Inner Canal Channel and turning basin are dredged every four years. Across the Flats was last dredged in 2020 to a depth of five feet below MLLW. The Inner Canal Channel was last dredged in 2022; the turning basin was last dredged in 2022. Dredging has historically been conducted using clamshell-bucket equipment or a hydraulic cutterhead dredge. Dredged material has typically been less than 80 percent sand and placed at SF-11. In 2002 and 2010, sampling and testing of the shoaled sediment revealed that upstream of Station 175+00 in the Inner Canal Channel, pesticide and PCB concentrations were at levels that are not suitable for in-Bay placement; this material was placed at Winter Island in 2002. Downstream of Station 175+00, the shoaling is relatively “clean,” and is deemed suitable for in-Bay placement. Follow-up analysis in June 2011 confirmed that there has been no downstream migration of the contaminated sediment beyond Station 175+00 since the 2010 sampling and testing event. SF-10 and SF-DODS also may be used for San Rafael Creek material placement. When work must occur outside the NMFS work window, sediment is placed at beneficial use site to mitigate for impacts to salmonids (see Section 2.3.1.5)

Confirmation sediment testing of the Inner Canal Channel in 2022 indicates no significant migration of contaminated material from upstream locations. The data results for metals, PCBs, PAHs, organotoxins, total dichloro-diphenyl-trichloroethane (DDT) and dioxins/furans all indicate no significant changes in channel sediment chemistry and no migration of material from higher concentration areas. The consistent shoaled volumes and consistent, or lower, concentrations of constituents indicate that the channel is stable and unchanged since the April 2021 sampling effort (USACE 2022a).

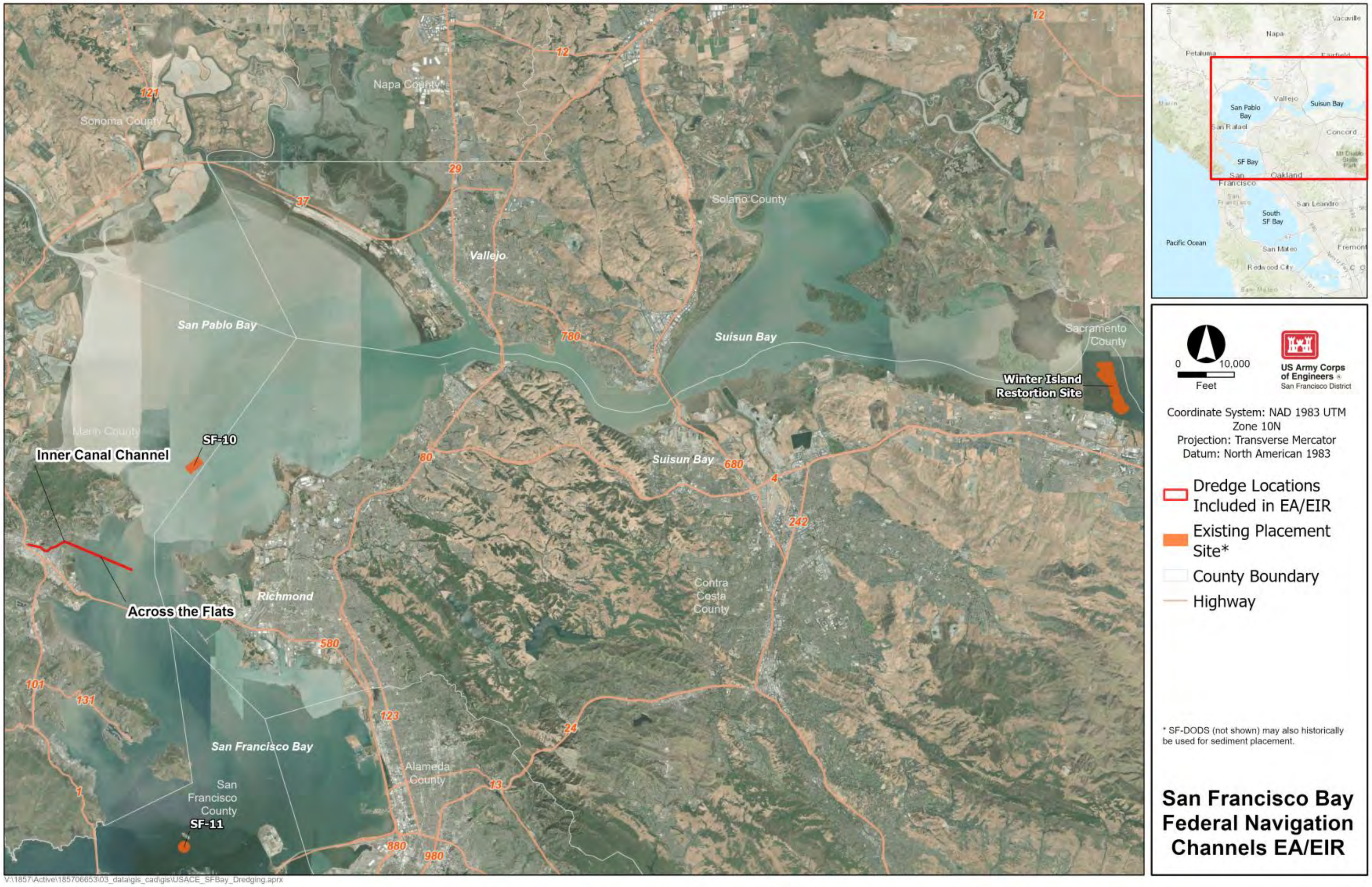


Figure 1-11. Dredge Locations and Material Placement Areas for San Rafael Creek Channel

Sea Trials

In addition to the dredging of the federal navigation channels described above, USACE may perform “sea trials,” which involves dredging that is a necessary component of the maintenance and repair of its hopper dredges, the *Essayons* and/or *Yaquina*. Sea trials occurred in 2016 for the *Essayons* and 2019 for the *Yaquina*. Following the completion of dry dock work, the dredges must undergo standard calibration and testing of all the systems. Federal O&M dredging in SF Bay includes an estimate of three sea trials over the 10-year project horizon. Sea trials are usually conducted at Pinole Shoal for about three to five days between mid-January to late March, depending on when the ship emerges from dry dock. Each episode would generate between 10,500 and 12,000 CY of mostly sandy material, and the material would be placed at SF-11. SF-8 serves as a backup if time and weather conditions allow. Any material placed outside the window will have an equivalent amount placed at a suitable beneficial use upland site per the conditions of the LTMS BiOp (NMFS 2015).

1.5.2.2 Description of Placement Sites

After sediment is dredged from navigation channels, the dredged material is transported to either disposal or placement sites. Use of term “disposal” in this EA/EIR is consistent with definition provided in USACE’s memorandum on *Expanding Beneficial Use of Dredged Material in the USACE* (2023a). “Disposal” is defined as the placement of material in an area where the material is anticipated to remain in place and have no measurable benefit. In open-water placement sites, nondispersive sites are considered disposal; in confined placement sites, disposal applies if the material is not intended to be offloaded for another beneficial use. Transitional placement a new term used by USACE and is defined as keeping sediment in the riverine or coastal system as a part of a management process or in a period of transition. USACE and the Regional Water Board acknowledge that application of “placement” terminology for in-Bay sites differs from terminology used for these sites by most LTMS agencies, including the terminology used by the Regional Water Board in its Basin Plan. Descriptions of the various placement site types are provided in subsections below and defined in Table 2 of the RDMMP.

The regional geographic location of in-Bay and ocean placement and ocean disposal sites currently in use or expected to be used during the 10-year planning horizon is presented in Figure 1-2 and Table 1-2. BUDM placement sites are presented in Figure 1-2 and discussed below. The use of placement and disposal sites is described under the description of the alternatives in Chapter 2.

There are costs associated with use of all sites; these costs vary depending on the dredge equipment used, proximity of the navigation channel to the placement or disposal site, and any applicable tipping fees,[16] among other factors. Typically, the Federal Standard Base Plan placement site is used; however, dredging contractors may propose other permitted upland locations as an alternative to the placement or disposal site or sites identified in a given solicitation for maintenance dredging contracts, so long as the cost to the federal government of the site is comparable to the cost of the Federal Standard Base Plan. All necessary environmental documentation, including regulatory and resource agency review and

[16] A tipping fee is the cost/price per cubic yard dredgers would pay to compensate the contractor’s (or other entity’s) work to install and operate equipment (pipeline, barges, etc.), prepare the site to receive dredged material, and manage the site during dredged material placement operations.

approvals, must be completed for a site prior to receiving any dredged material from the federal channels maintained by USACE.

Existing Beneficial Use Sites

BUDM is the reuse of dredged sediment for construction, levees, tidal wetland restoration or other projects. Existing upland and nearshore placement sites for BUDM are described below; locations are depicted on channel figures in Section 1.5.2.1 where applicable. Not all beneficial use sites will provide the same benefits. For example, sites that restore or supplement tidal wetlands provide benefits to native and endangered species, water quality, and shoreline infrastructure, while levee maintenance primarily provides benefits to shoreline infrastructure.

Non-Aquatic Direct Placement Sites

Non-aquatic direct placement beneficial use sites[17] are those where sediment is transported and placed at desired locations for the purposes of wetland restoration or beach nourishment. These placements occur at or above the water level (Bay or ocean depending on type of placement) between the intertidal and supratidal zones.

Cullinan Ranch Restoration Project

Cullinan Ranch is part of the San Pablo Bay National Wildlife Refuge (Figure 1-2). The USFWS operates the site for the purpose of increasing habitat for salt marsh harvest mouse and Ridgway's rail by restoring diked baylands to historic tidal marsh conditions. The southern property boundary is a naturally formed levee that is the base for State Highway 37. Cullinan Ranch is permitted to restore approximately 290 acres of tidal marsh habitat through the importation of approximately 2.8 million CY of dredged material via an offloading facility temporarily located in the Napa River near its confluence with Dutchman Slough, which accommodates deep-draft barges. Cullinan Ranch is still an active placement site as of 2024, permitted by the Regional Water Board R2-2010-0108.

Montezuma Wetlands Restoration Project

MWRP is a privately owned and operated site of approximately 1,800 acres adjacent to Montezuma Slough in Solano County (Figure 1-2); the owner/operator is Montezuma Wetlands LLC. MWRP has indicated there are two phases of the project remaining, which could accommodate up to 30 million CY of sediment. Imported material is being used to create wetlands. The site can accept both cover and foundation quality material. MWRP is still an active placement site as of 2024, permitted by the Regional Water Board R2-2012-0087.

Nearshore Strategic Placement Site, SF-17 (Ocean Beach Nearshore Placement Site)

The Ocean Beach Nearshore Placement Site, SF-17, which includes the Ocean Beach Demonstration Site, is in waters of the Pacific Ocean adjacent to the south-of-Sloat-Boulevard stretch of Ocean Beach, and outside of the southern section of the San Francisco Bar (Figure 1-2). SF-17's eastern boundary is

[17] Non-aquatic direct placement BU sites may include upland habitat, which is not typically inundated, as well as wetland habitat that is periodically or permanently inundated, such as tidal freshwater and saltwater marshes. Existing non-aquatic direct placement sites considered in this document are wetland restoration sites.

approximately 0.35 mile offshore from the back-beach bluff; its center is four miles southwest of SF-8; and the site's area is 3.3 square miles. Water depths along the shoreward boundary range from approximately 25 to 35 feet below MLLW, and depths along the seaward boundary ranges from approximately 37 to greater than 50 feet below MLLW. Although SF-8 (see subsequent section) was established to disperse sandy material dredged from the San Francisco Bar Channel within the littoral cell[18], sufficient material has not reached the southern reach of Ocean Beach to protect infrastructure from storm damage. The Ocean Beach Demonstration Site was chosen as a demonstration site because it is in a location where waves can potentially feed sediment toward that reach of Ocean Beach, which may ultimately help mitigate ongoing shoreline erosion in the area that threatens expensive municipal infrastructure, including segments of the Great Highway.

Transitional Placement Sites

In transitional placement, sediment is placed in a riverine or coastal system as a part of a management process or for a temporary period. This material will generally be re-dredged or managed for some other purpose (USACE 2023a). Transitionally placed sediment is expected to disperse throughout the system.

SF-8, San Francisco Bar Channel Placement Site

The SF-8 placement site is a 15,000- by 3,000-foot-wide rectangle 7,500 feet south of the San Francisco Bar Channel in the Pacific Ocean (Figure 1-2). Depths at SF-8 range from approximately 30 to 45 feet below MLLW. Disposal is limited to sandy material dredged by USACE from the San Francisco Bar Channel. However, the easternmost portion of SF-8 is within the 3-mile limit, and sand from non-USACE SF Bay Area dredging projects can be permitted there as BUDM for beach nourishment. The trapezoidal portion of SF-8 that is within the 3-mile limit is approximately 3,000 feet long by 430 feet at its northern end; and 1,000 feet wide at its southern end. There is no set limit on disposal at SF-8.

It was expected that sand placed at SF-8 would eventually move shoreward to the surf zone and beach; however, surveys indicate that spreading occurs at a much slower rate than expected. Operation reports from the captain of USACE's hopper dredge *Essayons* state that vessel maneuverability is impaired during times of rough seas because sand is being placed faster than it disperses. Instead of dispersing, sand has mounded and remained on site to the point that safe operation of the *Essayons* (and other large hopper dredges) in much of the SF-8 footprint is often restricted or precluded during the rough seas that commonly occur on the San Francisco Bar. Shoaling at SF-8 was unexpected because pre-site-designation studies concluded that the area would be dispersive, meaning that waves would spread the sand at such a rate that accumulation would be minimal. SF-8 remains a placement site option; however, because of this shoaling, USACE limits the use of SF-8 to the extent feasible.

In-Bay Placement Sites

The four in-Bay placement sites include:

- **SF-9, Carquinez Strait Placement Site**: A 1,000-foot by 2,000-foot rectangle, approximately 10 to 55 feet deep, 0.9 mile west of the entrance to Mare Island Strait in eastern San Pablo Bay

[18] Littoral cells are self-contained beach compartments with distinct sediment movement characteristics that are geographically separated from other cells (Patsch and Griggs 2006).

in Solano County (Figure 1-2). Placement is limited to 1.0 million CY of dredged material per month and a maximum of 3.0 million CY per year during wet or above-normal water flow years, and 2.0 million CY per year during all other years.

- **SF-10, San Pablo Bay Placement Site**: A 1,500-foot by 3,000-foot rectangle, approximately 30 to 45 feet deep, 3.0 miles northeast of Point San Pedro in southern San Pablo Bay in Marin County (Figure 1-2). Placement is limited to 500,000 CY of dredged material per year.
- **SF-11, Alcatraz Placement Site**: A 1,000-foot-radius circular area, approximately 40 to 70 feet deep, approximately 0.3 mile south of Alcatraz Island in the Central Bay (Figure 1-2). Since at least 1972, SF-11 has been the most heavily used placement site in SF Bay. Placement is currently regulated at a maximum of 400,000 CY per month from October to April; and 300,000 CY per month from May to September. Placement is limited to 4.0 million CY of dredged material per year.
- **SF-16, Suisun Bay Placement Site**: A single-user in-Bay unconfined placement site reserved for sand dredged from the Suisun Channel and New York Slough projects only. SF-16 is a 500-foot by 11,200-foot rectangle adjacent to the northern side of Suisun Bay Channel, approximately 1 mile upstream of the Interstate 680 Bridge (Figure 1-2). The depth at this site is approximately 30 feet below MLLW. Currently, the site is authorized to receive 200,000 CY of dredged sand per year.

Upland (Sponsor-Provided) Sites

Two existing upland (sponsor-provided) sites, Shollenberger Park and Imola Avenue, are described below.

- **Shollenberger Park**: Confined placement ponds at the City of Petaluma’s Shollenberger Park are used for placement of sediment dredged from the Petaluma River and permitted by the Regional Water Board under R2-1992-080. Petaluma purchased this 165-acre ranch along the Petaluma River to use for dredged material placement. In 1975, an agreement was reached between Petaluma and the former California Department of Fish and Game (now CDFW) regarding management of the site. Pursuant to this agreement, Petaluma dedicated, in perpetuity, the 80-acre Alman Marsh for open space and fish and wildlife uses. The City also executed an open-space deed restriction for approximately 65 acres of the dredged material placement site. Petaluma continues to protect and maintain Alman Marsh and the 65-acre area. In 2002, Petaluma began the formal process to continue using the Shollenberger site as a decant area for dredged material. In response to resource agency requirements pertaining to salt marsh harvest mouse habitat on the site, Petaluma proposed development and implementation of a management, maintenance, and monitoring plan to operate a 48-acre mitigation site adjacent to the dredged material placement site. Petaluma prepared the Shollenberger Marsh Plan and constructed a berm to separate the mitigation area from the dredged material placement area. As of 2024, the Shollenberger site is at capacity and cannot take any additional dredged material. The City of Petaluma has proposed moving sediment to another parcel or site to create additional capacity but has not found a suitable placement site at this time.
- **Imola Avenue**: The Napa County Flood Control and Water Conservation District’s Imola Avenue dredged material rehandling site is in the City of Napa on the eastern bank of the Napa River, at

the previous location of the Napa Sanitation District. The overall capacity of the Imola Avenue site is 55,000 CY permitted by the Regional Water Board under R2-2016-0040. Material must be dredged via the hydraulic cutterhead method to be placed at this site, because material must be pumped as a slurry. During placement of dredged material, any decant water is discharged into Tulocay Creek, which joins the Napa River to the west.

Deep Ocean Disposal, SF-DODS

Approximately 55 nautical miles west of the Golden Gate Bridge, SF-DODS is the farthest offshore and deepest (8,000 to 10,000 feet) dredged material placement site in the United States. SF-DODS is authorized to receive up to 4.8 million CY of dredged material per year. Data from the period beginning in 2012 and ending in 2021, which is the past 10 years of available data, shows annual disposal at SF-DODS for all dredging projects in SF Bay (not just the federal navigation channels maintained by USACE) has averaged 760,509 CY/year (DMMO Annual Reports). From 2006 through 2013, the amount of dredged material placed annually at SF-DODS by USACE ranged from 0 CY to 1,473,200 CY and averaged 471,590 CY. Annual monitoring by USACE has confirmed that disposal at SF-DODS has occurred without causing significant impacts on the ocean and the marine biology in and around SF-DODS.

Sediment disposed at SF-DODS can have levels of contaminants slightly above that of sediment placed at in-Bay placement sites. Therefore, the LTMS EIS/EIR determined disposal at SF-DODS to be environmentally superior to placement of the same material at the traditional unconfined placement sites in the more sensitive Estuary.

Possible Future Beneficial Use Placement Sites

In its 2023 RDMMP planning charrette, USACE, along with approximately 70 attendees from various state and federal agency partners, resource and regulatory agencies, industry, dredgers, stakeholders, interested parties, and environmental nonprofits, identified additional placement sites as possible future sites for BUDM. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR. Potential impacts related to use of these sites are disclosed on a broad level in Chapter 3 because these sites may become authorized placement sites within the 10-year planning horizon for this document. Use of these sites by USACE would be conditioned upon the completion of supplemental environmental review under NEPA and/or CEQA, and upon acquisition of required environmental approvals from resource and regulatory agencies. The ability of USACE to use a given site for placement would be dependent on the accessibility of the site to different dredge equipment, types of dredged material authorized for placement at the site, cost, and other parameters. Potential future beneficial use placement sites are described in the RDMMP and listed below:

- **Non-Aquatic Direct Placement Sites**: Potential sites include Bel Marin Keys, Skaggs Island (Haire Ranch), Southern Eden Landing Ecological Reserve, Alviso Ponds (A8 Complex), Ocean Beach Onshore, Pacifica Onshore, Surfers Beach, and Stinson Beach Onshore.
- **Nearshore Strategic Placement Sites**: This is the placement of sediment in the shallow subtidal (or potentially intertidal) environment with the expectation that tidal and wave forces will transport

that sediment onto the intertidal mudflat and marsh. Building upon the Eden Landing Whale's Tail 2023 pilot project, the RDMMP team in coordination with non-federal partners and based on feedback received during the June 2023 planning charrette, identified several opportunities to implement future nearshore strategic placement pilot projects. Potential sites include: Bel Marin Keys Nearshore (proximal to the Petaluma River and Across the Flats Channel), Cogswell Marsh Nearshore (proximal to the Oakland Inner and Outer Harbor and Redwood City Harbor Channels), Emeryville Crescent Nearshore (proximal to the Oakland Outer Harbor Channel), Faber Tract (proximal to the Redwood City Harbor Channel), Giant Marsh Nearshore (proximal to the San Pablo Bay Pinole Shoal Channel), Ryer Island Nearshore (proximal to the Suisun Bay Channel), Stege Marsh Nearshore (proximal to the Richmond Inner Harbor Channel), Stinson Beach Nearshore (proximal to the MSC), and Surfers Beach Nearshore (proximal to the MSC), and Whale's Tail Nearshore[19] (proximal to the Redwood City Harbor Channel).

  - **Water Column Seeding Sites**: This is the transport of dredged sediment to the mouth of an existing tidal marsh channel using a modified pipeline offloader, and the placement of that sediment on a flood tide to leverage the tidal flux into the marsh channel and facilitate sediment deposition on the slack high tide. Potential Sites include Arrowhead Marsh, Corte Madera Marsh, Faber Tract, Pond A6 (Knapp Tract), and Ravenswood.

- **Elevation Augmentation/Marsh Spraying Sites**: This is the transport of sediment by pipeline to an existing marsh and the use of a modified pipeline offloader to fan the sediment over top of the existing marsh plain to provide an elevation boost of inorganic sediment, thus facilitating continued natural organic marsh sedimentation. Potential sites include Bothin Marsh in Marin County and Sears Point in Sonoma County.

For descriptions of these types of future beneficial use placement sites and/or descriptions of the individual sites above, see the companion RDMMP to this EA/EIR.

1.6 Regulatory Authorities

Key federal and state laws applicable to of regulation USACE's maintenance dredging program and the development of this EA/EIR are summarized below.

1.6.1 Federal Laws

Key federal laws applicable to of regulation USACE's maintenance dredging program and the development of this EA/EIR are summarized in the following sections. Additional detail on federal laws and regulations specific to resource areas evaluated in this EA/EIR is provided in Regulatory Setting sections in Chapter 3. USACE rescinded its NEPA implementation regulations for the Civil Works program on July 3, 2025, with publication of its interim final rule: Procedures for Implementing NEPA; Removal (90 FR 29461). Since the Interim Final Rule states that "Actions that were ongoing as of the effective date of this rule will continue to use the rule in place at the time the action was started" and this

[19] Preliminary evaluation of Whale's Tail was conducted under a pilot program that was implemented in December 2023, in which sediment was place in shallow subtidal areas to evaluate transport to intertidal mudflat and marsh areas under tidal and wave forces.

EA was released for public review before publication of the Interim Final Rule, it adheres to the prior regulations published in 33 CFR 230.

1.6.1.1 Operation and Maintenance of the US Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged or Fill Material into Waters of the United States or Ocean Waters (33 C.F.R. pt. 335-338)

USACE's maintenance dredging program, including discharge of dredged or fill material into waters of the United States and transportation of dredged material for the purpose of disposal into ocean waters, is regulated under 33 C.F.R. pt. 335-338. Part 335 identifies applicable laws and provides relevant definitions, including the Federal Standard. Part 336 describes factors to be considered in the evaluation of USACE dredging projects involving the discharge of dredged material into waters of the United States and ocean waters, including compliance with Section 404(b)(1) of the CWA, and Section 103 of the MPRSA. Part 337 addresses practice and procedures to be followed in implementing state requirements, responding to emergency actions, and notifying the public of disposal sites.

1.6.1.2 National Environmental Policy Act

NEPA (42 United States Code [U.S.C.] § 4331 *et seq.*), enacted by Congress and signed into law in 1970, was the first major environmental law in the United States. Under NEPA, federal agencies must assess the environmental effects of proposed major federal actions. NEPA outlines a process of environmental analysis and documentation to facilitate decision making. Under NEPA, the lead federal agency, in this case USACE, is the agency that proposes an action and supervises the preparation of an environmental document. This EA/EIR is intended to fulfill the requirements of NEPA, and USACE Procedures for Implementing NEPA (Engineer Regulation 200-2-2).

This integrated NEPA EA/ CEQA EIR was prepared to satisfy the requirements of both NEPA and CEQA. While there are similarities between the two laws, there are several differences. The document reflects these differences in the analysis and inclusion of both a NEPA and CEQA impact determination for each resource. Large sections of the document are only required under CEQA, for example Regulatory Setting, Public Comment NOP, Cumulative Impacts and Growth Inducing Impacts. The USACE believes that the NEPA analysis herein complies with the 75-page limit required by NEPA amendments promulgated in the Fiscal Responsibility Act of 2023. Conforming to the 75-page limit would require that either the EA be separated from the EIR resulting in two separate documents, or a large amount of text and detail would need to be removed from the main body of the document and instead included as appendices. USACE has opted to retain the joint document as originally provided for public review. This approach reduces the potential for inconsistencies that may occur between two documents and ensures sufficient information is provided to both USACE and the Regional Board upon project consideration.

1.6.1.3 Clean Water Act

The Federal Water Pollution Control Act, or CWA (33 U.S.C. §§ 1251 *et seq.*) was enacted in 1972, to establish a structure to restore and maintain clean and healthy waters.

Section 401 (Certification)

Section 401 of the CWA (33 U.S.C. § 1341) requires states to issue WQCs for any activity that requires a federal permit or license, and that may result in discharge into navigable waters, defined in the CWA as "waters of the United States." Under the CWA, waters of the United States include traditional navigable waters and tributaries; impoundments of "waters of the United States;" territorial seas and interstate waters; and some wetlands, lakes, ponds, and streams. (33 C.F.R. Part 328, Final rule, published January 18, 2023). In areas subject to tidal influence, Section 404 jurisdiction extends to the high tide line or boundary of any adjacent wetlands.

In California, the State and Regional Water Boards have the authority to regulate these discharges and issue WQCs. A certification must set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, under section 1311 or 1312 of the CWA, standard of performance under section 1316 of the CWA, or prohibition, effluent standard, or pretreatment standard under section 1317 of the CWA, and with any other appropriate requirement of State law set forth in such certification. (33 U.S.C. section 1341, subd. (d).) To issue a WQC, agencies must ensure compliance with sections 301, 302, 306, and 307 of the CWA, which address, respectively, effluent limitations, water-quality-related effluent limitations, national standards, and toxic and pretreatment effluent standards. The Regional Water Board issued WQC permits for USACE for maintenance dredging for 2015–2024 (Regional Water Board 2015, 2020). Development of this EA/EIR provides the basis for the permit application for CWA Section 401 WQC.

Section 404 (Permits for Dredged or Fill Material)

Under Section 404 of the CWA (33 U.S.C. § 1344), USACE regulates the discharge of dredged and fill materials into waters of the United States. USACE implements Section 404 of the CWA, and USEPA has oversight authority (under Section 404c). Section 404(b)(1) of the CWA establishes procedures for the evaluation of permits, typically by states, for discharge of dredged or fill material into waters of the United States. The law is administered by USACE and USEPA. USACE does not issue permits for its own projects that discharge dredged or fill material into waters of the United States; however, USACE projects must comply with the requirements of the Section 404(b)(1) guidelines. The 2015 EA/EIR (USACE and Regional Water Board) included a Section 404(b)(1) analysis for fiscal years 2015 to 2024. This EA/EIR includes Section 404(b)(1) analysis for continued maintenance dredging in compliance with the CWA (Appendix A).

1.6.2 State Laws

Key state laws relevant to USACE's maintenance dredging program and the development of this EA/EIR are summarized in the following sections. Additional detail on state laws and regulations specific to resource areas evaluated in this EA/EIR is provided in Regulatory Setting sections in Chapter 3.

1.6.2.1 California Environmental Quality Act

CEQA was signed into law in 1970, about eight months after the signing of NEPA. Similar to NEPA, CEQA requires public agencies to consider and disclose to the public the environmental implications of proposed actions, supporting informed decision making on projects and operations that may affect the environment. In addition, under CEQA, agencies are to minimize significant adverse environmental effects to the extent feasible. This EA/EIR is intended to fulfill the requirements of CEQA and the CEQA Guidelines regarding the Water Board's issuance of a WQC. As a federal agency, USACE is not required to comply with CEQA.

1.6.2.2 McAteer-Petris Act

The McAteer-Petris Act, first enacted in 1965, created BCDC with a mandate to prepare a plan to protect SF Bay and its shoreline, and to provide for appropriate development and public access. The McAteer-Petris Act also gave BCDC the power and authority to limit fill, promote public access, prepare for rising sea levels, issue and deny permits within its jurisdiction (SF Bay waters and 100 feet above the shoreline). BCDC also reviews determinations of consistency with the CZMA for federally sponsored projects in SF Bay. The SF Bay Plan, first adopted in 1969 and most recently amended in 2019, is BCDC's policy document specifying goals, objectives, and policies for BCDC jurisdictional areas. BCDC has authority to enforce the CZMA under the policies of the Bay Plan, and USACE is required to be consistent, to the maximum extent practicable.

1.6.2.3 Porter-Cologne Act

The Porter-Cologne Water Quality Control Act, also known as the California Water Code, was established in 1969 and last amended in 2019. Water Code sections 13000 et seq., (Porter-Cologne Act or Act) establishes a comprehensive statutory program for water quality control. The Act is administered by the State Water Resources Control Board and nine Regional Water Quality Control Boards (Regional Water Boards). The Regional Water Boards have primary responsibility for the adoption of WDRs, which regulate the discharge of waste to waters of the state, and for the adoption of water quality control plans for all waters within their respective regions. See Water Code sections 13240, 13260, and 13263. Water quality control plans, or basin plans, consist of a designation for waters within a specified area of (1) beneficial uses to be protected, (2) water quality objectives, and (3) a program of implementation needed for achieving water quality objectives. Id. at section 13050(j). Waste discharge requirements must implement the relevant basin plan. Id. at section 13263. As a federal agency, USACE does not believe it is required to apply for WDRs; however, the Water Board may issue WDRs with the WQC.

1.6.3 Additional Key Environmental Compliance Requirements

USACE and the Regional Water Board, as the lead agencies, are responsible for documenting compliance with other relevant federal and state environmental laws and regulations, and USACE is responsible as the project lead for obtaining the regulatory permits needed to implement the chosen alternative. Table 1-3 lists the key required regulatory permits along with the authorizing agency. More detail on these regulations and relevant required coordination with the issuing agencies is discussed in the regulatory setting sections for each relevant resource area in Chapter 3, as appropriate. A complete list of the relevant federal, state, and local laws and regulations is provided in Appendix B.

Table 1-3. Additional Key Regulatory Requirements

Permits and Approvals	Relevant Resource Areas	Agency
Rivers and Harbors Act	Hazards and Hazardous Materials, Hydrology and Water Quality	USACE
Endangered Species Act Section 7 consultation	Biological Resources	USFWS, NMFS
EFH consultation. Sections 305(b)(1)(D) and 305(b) (2-4) of the Magnuson-Stevens Fishery Conservation and Management Act	Biological Resources	NMFS
Marine Protection, Resources, and Sanctuaries Act	Geology, Soils, and Sediment Quality, Hydrology and Water Quality	USACE
California Endangered Species Act coordination	Biological Resources	CDFW
CZMA Consistency Determination	Fish and Wildlife, Geology, Soils, and Sediment Quality, Hydrology and Water Quality, Land Use and Planning, Tidal Marshes, Tidal Flats, and Subtidal Areas	BCDC

Key: BCDC = San Francisco Bay Conservation and Development Commission
CDFW = California Department of Fish and Wildlife
CZMA = Coastal Zone Management Act
EFH = essential fish habitat
NMFS = National Marine Fisheries Service
USACE = US Army Corps of Engineers
USFWS = US Fish and Wildlife Service

2.0 Proposed Project and Alternatives

This EA/EIR includes six alternatives for detailed evaluation: the NEPA No Action Alternative, the CEQA No Project Alternative, and four action alternatives. The Proposed Action/Proposed Project Alternative is described in Section 2.4. This chapter also describes the alternatives development process and screening criteria, and the alternatives that were considered but not carried forward for detailed evaluation in this EA/EIR.

2.1 National Environmental Policy Act and California Environmental Policy Act Requirements for Evaluation of Alternatives

2.1.1 General NEPA/CEQA Requirements

Both NEPA and CEQA Guidelines emphasize the need for an evaluation of a range of alternatives. The lead agencies are responsible for selecting the range of reasonable alternatives to the project. Because the lead agencies have determined that the level of significance of the potential environmental impacts of this project differ under NEPA and CEQA, they have elected to prepare a joint EA/EIR that involves different levels of detail in the review of alternatives under NEPA and CEQA. The joint NEPA/CEQA approach presents many opportunities for coordination and efficiency. There are, however, a few important differences between the NEPA and CEQA approach to alternatives analysis that are discussed in detail as part of the discussion of each alternative. Consistent with NEPA regulations and the CEQA Guidelines, USACE and the Regional Water Board considered a range of alternatives that: 1) could feasibly attain most of the basic project objectives; and 2) would avoid or substantially lessen any significant adverse impacts from the project.

2.1.2 Requirements Unique to the National Environmental Policy Act

NEPA requires that federal agencies explore and objectively evaluate a range of reasonable alternatives to a proposed federal action to provide a clear basis for choice among options by the decision-makers and the public (42 U.S.C. § 4332(C)(iii)). Under NEPA, agencies are also required to describe and analyze a "no action" alternative. The No Action Alternative for an existing or ongoing federal project considers what would happen if the federal agency continued to operate and maintain the project as authorized with no changes. Thus, the No Action Alternative describes the continuation of the maintenance dredging program in SF Bay as authorized with no changes.[20]

2.1.3 Requirements Unique to the California Environmental Policy Act

CEQA Guidelines (Section 15126.6) require that an EIR "describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the

[20] The No Action Alternative does not meet requirements for a feasible alternative under CEQA. Per CCR Title 14 Section 15364, feasible means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." Current regulatory constraints and dredging equipment limitations preclude USACE's ability to implement the No Action Alternative, thus the No Action Alternative is not technologically or environmentally feasible, respectively, per CEQA.

project but would avoid or substantially lessen any of the significant effects." An EIR should briefly describe the rationale for selecting the alternatives; identify any alternatives that were considered but eliminated by the lead agency; and briefly explain the lead agency's determination. Every conceivable alternative does not need to be considered, but a reasonable range of potentially feasible alternatives should be examined to foster informed decision making and public participation.

Also, an EIR must evaluate a "No Project" alternative (CEQA Guidelines Section 15126.6(e)). Evaluation of a No Project Alternative considers the existing conditions at the time the Notice of Preparation (NOP) is published, or if no NOP is published, at the time environmental analysis is commenced, as well as what impacts would be reasonably expected to occur if the Proposed Project were not approved and implemented. An alternative analysis is one means by which an EIR identifies ways to mitigate or avoid significant effects a project may have on the environment. Lead agencies may not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects, unless certain findings and a statement of overriding considerations can be made (California Public Resources Code [PRC] sections 21002 and 21081; CEQA Guidelines Section 15091.[21])

2.2 Alternatives Development and Screening Process

USACE San Francisco District developed an RDMMP for the District's SF Bay O&M dredging program that outlines the plan for dredging and dredged sediment management over the next 20 years, starting in 2025. The RDMMP presents a detailed assessment of dredging and placement alternatives for federally authorized navigation channels within the study area and establishes a regional Federal Standard Base Plan, i.e., the least cost, environmentally acceptable, and technically feasible dredging and placement option across the SF Bay region. During development of the RDMMP, in the identification of relevant scientific knowledge gaps (which informed subsequent gap analysis studies), and throughout the past ten-year dredging cycle, USACE has continually engaged the public, agencies, and interested parties through its RDMMP planning process, including development of alternatives. Agency input on the RDMMP was provided by the Regional Water Board, BCDC, the USEPA, state and federal fish and wildlife agencies, other resource and regulatory agencies, stakeholders and interested parties, industry, dredgers, environmental nonprofits, and others.

The RDMMP website, https://spn.usace.afpims.mil/Missions/Projects-and-Programs/Regional-Dredge-Material-Management-Plan/, provides a history and overview of the public meetings and outreach that

[21] CEQA Guidelines section 15091 states that "no public agency shall approve or carry out a project for which an environmental impact report has been certified which identifies one or more significant effects on the environment that would occur if the project is approved or carried out unless both of the following occur:

(a) The public agency makes one or more of the following findings with respect to each significant effect:
    (1) Changes or alterations have been required in, or incorporated into, the project that mitigate or avoid the significant effects on the environment.
    (2) Those changes or alterations are within the responsibility and jurisdiction of another public agency and have been, or can and should be, adopted by that other agency.
    (3) Specific economic, legal, social, technological, or other considerations, including considerations for the provision of employment opportunities for highly trained workers, make the mitigation measures or alternatives identified in the environmental impact report infeasible.

(b) With respect to significant effects that were subject to a finding under paragraph (3) of subdivision (a), the public agency finds that specific overriding economic, legal, social, technological, or other benefits of the project outweigh the significant effects on the environment."

have taken place over the past ten-year dredging cycle. USACE has also given numerous presentations at public meetings to solicit feedback, including description of the RDMMP alternatives during the LTMS Committee meeting on April 12, 2024, and in a plenary presentation at the State of the San Francisco Estuary on May 27, 2024. Additionally, USACE leads an interagency working group, in partnership with the San Francisco Estuary Institute (SFEI), to solicit expert technical advice and decision support to USACE on gap analysis studies, including the regional analysis, sediment transport modeling, ecological modeling, sediment transport framework, and decision support and benefits-pathways analysis, https://www.sfei.org/projects/regional-analysis-potential-beneficial-use-locations-san-francisco-bay. These meetings and outreach informed the development, refinement, and subsequent analysis of the alternatives analyzed in this document. Nine RDMMP meetings and outreach events occurred between July 2019 to March 2024 (SFEI 2024).

2.3 Project Description and Alternatives

This section provides a general description of dredging and placement practices that would be implemented under the project alternatives, followed by descriptions of the six alternatives that are analyzed in detail in this EA/EIR. All project alternatives address USACE’s basic project purpose and most of the basic project objectives in accordance with CEQA. Placement locations for dredged material are presented in terms of placement category, rather than specific placement location. The Proposed Action/Proposed Project, described in Section 2.4, comprises a phased implementation of the No Project Alternative, Alternative 1 and Alternative 2, described below:

- The No Project Alternative is alternating hopper dredging at Richmond Outer Harbor and the Pinole Shoal Channel portion of San Pablo Bay every other year.
- Alternative 1 - Beneficial Use: Diversion from Deep Ocean Disposal. This alternative diverts dredged material planned for disposal at SF-DODS to an in-Bay site and upland BU site.
- Alternative 2- Beneficial Use: Regional Optimization, Leverage Hopper Dredging. This alternative proposes to increase hopper dredging in the Bay to offset the increased cost of BU and achieve more BU than Alternative 1.

Lastly, in any given year, USACE may partner with a local sponsor to cost share the incremental cost of beneficial reuse or may fund the incremental cost if suitable funds were provided to USACE through federal appropriations. This would increase beneficial reuse beyond what is described above.

2.3.1 Features and Measures Common to All Alternatives

This section describes measures, or components, that are common to all alternatives evaluated in this EA/EIR.

Maintenance dredging typically involves the following steps: 1) surveying a site to identify sediment accumulated (shoaled) above the authorized project depth, then sampling and testing for sediment quality; 2) excavating shoaled sediment from the dredging site; 3) transporting dredged sediment via scows, hopper dredges, or pipeline to the designated placement site; and 4) placing the dredged material at the designated site, or transfer to another permitted location for placement or use.

The sampling results are reviewed by the DMMO to determine if the sediment is suitable for unconfined aquatic disposal at an in-Bay placement site, ocean disposal, and beneficial use sites (sediment testing requirements are discussed in Section 1.2.2.2).

Typical methods of maintenance dredging include hydraulic or mechanical dredging. Hydraulic dredging involves hopper dredges (a ship with a hopper bin to store and transport material) or suction/cutterheads attached to hydraulic pipelines that convey the dredged material to a scow or directly to a placement site. Mechanical dredging involves bucket or clamshell dredges that scoop material from the channel bed and place it directly into a scow for transport to a placement site. The various methods of dredging and equipment used are discussed below.

2.3.1.1 Dredge Equipment and Methods

The choice of dredging method for a particular area is determined by various site-specific factors. These include the type of substrate, sediment quality, site bathymetry and layout, wave energy, dredging depth, desired production rate, placement method and distance, environmental concerns, and spatial constraints. Additionally, considerations such as equipment costs and availability play a significant role in the decision-making process for selecting the most suitable dredging approach. For the purposes of this EA/EIR, dredging equipment is categorized by two mechanisms (see Figure 2-1):

- **Hydraulic dredging:** Material is removed through a hydraulic pumping or forcing mechanism. For USACE-maintained navigation channels in SF Bay, this can be done with cutterheads, hoppers, or hydraulic pipelines.
- **Mechanical dredging:** Material is removed by using mechanical systems to remove sediments from the dredging site. This can be done with clamshell, bucket, excavator, dipper, or ladder dredges.

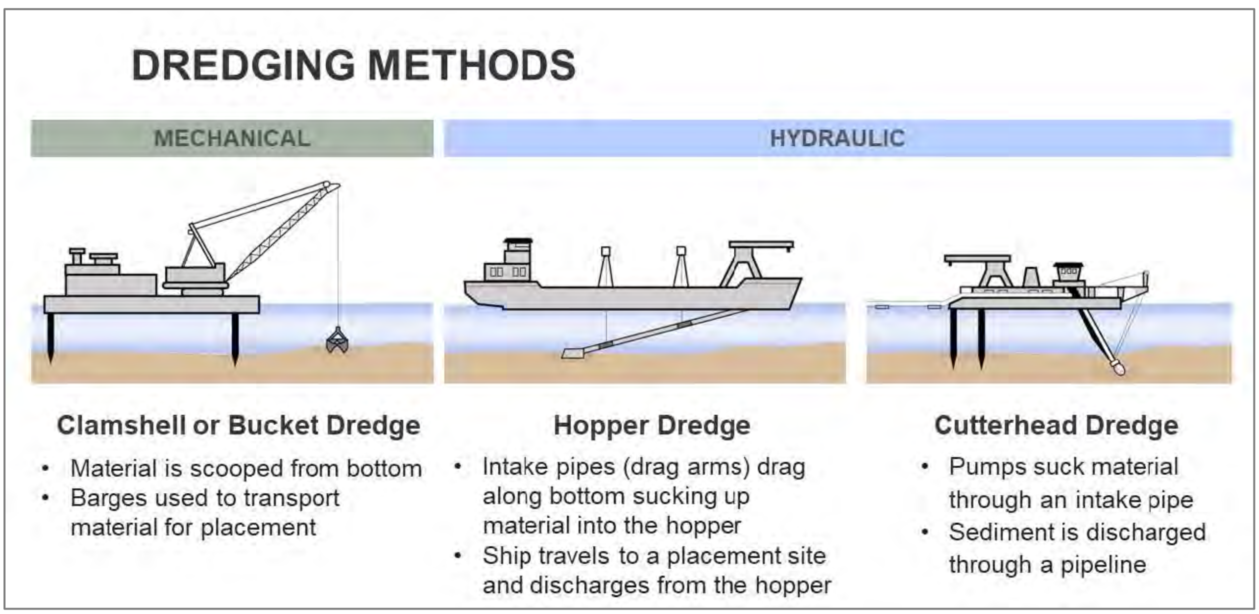


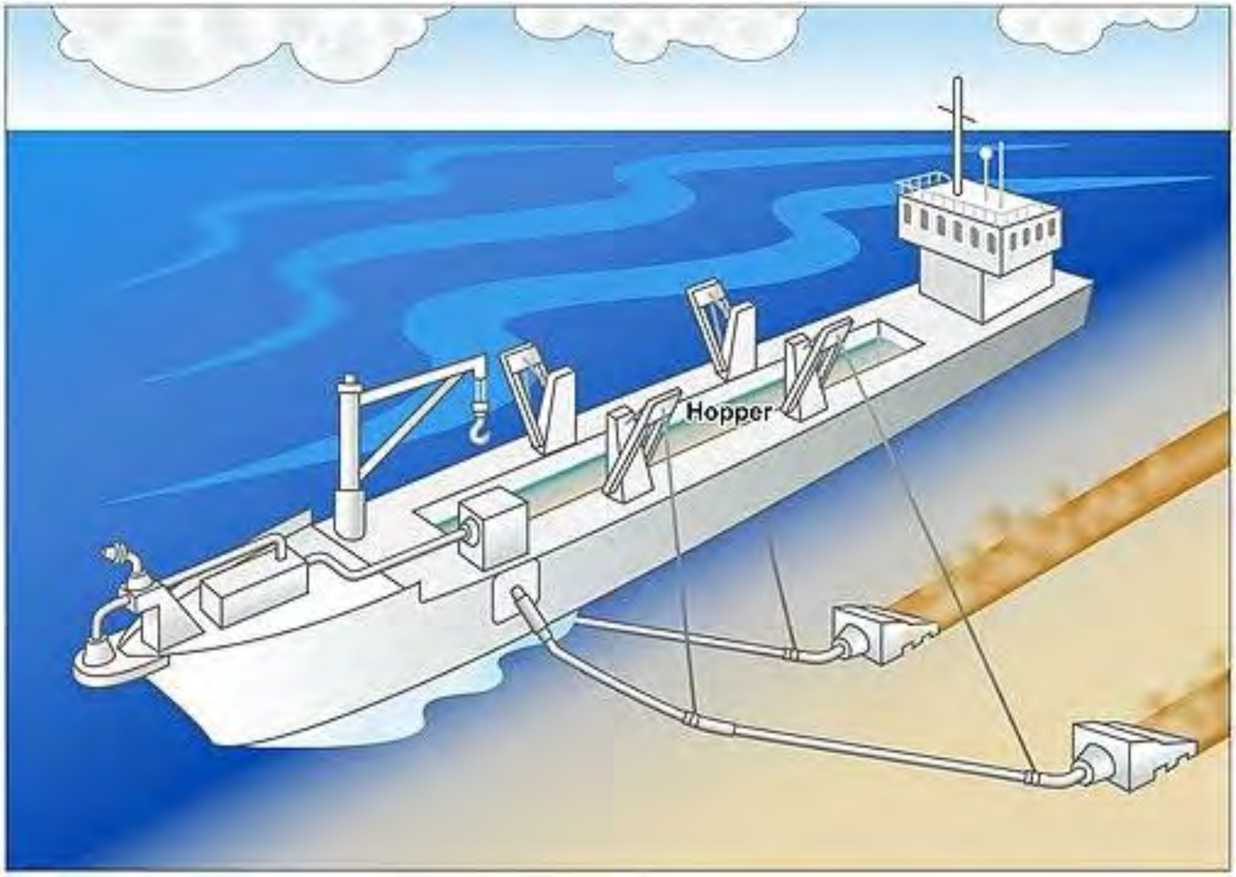
Figure 2-1. Depiction of Mechanical (left, clamshell or bucket) and Hydraulic (right, hopper or cutterhead) Dredge Methods

Hydraulic Dredges

Hydraulic dredges are used to remove and transport sediment in the form of a liquid slurry, typically comprising 80 percent water and 20 percent sediment by weight. Among these, hopper dredges are a specific type of apparatus that pump the dredged material into a self-contained hopper bin onboard the dredge, rather than using a pipeline or scow. Hopper dredges store and transport the sediment in their hopper bins temporarily. Other types of hydraulic dredges, like cutterhead dredges, are generally mounted on barges and use diesel or electric-powered centrifugal pumps with discharge pipes ranging from 6 to 48 inches in diameter. These pumps create a vacuum on the intake side, drawing water and sediments through the suction pipe. The resulting slurry is then transported to the placement site via a pipeline or scow (USACE and Regional Water Board 2015).

Hopper Dredges

Hopper dredges are seagoing vessels designed for dredging and transporting material from navigation channels to open-water disposal areas. They are equipped with a drag arm on each side, consisting of long suction pipes with drag heads at their ends. During dredging, the drag arms are lowered until the drag heads reach the channel bottom. Suction is then activated, and the drag heads are slowly moved across the sediment by the vessel's forward motion (Figure 2-2). Sediment and water slurry are drawn up through the drag heads and arms by onboard pumps and deposited in the hopper bin located in the midsection of the vessel. Once the hopper bin is full, the drag arms are raised, and the dredge moves to a designated disposal or placement area to release the dredged material through large doors at the vessel's bottom. The advantages of hopper dredges include their ability to operate in rough, open water, their capability to move quickly to project sites under their own power, and their minimal interference with vessel traffic during operation. Hopper dredgers also have a low cost in comparison to other mechanical dredging methods. However, technical limitations include draft and maneuvering requirements that restrict their use in shallow waters and narrow channels, interrupted production during transit to and from placement sites, and difficulties in dredging around structures (USACE and Regional Water Board 2015).



Source: US GAO 2014

Figure 2-2. Hopper Dredge Schematic

Table 2-1 lists specifications of the two federally owned hopper dredges used in the SF Bay Area, the *Essayons* and the Yaquina. The *Essayons* is the larger of the two and has a higher production rate, 6,000 CY/load and 43,000 CY/day, respectively, in comparison to the *Yaquina*, 1,050 CY/load and 13,000 CY/day. While it is not commonly used in SF Bay, the *Yaquina* did conduct dredging in the region from 2012 to 2014.

The *Essayons* and the *Yaquina* operate similarly, with one difference being that the *Yaquina* uses a priming system while the *Essayons* features self-priming drag arms that eliminate the need for a separate priming pump. On the *Yaquina*, once the priming system is filled with water, the main pump is activated. In both vessels, priming takes about 15 to 40 seconds and happens within three feet of the sediment surface. Priming allows the pipeline to fill with water, eliminating all air from the system. If there is any air in the system when the main pump starts, it can cause cavitation, which disrupts the pump's operation and can damage the equipment.

Table 2-1. Specifications of Federally Owned Hopper Dredges

Parameter	*Essayons*	*Yaquina*
Length	350 feet	200 feet

Parameter	*Essayons*	*Yaquina*
Drag arm extension	-94 feet MLLW	-45 to -55 feet MLLW
Hopper capacity	6,000 CY	1,050 CY
Draft (when fully loaded)	-27 feet MLLW	-14 feet MLLW
Max speed (when fully loaded)	13.5 knots	10.5 knots
Size of intake pipe	28 inches	20 inches
Size of drag head	100 × 100 inches	54 × 54 inches
Pump size (gpm)	2 at 28,500	2 at 15,000
Water: Sediment Ratio[1]	80:20	80:20
Production Rate[2]	43,000 CY/day	13,000 CY/day
Locations dredged annually	San Francisco Harbor (MSC) Richmond Outer Harbor Pinole Shoal	Varies annually[3]
Volume dredged annually	900,000 CY (annual average)	Varies annually[3]

Source: USACE and Regional Water Board 2015

[1] Average ratio; actual ratio varies by sediment type.
[2] Average Daily Production
[3] The Yaquina does not often dredge in the San Francisco Bay Area. At times, it is scheduled to dredge the federal navigation channels in place of the Essayons. As such, volumes of dredged material vary annually.

Key: CY = cubic yard
CY/day = cubic yards per day
gpm = gallons per minute
MLLW = mean lower low water

In both vessels, once the drag head is embedded in the sediment, the dredge moves forward, cutting through and removing the shoaled sediment along with water, forming a slurry. This slurry is vacuumed through the drag arm to the hopper for temporary storage. Both the *Essayons* and the *Yaquina* have four water intake doors located on top of each drag head, each measuring approximately six inches square. If the drag arms become clogged during dredging, one or more of these doors need to be opened to allow water to flow through the drag arm and clear the clog. The doors should ideally remain closed during dredging to maximize productivity, except for when they are opened to address clogs.

The drag head doors are manually operated. To open the doors, the drag heads are lifted out of the water, and the doors are tied back. To clear a clog, the drag head is lifted from the sediment, and water is pumped through the drag arm to remove any remaining sediment. The drag head lacks a watertight door or valve at its end so when it is lifted out of the water and the pipe tilts enough to allow air in, the system will need to be re-primed before resuming dredging. Clearing clogs and sediment from the drag arm, like priming, takes about 15 to 40 seconds and is done within three feet of the sediment surface. Typically, the drag arms do not clog in areas with mostly sand, but in regions with more silt or mud, one or two doors might need to be opened.

When the hopper is full of dredged material, the drag heads are lifted entirely out of the water and secured in their resting positions on the side of the dredge. The dredge then travels to the designated placement site.

At the placement site, the hopper doors at the bottom of the dredge’s hull open, allowing the dredged material to fall through and settle on the site floor. Sandy material settles quickly, while finer materials like silts and clays remain suspended in the water column for a longer period. Water is taken in at the bottom of the ship and stored in the sea chest. This water is used to both to cool the engines and to flush the hopper bins. On the *Yaquina* or a contractor hopper dredge, water for flushing may also come from the drag arms, which are positioned just below the water surface. In this situation, maintaining the drag head near the surface is crucial to maintaining vessel maneuverability and safety.

The *Yaquina* employs a jetting system with a screened water intake on each of its four sea chests—two forward and two aft. The depth of these sea chests varies due to displacement and can range from eight to 16 feet at the bow and 11 to 14 feet at the stern. The *Essayons* has six sea chests, four for flushing the hopper and two for cooling the engines. The depth of the forward sea chests ranges from 12 to 25 feet, and the rear ones from 18 to 29 feet. For both the *Yaquina* and *Essayons*, the hopper is flushed after each in-Bay placement, a process that takes five to 10 minutes.

It is often beneficial to release excess water from hopper dredges to increase the sediment load in the hopper. This process is called overflow dredging and restrictions may limit its use due to water quality concerns near the dredging site. Overflow dredging happens when the hopper reaches capacity with sediment slurry, and pumping continues to fill the hopper with both water and sediment. Coarser materials settle to the bottom of the hopper, while finer sediments remain suspended in the water. Typically, the hopper retains all dredged material for the first six to seven minutes, after which overflow begins. The amount of fine-grained material reintroduced to the water column varies depending on the sediment type being dredged. In SF Bay, overflow dredging for fine-grained sediments is limited to 15 minutes at all times during hopper maintenance dredging, whereas overflow is unrestricted for sandy sediments (containing over 80 percent sand) due to minimal fine-grained material remaining suspended in the overflow.

On the *Essayons*, overflow from the hopper is directed through overflow weirs, which are tubes extending from the top of the hopper bin to the vessel's bottom, releasing into the water column at the draft level of the ship. In contrast, the *Yaquina* uses a skimmer - a floating pipe within the sediment collection bin - to remove excess water. This water is drained internally within the ship's hull into a collection tank, then released through a valve below the water's surface. Unlike the *Yaquina*, the *Essayons* is equipped with anti-turbidity valves on its overflow weirs. These butterfly-type valves regulate the water volume passing through the overflow tube, thereby minimizing air entrainment during the dredging overflow process, which allows for more efficient settling of sediments and reduced turbidity.

California requires that diesel-powered hopper dredges be equipped with timing retards and turbocharging to minimize nitrogen oxide emissions. The engines on the *Essayons* and *Yaquina* comply with current Tier II standards. USACE holds the appropriate permits from air resource agencies for the operation of both vessels.

Cutterhead-Pipeline Dredges

Cutterhead-pipeline dredges are a type of hydraulic dredge that are equipped with a cutterhead positioned at the end of a pipeline (Figure 2-3). These dredges use onboard pumps to suction material through the intake pipe and subsequently discharge it directly onto the placement site through the pipeline. Due to their direct pumping to the placement site, cutterhead-pipeline dredges can operate continuously and often offer greater cost-efficiency compared to mechanical dredging methods.

A cutterhead is a mechanical device equipped with rotating blades or teeth designed to break up or loosen bottom materials, enabling their suction through the dredge. Some cutterheads are robust enough to handle and remove rock. Cutterhead-pipeline dredges are most effective in deep shoal areas where the cutterhead can penetrate into the sediment. The pipeline itself is made of durable plastic material and is slightly buoyant, designed to float about two inches above the water’s surface when empty and sink to the bottom when filled with dredged slurry. Water mixed with dredged material must be contained at the placement site until the solids settle out, after which it is typically discharged back into the waterway. Cutterhead-pipeline dredges are not suitable for use in areas where sediments are contaminated with chemicals that could dissolve in the dredge water and potentially spread into the environment during discharge.

Pipeline dredges are typically installed on barges, which are not self-propelled and are therefore towed to the dredging site and anchored in place using specialized anchor pilings known as spuds or pivot pipes. Once positioned, the pipeline and cutterhead are lowered to the channel bottom using a ladder. The cutterhead then begins rotating slowly, usually at approximately 30 revolutions per minute, to break up the sediment. As it becomes buried in the sediment, the dredge pumps are activated, suctioning sediment slurry through the pipeline to the designated placement site. During operation, the cutterhead moves from side to side, using the port and starboard spuds as pivots. Cables connected to anchors on either side of the dredge control its lateral movement and assist in propelling the dredge forward.

Cutterhead-pipeline dredges offer several benefits, including the capability to excavate various materials and pump them over long distances; continuous operation, which makes them cost-effective; and the ability to handle certain rock formations without the need for blasting. However, technical limitations include that they are not suitable for projects in open, rough waters and can cause increased turbidity during dredging operations. They also require towboats for transportation, are hard to deploy in strong currents, and can impact navigation due to the presence of the dredge's pipeline leading to the disposal site, particularly in areas with congested, heavy traffic (USACE and Regional Water Board 2015). Due to the need to create a pipeline connecting the source and placement sites, this method can only be paired with BUDM sites when both the dredging and beneficial use sites can be connected without creating a navigation safety hazard.

Source: USACE 2022b

Figure 2-3. Example of a Cutterhead-Type Dredge

Mechanical Dredges, Including Clamshell Dredges

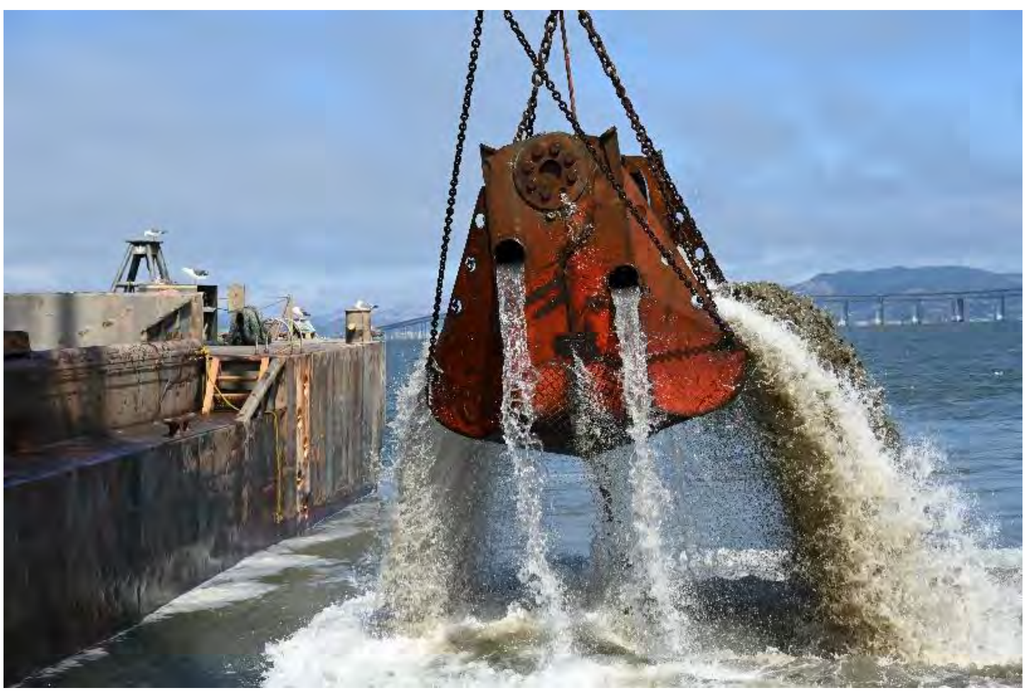
Mechanical dredges remove sediment from the bottom by applying direct mechanical force to dislodge and contain the sediment into a barge or scow for transport to a placement/disposal site. These dredges are typically mounted on barges, towed to the dredging location, and secured using anchors or spuds. Mechanical dredging offers precise positioning and cutting accuracy, making them suitable for use in harbors, around docks, and in protected channels. However, they may be less effective in high-traffic areas or rough seas, where stability can be compromised. Mechanical dredges excel in removing moderately compacted materials and handling large particles, such as gravel, cobbles, and debris. They are, however, inefficient for lighter, free-flowing materials and are unable to excavate relatively hard substances.

Typically, mechanical dredges operate with two or more scows or barges. While one barge is filled, another is towed to the dredged material placement site. This allows for continuous work, with interruptions only occurring when switching scows/barges or relocating the dredge. This setup makes mechanical dredges especially effective for projects where the placement/disposal site is located several miles away. Mechanical dredging is the preferred dredge type when sediment is taken to an non-aquatic beneficial use site, such as MWRP or Cullinan Ranch (USACE and Regional Water Board 2015).

A clamshell dredge is a type of mechanical dredging that uses a vertical-loading grabber connected to a wire rope (Figure 2-4). Bucket, dipper, and backhoe dredges are also categorized as mechanical dredges and function similarly to clamshell dredges. Clamshells are equipped with various bucket configurations designed to optimize the removal of different types of sediment such as silt, mud, clay, sand, gravel, rock, and boulders. In operation, the clamshell dredge lowers the vertical-loading grabber in an open position. The weight of the grabber allows it to penetrate the substrate, after which the bucket is closed around the material. The dredge then raises the loaded bucket above the level of the scow or barge and deposits the material inside.

The grabbers or buckets used for loading can range in size up to 50 CY, although 10- to 20-CY grabbers are typically employed, with 1-CY buckets used for smaller projects. Larger sizes can be custom made for special projects. The operational depth of a clamshell dredge is limited by the length of its wire rope. The dredging production rate is dependent on cycle time, bucket size, dredging depth, type of material being dredged, thickness of the cut, and the efficiency of the transport equipment. According to a study conducted by the USACE San Francisco District, dredging a channel in the SF Bay using a clamshell-bucket dredge can take up to ten times longer than dredging with a hopper dredge (USACE 2013b).

Environmental buckets are primarily used for maintenance dredging tasks because they are not designed for excavating hard materials. They operate similarly to regular clamshell buckets but lack digging teeth and instead feature a seal where the teeth would normally be. This design characteristic enables environmental buckets to retain a higher proportion of water and fine sediment that might otherwise escape from a standard clamshell bucket. Although not typically mandated for USACE maintenance dredging contracts in SF Bay, contractors have the option to use environmental buckets on mechanical dredges. In specific situations, such as dredging sediments of concern, the use of environmental buckets may be mandated (USACE and Regional Water Board 2015).



Source: USACE no date

Figure 2-4 Mechanical (Clamshell) Dredge

2.3.1.2 United States Army Corps of Engineers Hopper Dredge Timing Constraints

USACE uses hopper dredges *Essayons* and *Yaquina*, as well as contract dredgers (West Coast hopper contract) in numerous locations within the West Coast Districts every year. Maintenance dredging in SF Bay deep draft projects (including Richmond Outer, MSC, and Pinole Shoal) has historically been conducted in the early weeks of June and is anticipated to continue during this period for all alternatives evaluated in this EA/EIR. The timing of this work is incorporated into the overall regional maintenance dredging schedule through extensive and rigorous collaborative planning exercises. Every year, navigation managers from each USACE district on the West Coast and surrounding Pacific Ocean regions (Seattle, Portland, San Francisco, Los Angeles, Honolulu, and Alaska) meet to discuss a two-year look ahead plan for the USACE hopper dredging schedule for the next two fiscal years. Because of uncertainty due to many variables and unforeseen events, there is more certainty on the upcoming dredging cycle and less on the second year. The discussion includes days allocated to each project, and how the needs of projects are split up and balanced between the small and medium government hopper dredges and the West Coast hopper contract.

Currently, draft restrictions are frequently implemented in place at Richmond Outer Harbor when shoaling reduces the depth to less than 43 feet below MLLW, with areas that have shoaled to even shallower depths. These conditions can lead to economic impacts because ships carry lighter/reduced loads or change schedules based on tides to reach ports, and shoaling also increases the risk of grounding, which poses health and safety issues from potential oil release into the Bay. Therefore, Richmond Outer Harbor is prioritized for dredging of high spots as soon as possible, with a typical planned start date of June 1. Richmond Outer Harbor has historically been dredged with the *Essayons*, since the *Yaquina* cannot dredge this channel efficiently. The small hopper capacity of the *Yaquina* (1,050 CY versus 6,000 CY for the *Essayons*), coupled with the haul distance to the placement site, would not make it possible to clear the channel in the time allotted.

Aside from the need to address shoaling issues in June, there are equipment availability issues that preclude use of USACE hopper dredges in SF Bay during later June through September

While a change to the start date for dredging from June 1 to later in the season (August 1) for the SF in-Bay projects (Richmond Outer Harbor and Pinole Shoal) has the potential to reduce impacts to some species, a change in the start date would very likely result in projects, such as the Richmond Outer Harbor, not receiving the necessary dredging. This is because dredging equipment typically may not be available due to the timing of work and needs in the other USACE districts. Project site conditions and environmental constraints at each of the USACE navigation projects throughout the West Coast vary greatly, in terms of both timing and severity, and necessitate some amount of flexibility in the scheduling of dredging. Constricting the timing of dredging in SF Bay at one location would affect the ability to maintain all the West Coast projects due to limited availability of existing dredge equipment, as all contractor hopper dredges are home-ported on the East and Gulf coasts. This limited availability also contributes to extremely high cost (up to $10 million) for mobilization and demobilization from the East and Gulf Coast regions, typically between $6 and $8 million per mobilization. Due to these constraints, it is assumed that hopper dredging in Richmond Outer Harbor will only occur in June under all alternatives. However, dredging could occur during other times of the year in accordance with the environmental requirements when dredging outside the environmental work window.

Shoaling in Portland District navigation channels requires the use of the *Essayons* and a contract hopper dredge from late June through mid-November. Dredging during these months is prioritized to address the severe and rapidly changing/developing shoaling In the Columbia River associated with the high flows during spring snowmelt. Two decades ago, the SF dredging projects started in the June and July time frame. However, the period of increased streamflow caused by heavy rain and rapid snowmelt into the Columbia River have been starting earlier than in the past. Changing conditions are causing more intense storms and more variable precipitation. This has significant consequences for the amount and type of sediment that accumulates at the mouth of the Columbia River, which needs to be dredged. It is critical that project depth is reached throughout the river before the low water period in the Columbia River begins in September. Not reaching full project depth would result in draft restrictions in the channel and would greatly hinder the deep draft import/export operations of the various ports located on the Columbia River, resulting in major economic losses for the region, and ultimately the nation.

In the July through November timeframe, the focus of hopper dredging shifts to the Columbia River, where on average 2.5 million to 3.5 million CY are dredged every year by a combination of *Essayons* and the West Coast hopper contract dredge. Timing of this work, like that of the dredging upstream, is critical. Shoaling at the mouth of the Columbia River continues to build well into August, and by the end of September, deteriorating weather conditions at the mouth of the Columbia River become prohibitive for dredging. Insufficient maintenance dredging at the mouth of the Columbia River during the August and September months results in potential draft restrictions, as well as the possibility for more dangerous bar conditions for the rest of year. Even with the multiple dredging events with two hopper dredges concurrently at the Columbia River there are still regular and reoccurring ship closures mandated by the United States Coast Guard (USCG). The mouth of the Columbia River sees an average of two to three bar closures per year due hazardous conditions, which result from a combination of the immense amount of sediment coming from the largest river in the Pacific Northwest colliding with incoming tides, ocean swells, and winds that create unpredictable and dangerous conditions for vessels attempting to transit the river. During these closure periods, no vessel traffic is permitted to transit the bar, which results in severe economic impact. Insufficient maintenance dredging would increase the number of bar closures every year. Even with multiple dredging events by USACE during the July to November time frame, the USCG still restricts transit across the bar at the mouth of the Columbia River when conditions pose a life and safety hazard to vessels.

In 2024, USACE San Francisco District closely coordinated with other West Coast districts to explore flexibility in the regional dredging schedule, considering potential impacts on the San Francisco District’s dredging projects. These discussions included an assessment of each district's environmental windows for threatened and endangered species, as shifting project schedules could jeopardize compliance with those windows. Each project faces unique constraints that influence the overall regional schedule. Given the limited availability of hopper dredges, maintaining flexibility is crucial, but limited; it is not typically possible to schedule around all threatened and endangered species work windows. The Columbia River's dredging schedule, due to its scale and impact, is the overwhelming factor in determining the overall availability of the *Essayons*. Further constraints include the aging government hopper dredge fleet, which is becoming less reliable, and the infeasibility of adding capacity, especially as the government fleet undergoes scheduled maintenance in mid-November to mid-March each year.

2.3.1.3 Transportation of Dredged Material

Dredged material is typically transported using pipelines, hopper dredges, barges, or scows, and occasionally trucks or trains. Hydraulic dredges, like cutterhead dredges, commonly use pipelines to transport material over several miles, with booster pumps extending pumping distances at an increased cost. Hopper dredges, equipped with self-contained hoppers that store dredged sediment, can transport material over long distances and either discharge the material through bottom doors, as is the case for the *Essayons* and *Yaquina*, or by pumping off sediment to shore or a placement location. Barges and scows, often paired with mechanical dredges, are widely used for transporting large quantities of dredged material over long distances. Truck and train transport, more costly than barge transport, is reserved for material that requires rehandling and secondary placement after drying (USACE and Regional Water Board 2015). For comparison, hopper dredge capacities can vary from 130 to 3,300 CY, while scows for typical dredging projects range from about 500 to 5,000 CY (Agarwal 2021; SunCam 2024). Dump trucks can carry about 10 to 16 CY of material, and one rail car can carry 30 to 60 CY. Transport of material to upland placement sites is typically the most expensive option, followed by transport to ocean disposal sites at intermediate cost, while dredged material transport to in-Bay placement sites is the least costly option.

2.3.1.4 Material Placement or Disposal Operations

Proper selection of dredging and transport equipment must align with placement or disposal site requirements. Various methods are used for placement at open-water sites (i.e., in-Bay placement sites or deep ocean disposal), including direct pipeline discharge, mechanical placement, or release from hopper dredges or scows. These sites are categorized as either nondispersive or dispersive. Over the long-term, material placed at nondispersive sites is expected to settle and remain on the bottom, possibly forming mounds. Conversely, over the long-term, predominantly dispersive sites experience material dispersal during placement or through erosion over time due to currents or wave action (USACE and Regional Water Board 2015). Most open-water sites tend to be dispersive.

Placement of dredged material at existing non-aquatic direct placement sites or at upland (sponsor-provided) sites involves placing dredged material in diked nearshore or upland confined facilities using pipelines or other methods to directly remove sediment from a dredge vessel or scow and place it at the site. Material deposited in these sites initially may occupy several times its original volume due to water content. Over time, through settling and desiccation, the sediment will consolidate to its original volume or less (USACE and Regional Water Board 2015).

Placement site categories for alternatives are as described in Chapter 1, Section 1.5.2.2 and include the following:

- Existing Beneficial Use Sites:
  - Non-aquatic Direct Placement Sites: Cullinan Ranch and MWRP for tidal wetland restoration
  - Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)
- Transitional Placement Sites:
  - SF-8 (San Francisco Bar Channel Placement Site)

  - In-Bay Placement Sites: SF-9 (Carquinez Strait Placement Site), SF-10 (San Pablo Bay Placement Site), SF-11 (Alcatraz Placement Site), SF-16 (Suisun Placement Site)
  - Upland (sponsor-provided) Sites: Shollenberger Park, Imola Avenue
- Deep Ocean Disposal Site: SF-DODS
- Possible Future Beneficial Use Placement Sites:
  - Non-Aquatic Direct Placement Sites: Bel Marin Keys, Skaggs Island (Haire Ranch), Southern Eden Landing Ecological Reserve, Alviso Ponds (A8 Complex), Ocean Beach Onshore, Pacifica Onshore, Surfers Beach, and Stinson Beach Onshore
  - Nearshore Strategic Placement Sites: Bel Marin Keys Nearshore (proximal to Petaluma River and Across the Flats Channel), Cogswell Marsh Nearshore, (proximal to Oakland Inner and Outer Harbor and Redwood City Harbor Channels), Emeryville Crescent Nearshore (proximal to Oakland Outer Harbor Channel), Faber Tract (proximal to Redwood City Harbor Channels), Giant Marsh Nearshore (proximal to San Pablo Bay Pinole Shoal Channel), Ryer Island Nearshore (proximal to Suisun Bay Channel), Stege Marsh Nearshore (proximal to Richmond Inner Harbor Channel), Stinson Beach Nearshore (proximal to MSC), Surfers Beach Nearshore (proximal to MSC), and Whale’s Tail Nearshore (proximal to Redwood City Harbor Channels)
  - Water Column Seeding Sites: Arrowhead Marsh, Corte Madera Marsh, Faber Tract, Pond A6 (Knapp Tract), Ravenswood
  - Elevation Augmentation/Marsh Spraying Sites: Bothin Marsh in Marin County, Sears Point in Sonoma County

2.3.1.5 Dredging and Placement Measures

Under all alternatives, dredging and placement would be conducted in accordance with the following measures:

- Dredging at each project location would be limited to the authorized depth.
- Knockdowns (i.e., knocking down high spots or isolated shoals) may be performed in all locations except the MSC. The volume of material above project design depth to be knocked down is not anticipated to exceed 15,000 CY per year in each deep-draft channel. Knockdowns are subject to the same sediment testing requirements and approvals as full dredging episodes.
- No overflow would be discharged from any barge during transportation, except for spillage incidental to clamshell dredge operations.
- Overflow from hopper-type suction dredges would be limited to no longer than 15 minutes at the dredge site during any one excavation action (cut). Overflow would be unrestricted when dredging material is greater than 80 percent sand.
- Dredging would be conducted during the following time periods (see Table 2-2):
  - Between June 1 and November 30, to the extent feasible, at Oakland Inner and Outer Harbor, Redwood City Harbor (Channels and San Bruno Shoal), Richmond Inner and Outer Harbor, MSC, San Pablo Bay (Pinole Shoal), Petaluma (River Channel and Across the Flats), and San Rafael Creek.
  - Only between August 1 and November 30 at Suisun Bay Channel/New York Slough, and Napa River.

- It is assumed that priority hopper dredging in the Columbia River could preclude dredging during certain times of the year resulting in hopper dredging occurring in June at Richmond Outer Harbor and Pinole Shoal and between December and February for Oakland Harbor and Richmond Inner Harbor. However, there may be instances where dredging outside these timeframes may occur. Dredging and placement activities would be consistent with the work window requirements set out by NMFS, and USFWS in their BiOps on the LTMS (USFWS 2004a; NMFS 2015) (Table 2-3).
- Dredging would stop immediately following any fuel or hazardous waste leaks or spills, and cleanup actions would be implemented.
- During dredging and placement activities, notes to mariners and navigational warning markers would be used as needed to prevent navigational hazards.
- Avoidance and minimization measures, as identified in current LTMS BiOps (NMFS 1998, 2015; USFWS 1999, 2004a, 2004b, 2024, 2025) and EFH Consultation (USACE and USEPA 2011) would be employed to reduce impacts to species and habitat.
- The following measures would be implemented for hydraulic dredging to protect longfin smelt and delta smelt:
  - No dredging would occur in water ranging from zero to five parts per thousand (ppt) salinity between December 1 and June 30.
  - At the beginning and end of each hopper load, pump priming, drag head clearing, and suction of water would be conducted within three feet of the seafloor.
  - Hopper drag head suction pumps would be turned off when raising and lowering the drag arms from the seafloor when turning the dredge vessel.
  - USACE would implement a worker education program for listed fish species that could be adversely impacted by dredging. The program would include a presentation to all workers on biology, general behavior, distribution, and habitat needs, sensitivity to human activities, legal protection status, and project-specific protective measures. Workers would also be provided with written materials containing this information.
  - The drag head, cutterheads, and pipeline intakes will remain in contact with the seafloor during suction dredging.
  - The drag head water intake doors will be kept closed to the maximum extent practicable in locations most vulnerable to entraining smelt. In circumstances when the doors need to be opened to alleviate clogging, the doors will be opened incrementally (i.e., the doors will be opened in small increments and tested to see if the clog is removed) to ensure that doors are not fully opened unnecessarily.
  - USACE will set up a pilot study to assess the potential for directing fish away from the hopper dredge during operations to reduce entrainment. To start, USACE will work with the *Essayons* crew (and/or the future federal hopper dredging vessel) to install and operate fish deterrent equipment such as lights, sound speakers, and/or air jets that would trigger an avoidance response in fish and thus push them from the area of exposure and substantially reduce the risk of entrainment. Light and sound have been shown to trigger avoidance behavior in some fish species, though they may attract others (HDR 2015). There is no data on avoidance or attraction for longfin smelt. Should light and/or sound attract listed species, it will immediately be discontinued. Accordingly, installing fish deterrent equipment that emits light and/or sound prior to initiating priming the hopper dredge and prior to retracting the

hopper from the sediment may reduce impacts to longfin smelt and other fish species by triggering avoidance behavior. This is a new technology that was not available in 2015 when fish entrainment impacts and mitigation were last analyzed. This pilot study will be implemented for two years to determine its effectiveness. If the methods as set up are shown not to be successful, the pilot study will be refined, and tools adjusted and retested. The pilot study could potentially include a lab study providing USFWS and CDFW would allow for some individual longfin smelt be collected to be used for testing. These are pilot studies, meant to be tested to determine whether they would provide protection. These are not considered mitigation to the project. If they provide a measure of protection for all fish species, then the USACE will implement for the long-term if structurally feasible.

- USACE has been testing both environmental DNA (eDNA) sampling and the use of an echosounder in conjunction with hopper dredging activities. From July 21 through July 31, 2023, during hopper dredging by the Essayons at Pinole Shoal Channel, six eDNA sampling events with three replicates per sample occurred. These samples later were assessed for the presence of longfin smelt. Despite being repeatedly observed during the physical entrainment monitoring aboard the Essayons, no longfin smelt were detected in the eDNA samples (ICF 2023). However, USACE also funded a study of new eDNA collection methodologies in wetlands, which found good detection probabilities of longfin smelt when sampling a large volume of water with a tow net and concentrating the eDNA (Bowen et al. 2024). Prior to dredging, eDNA samples could be collected from two potential dredging locations (likely Pinole Shoal Channel and Richmond Outer Harbor), tested the same day for the presence of longfin smelt, and then used to prioritize the order of dredging based on the presence or absence of longfin smelt. Similarly, echosounder data could be collected to assess the fish community in potential dredging locations, and prioritization for dredging could be based on those results. Results of data collected will be evaluated and will inform measures for avoidance and minimization measures to fish species from dredging operations. Echosounding is identified as a potential method that can be applied with eDNA, but use of echosounders is not guaranteed at this point in time. Echosounding has been used in the past in conjunction with trawling as a verification method. This data is still in the process of being analyzed for its effectiveness of use and/or next steps. Turbidity and suspended sediment does impact echosounder as a sampling method. USACE found that echosounder data was more useful at Pinole Shoal and Suisun Bay than at Richmond Outer Harbor because the sediment is sandier in Pinole Shoal. An additional analysis would need to be conducted to determine if there are impacts to other wildlife. As described in Impact BI-1, page 3.42, for many entrainment monitoring samples, often for entire hopper loads, the count of special status species collected by entrainment monitoring aboard the Essayons in San Francisco Bay is zero. This results in a non-normal data distribution, therefore, scaling the data using simple percentages gives questionable results. Protocol for genetic sampling in the Estuary established by Bowen et al. 2024, would be followed and would likely be improved over time. The pilot study could potentially include a lab study providing USFWS and CDFW would allow for some individual longfin smelt be collected to be used for testing. These are pilot studies, meant to be tested to determine whether they would provide protection. These are not considered mitigation to the project. If they provide a measure of protection for all fish species, then the USACE will implement for the long-term if structurally feasible. Effects to marine mammals and other species of the pilot study measures are unknown but will be considered during the pilot study design. Neither the pilot study, eDNA, nor echosounding sampling are mitigation for this project. USACE will conduct tests or analyze existing data (e.g., echosounder) as to whether the deterrent methods, eDNA, and/or echosounders would be an effective means for reducing entrainment risks. Results will be evaluated for the potential to inform measures for avoidance and minimization measures to fish or other species from dredging operations. If results show measures would cause detrimental impacts to species techniques would be revised.

- Under all alternatives, USACE would meet all federal environmental compliance requirements (e.g., CWA Section 404, Endangered Species Act, Marine Protection, Research, and Sanctuaries Act), including those federal requirements implemented by state agencies as applicable (e.g., CWA Section 401, Coastal Zone Management Act).
- In order to avoid and minimize impacts to Cultural and Tribal Resources the following standard practices will be performed.
    - Inadvertent Archaeological Discovery Protocol: If any inadvertent cultural material, or an unusual amount of bone, shell, non-native stone, or historic submerged industrial debris is encountered during dredging, work would be immediately stopped in the area of the find until a qualified archaeologist can be retained to evaluate the find. The archaeologist will determine the potential scientific/historical/cultural significance and will make a recommendation to USACE as to what action or additional measures, if any, are warranted. Additional measures may include additional submerged study, such as geophysical survey ranging from side-scan sonar, marine magnetometry, sub-bottom profiling, and/or diver investigation, to further evaluate the context of the find and make recommendations to USACE. Typical measures include development and implementation of a detailed archaeological resources management plan to recover the scientifically consequential information from archaeological resources. Treatment for most archaeological resources consists of (but is not necessarily limited to) sample excavation, artifact collection, site documentation, and historical research, with the aim to target the recovery of important scientific data
    - Cultural Resources Monitoring Protocol: Identification of sensitive locations may differ for various regions, but shall be based on an archaeological sensitivity analysis that includes all of the following: mapped geologic formations and soils; density of surrounding buried archaeological deposits; potential for remnant Native American fish capture technologies (fish weirs and platforms); density of identified shipwrecks in the APE and vicinity; Native American consultation. Opportunistic monitoring shall include monitoring of the sediment as it is dredged from the submerged landscape and/or when it is placed at the placement locations. The archaeological monitor shall inspect the material dredged for the presence or absence of cultural material. If cultural material is discovered during monitoring or other project activities, all work shall be halted in the vicinity of the discovery until a qualified archaeologist can assess the significance of the discovery. Archaeological monitors shall have a Bachelor of Science or Bachelor of Arts degree in anthropology, archaeology, or a related field, and at least one year’s experience monitoring in California. The monitor should

possess training in maritime archaeology and demonstrate familiarity with ship construction, fastener types, and related artifact classes.

- USACE will conduct pacific herring spawn monitoring during all dredge events in potential spawning habitat between December 1 and March 15. USACE will contact CDFW and coordinate to secure a herring monitor to identify spawns. If observed, USACE will avoid the spawn area until hatch out is complete (14-21 days) and CDFW gives approval to restart.
- USACE will mitigate for take of listed species by taking the sediment dredged outside the work window to beneficial reuse or an equivalent volume in the following year as required by the NMFS' 2015 LTMS Amended Programmatic Biological Opinion.

Table 2-2. USACE San Francisco Bay Maintenance Dredging Timing

Dredging Channel	January		February		March		April		May		June		July		August		September		October		November		December	
	1–14	15–31	1–14	1–29	1–14	15–31	1–14	15–30	1–14	15–31	1–14	15–30	1–14	15–31	1–14	15–31	1–14	15–30	1–14	15–31	1–14	15–30	1–14	15–31
Oakland: Inner and Outer Harbor[1]						California Least Tern[2]																		
Redwood City Harbor: Channels																								
Redwood City Harbor: San Bruno Shoal																								
Richmond Inner Harbor[1]																								
Richmond Outer Harbor																								
San Francisco Main Ship Channel																								
San Pablo Bay (Pinole Shoal)																								
Suisun Bay Channel/New York Slough																								
Napa River																								
Petaluma: River Channel[3]																								
Petaluma: Across the Flats[3]																								
San Rafael Creek																								

[1] Under Alternatives 2 and 3 only, dredging may occur later (December 1 through February 29) at Oakland Inner and Outer Harbor and Richmond Inner Harbor
[2] Dredging during this period will require consultation with USFWS.
[3] Dredging can occur in areas that are not upstream or within 1,000 feet bayward in these locations if impacts are mitigated with BUDM
[4] No dredging can occur within 250 feet of suitable clapper rail habitat during this period.

Dredge Timing Key:
= Typical dredge timing
= Beneficial Use required (if dredging occurs in this window, beneficial use of dredged material is required by National Marine Fisheries Service to mitigate to for impacts to salmonids)
= Consultation with USFWS required
= Dredging Prohibited

Table 2-3. Long-Term Management Strategy Maintenance Dredging Work Windows by Area and Species[1]

Site	Species	Dredge Location (see Figure 1-2)	Jan 1–15	Jan 16–31	Feb 1–15	Feb 16–28	Mar 1–15	Mar 16–31	Apr 1–15	Apr 16–30	May 1–15	May 16–31	Jun 1–15	Jun 16–30	Jul 1–15	Jul 16–31	Aug 1–15	Aug 16–31	Sep 1–15	Sep 16–30	Oct 1–15	Oct 16–31	Nov 1–15	Nov 16–30	Dec 1–15	Dec 16–31
SF Bay Bridge to Sherman Island	Chinook Salmon and Steelhead	1-7	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W	W	W	C	C
Carquinez Bridge to Collinsville	Delta Smelt Water ≤10 feet	7	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Carquinez Bridge to Collinsville	Delta Smelt Water >10 feet	7	C	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W	W	C	C
Napa and Petaluma Rivers, Sonoma Creek	Steelhead	3, 4, 6	C	C	C	C	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	C	C
Napa River	Delta Smelt	3, 6	W	C	C	C	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W
All areas within 150 feet of eelgrass or eelgrass habitat	*Dungeness Crab*	*Various*	W	W	W	W	W	W	W	W	C	C	C	C	W	W	W	W	W	W	W	W	W	W	W	W
San Francisco Bay from Pinole Point to Redwood Creek	*Pacific Herring*	*1, 2, 8, 10*	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	C	C
Richardson Bay & San Francisco Waterfront (Hard stop at Nov 30)	*Pacific Herring*	*2*	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	C	C
Waters of Marin County from the Golden Gate Bridge to Richmond–San Rafael Bridge	Coho Salmon	1, 2, 12	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W	C	C	C	C
Berkeley Marina to San Lorenzo Creek within 1 mile of coastline	California Least Tern	8	W	W	W	W	W	W	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W	W	W
South of Highway 92 Bridge (San Mateo-Hayward)	California Least Tern	10	W	W	W	W	W	W	W	W	W	W	C	C	C	C	C	C	C	C	W	W	W	W	W	W
In Areas with Eelgrass Beds	California Least Tern	Various	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Bay-wide in Areas of Salt Marsh Habitat	Ridgeway's Rail	Various	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Bay-wide within 250 feet of Salt Marsh Habitat	Ridgeway's Rail	Various	W	W	C	C	C	C	C	C	C	C	C	C	C	C	C	C	W	W	W	W	W	W	W	W
In and adjacent to Salt Marsh Habitat	Salt Marsh Harvest Mouse	Various	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Within 300 feet of known roost site	California Brown Pelican	Various	W	W	W	W	W	W	W	W	W	W	W	W	C	C	C	C	C	C	W	W	W	W	W	W

Sources: CDFW 2020; NMFS 2015; USFWS 1999, 2004a, 2004b, 2024
[1] Italicized rows are work windows related to non-federally listed species.
[2] Work may occur outside this window if impacts are mitigated by BUDM. This exemption does not apply to areas upstream or within 1,000 feet bayward of Napa River Channel/Mare Island Strait and Petaluma River.

= Work Window = Consultation Required

2.3.2 No Action Alternative/No Project Alternative

Under NEPA, in cases where the project involves modification of an existing program or management plan, the No Action Alternative may be defined as no change from the current authorized program, or no change in management direction or intensity (*Am. Rivers v. FERC*, 201 F.3d 1186, 1201 (9th Cir. 1999). The No Action Alternative includes activities that may not be necessarily implemented in the current program, but are authorized to occur, such as more frequent dredging.

Section 15126.6 (e)(3)(A) of the CEQA Guidelines states that "when the project is the revision of an existing land use or regulatory plan, policy or ongoing operation, the No Project Alternative will be the continuation of the existing plan, policy or operation into the future." Therefore, under CEQA, the No Project Alternative is a continuation of existing dredging activities. USACE would continue current maintenance dredging practices for the projects it maintains in SF Bay, and the Regional Water Board would consider issuing a WQC/WDR based on USACE's current dredging practices.

The No Action Alternative and No Project Alternative differ in that the No Action Alternative represents the current authorized dredging program, regardless of current implementation, given that past implementation is different than current implementation due to recent restrictions (Regional Water Board 2020) placed on hydraulic dredging in SF Bay. The No Project Alternative, by contrast, represents the current, ongoing dredging operation as implemented over the last permit period per CEQA Guidelines Section 15126.6(e)(3)(A). The No Action Alternative is used as the baseline alternative for NEPA. The No Project Alternative is the baseline under CEQA because it is the same as the existing physical setting (CEQA Guidelines Section 15126.6(e)(1)).

The No Action Alternative and No Project Alternative assumptions are the same in all aspects, except that the No Action Alternative includes all authorized activities, even if they were not implemented at the time this document was prepared. Alternatively, the No Project Alternative includes only dredging activities that were carried out during the previously authorized ten-year program. Specifically, the difference between the No Action Alternative and the No Project Alternative is the dredging frequency at Richmond Outer Harbor and the Pinole Shoal Channel portion of San Pablo Bay. Under the No Action Alternative, dredging is assumed to occur every year via hopper at these locations; under the No Project Alternative, dredging occurs every other year via hopper. In addition, there are a few project depths that are authorized but not currently maintained by USACE at those depths, namely, Richmond Inner Harbor, Richmond Outer Harbor, and Napa River.

2.3.2.1 No Action Alternative (National Environmental Policy Act Baseline)

The No Action Alternative would continue to execute the navigation dredging program in the same way as it has been done in the past 10 years, as authorized. This alternative would place approximately 0 percent of dredged sediment at non-aquatic beneficial use sites, approximately 45 to 55 percent at deep ocean disposal sites, approximately 30 to 40 percent at in-Bay sites, approximately five to 15 percent at ocean beneficial use sites, approximately 0 to 10 percent at ocean sites, and approximately 0 to 10 percent at upland (sponsor-provided) sites. The specific details of the No Action Alternative are detailed in Table 2-4 and Table 2-5. This baseline condition was constructed based on the current navigation program, replicating how each channel would be dredged, how frequently each would be dredged, and where the sediment from each channel would be placed.

Table 2-4. No Action Alternative Placement Volume Summary

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-Aquatic Direct Placement Sites	0	0	0
Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	90,280	225,700
In-Bay Placement Sites	677,100	789,950	902,800
Upland (Sponsor-Provided) Sites	0	22,570	225,700
Deep Ocean Disposal Site	1,015,650	1,083,360	1,241,350
Potential Future Beneficial Use Placement Sites[3]	0	0	0

Notes:
[1] See Section 1.5.2.2 for description of placement sites.
[2] Maximum placement volumes would not be realized across placement locations concurrently.
[3] Potential Future Beneficial Use Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.

Key: CY = cubic yard

Oakland Harbor (Inner and Outer)

The Oakland Inner and Outer Harbor would be dredged annually using a clamshell; dredged sediment would be transported to the placement site by scow. Maintenance dredging activities would occur for a period of approximately 60 days between August 1 and November 30, if feasible. Dredging could start as early as June 1 if funds to the US Department of Agriculture for predator management on Alameda Island are contributed to mitigate for potential adverse impacts of dredging on threatened least terns. The volume of dredged material generated by the Oakland Harbor would range between 120,000 and 1,225,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be 750,000 CY per year.

Table 2-5. No Action Alternative Summary

Channel	Placement Site	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	SF-DODS[1]	Clamshell	Not Applicable	1	10	750,000	1,225,000	750,000
Redwood City Harbor: Channels	SF-11[1]	Clamshell	Not Applicable	1	10	180,000	650,000	180,000
Redwood City Harbor: San Bruno Shoal	SF-11[1]	Hopper	Clamshell	Infrequent (as needed)	1	30,000	30,000	5,000
Richmond Inner Harbor	SF-DODS[1]	Clamshell	Not Applicable	1	10	300,000	630,000	300,000
Richmond Outer Harbor	SF-10, SF-11[1]	Hopper	Clamshell	1	10	210,000	730,000	210,000
San Francisco Main Ship Channel	SF-17, SF-8	Hopper	Not Applicable	1	10	255,000 90,000	455,000 160,000	255,000 90,000
San Pablo Bay (Pinole Shoal)	SF-10[1]	Hopper	Clamshell	1 and advance dredging as needed	10	150,000	560,000	150,000
Suisun Bay Channel and New York Slough	SF-16[1]	Clamshell	Not Applicable	1 and emergency episodes as needed[2]	10	165,000	425,000	165,000
Napa River	Upland (sponsor-provided) Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000
Petaluma: River Channel	Upland (sponsor-provided) Site	Cutterhead-pipeline	Clamshell	4–7	2	150,000	210,000	30,000
Petaluma: Across the Flats	SF-10[1]	Clamshell	Not Applicable	3	3	70,000	70,000	20,000
San Rafael Creek	SF-11[1]	Clamshell	Not Applicable	4 - 6	3	110,000	280,000	35,000

[1] Non-aquatic beneficial use site outside of work windows as mitigation
[2] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 cy each per year.
Key: CY = cubic yard

Redwood City Harbor

Channels

The Redwood City Harbor Channels includes Entrance Channel, Outer Turning Basin, Connecting Channel, and Inner Turning Basin. These areas would be dredged annually using a clamshell and transported to the placement site by scow. Maintenance dredging activities would occur between June 1 and November 30. The volume of dredged material generated by the Redwood City Harbor Channels would range between 10,000 and 650,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 180,000 CY per year.

San Bruno Shoal

San Bruno Shoal would be dredged once over the 10-year cycle using a hopper dredge. Maintenance dredging activities would occur between June 1 and November 30. The volume of dredged material generated by San Bruno Shoal would be approximately 30,000 CY per episode. However, because this channel has historically been dredged infrequently, historical dredge volumes may not be representative of future dredge volumes.

Richmond Harbor

Inner Harbor

The inner reaches of Richmond Channel, excluding the Santa Fe Channel, would be dredged annually using a clamshell and transported to the placement site by scow. Maintenance dredging activities would occur for a period of approximately 45 days between June 1 and November 30, as feasible. The volume of dredged material generated by the Inner Harbor Channel would range between 10,000 and 630,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 300,000 CY per year. The Santa Fe Channel is not anticipated to be dredged within the planning horizon (2025 through 2034) and is therefore not included in the study area.

Outer Harbor

The Long Wharf and Southampton Shoal portions of the Outer Harbor would be dredged annually, alternating between using a hopper dredge or clamshell. Maintenance dredging activities would occur for a period of approximately 10 to 15 days for hopper dredging in June and 100 days for clamshell between August 1 and November 30, as feasible. However, dredging may occur anytime within the work window, should appropriate dredge equipment be available. The volume of dredged material generated by the Outer Harbor Channel would range between 85,000 and 730,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 210,000 CY per year.

San Francisco Harbor: Main Ship Channel

The MSC would be dredged annually using a hopper dredge. In-Bay channels within the San Francisco Harbor project are not scheduled for dredging within the planning horizon (2025 through 2034). Maintenance dredging activities would occur for a period of approximately 10 to 14 days in the months of

May and June but may occur as late as September. Dredging of the San Francisco Harbor MSC typically occurs with USACE's hydraulic dredge, *Essayons*, or as part of the west coast hopper contract, with the precise timing dependent on the sea conditions allowing for safe operations. The *Essayons* is the only USACE dredge that is large and stable enough to operate safely in the San Francisco Harbor MSC (USACE and Regional Water Board 2015). The volume of dredged material generated by the San Francisco Harbor MSC would range between 80,000 and 615,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 345,000 CY per year, with approximately 255,000 CY placed at SF-17 and approximately 90,000 CY placed at SF-8.

San Pablo Bay (Pinole Shoal)

The Pinole Shoal Channel would be dredged annually, alternating between a hopper dredge or clamshell. Maintenance dredging activities would occur for a period of approximately five to 15 days for hopper dredging in June and 85 days for clamshell between August 1 and November 30, if feasible. The volume of dredged material generated by the Pinole Shoal Channel would range between 60,000 and 560,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 150,000 CY per year.

Advance maintenance dredging may be performed in areas where it has previously been conducted. This includes the southern edge of the channel, between buoy markers 10 and 12; and further east along the northern edge of the channel starting at buoy marker 11 to just east of buoy 13. The extent of the advance maintenance dredging in these two areas would be 200 feet wide and 2 feet deep; the channel depth is 35 feet.

Suisun Bay Channel

The Suisun Bay Channel and New York Slough Channel would be dredged annually using a clamshell. The dredged sediment would be transported to the placement site by scow. Maintenance dredging activities would occur between August 1 and November 30 (USFWS 2024). The volume of dredged material generated by the Suisun Bay Channel and the New York Slough Channel would range between 50,000 and 425,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 165,000 CY per year.

At Bullshead Reach, past maintenance has included dredging up to four feet of advance maintenance material to accommodate rapid shoaling. This practice would continue to be reviewed annually and implemented as warranted during the regularly scheduled maintenance dredging with a clamshell dredge. In the case of Bullshead Reach Shoal, USACE typically elects advance maintenance every year because that area shoals faster than the annual dredging cycle, and it is essential for USACE to maintain the utility of the channel as long as possible before needing to address any shoaling issues outside of the work window. In recent years, advance maintenance at Bullshead Reach has reduced USACE's emergency dredging episodes[22] outside of the work window. To address continued excessive shoaling, USACE recently requested to increase advance maintenance dredging for Bullshead Reach and a portion of the

[22] Emergency dredging episodes occur outside the regular annual maintenance dredging of Suisun Bay Channel to remove a hazard to navigation when the channel is less than 35 feet below MLLW near the shoal.

Suisun Bay/New York Slough Channel, from elevation 37 feet to 39 feet below MLLW plus two feet of allowable overdepth (USACE 2024c). Approval is anticipated for 2025.

Napa River Channel

The Napa River Channel would be dredged every six to 11 years using a cutterhead attached to hydraulic pipelines, or alternatively using a clamshell. Maintenance dredging activities would occur for a period of approximately 40 days between August 1 and November 30, if feasible[23] (NMFS 2015). The volume of dredged material generated by the Napa River Channel would range between 65,000 and 165,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 20,000 CY per year. However, because of the lower frequency at which this channel is dredged, future dredge volumes could be greater than historical volumes. The Lower Napa River Channel and Upper Napa River Channel are authorized to be dredged to depths of 15 feet below MLLW and 10 feet below MLLW, respectively.

Petaluma River

River Channel

The Petaluma River Channel would be dredged every four to seven years using a cutterhead attached to hydraulic pipelines, or alternatively using a clamshell. Maintenance dredging would occur for a period of approximately 65 days between June 1 and November 30 (NMFS 2015). Dredging may occur outside this work window if impacts are mitigated with BUDM. The volume of dredged material generated by the Petaluma River Channel would range between 75,000 and 210,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 30,000 CY per year.

Across the Flats

Dredging of Across the Flats would occur every three years using a clamshell dredge. The dredged sediment would be transported to the placement site by scow. Maintenance dredging would occur for a period of approximately 45 days between June 1 and November 30, if feasible (NMFS 2015). Within 1,000 feet bayward of the mouth of Petaluma River for this channel, dredging may occur outside this work window if impacts are mitigated with placement of material at beneficial use site(s). The volume of dredged material generated by the Across the Flats portion of the channel would be approximately 70,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 20,000 CY per year. However, because this channel has historically been dredged infrequently, historical dredge volumes may not be representative of future dredge volumes.

San Rafael Creek

The San Rafael Creek Channel, which includes Across the Flats Channel and Inner Canal Channel, would be dredged every four to six years using a clamshell dredge. Maintenance dredging activities would occur for a period of approximately 35 days between June 1 and November 30, if feasible. The volume of dredged material generated by the San Rafael Creek Channel would range between 35,000

[23] Feasibility is contingent upon the availability of federal funds (e.g., timing of Congressional appropriations) to execute the dredging work, as well as by the availability of dredging equipment to perform the dredging work at the referenced time and locations.

and 280,000 CY per episode and the average volume of dredged material for the 10-year planning horizon would be approximately 35,000 CY per year.

2.3.2.2 No Project Alternative (California Environmental Quality Act Baseline)

The No Project Alternative (Table 2-6 and Table 2-7) represents a continuation of existing dredging activities and is the current dredging program as implemented by USACE irrespective of current federally authorized dredging frequencies for channels. This alternative, overall, includes less dredging than the No Action Alternative because dredging in Richmond Outer Harbor and Pinole Shoal occurs every other year under the No Project Alternative. Dredging in the Napa River Channel would be done to a higher depth. In all other aspects, this alternative is the same as the No Action Alternative.[24]

Detailed descriptions of the dredging activities for channels that differ than the No Action Alternative are provided below. For a detailed description of all other channels under the No Project Alternative, please refer to the discussion of the No Action Alternative above.

Table 2-6. No Project Alternative Placement Volume Summary

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-Aquatic Direct Placement Sites[3]	0	0	0
Nearshore Strategic Placement Site – SF-17 (Ocean Beach Nearshore Placement Site)	105,850	254,040	317,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	84,680	211,700
In-Bay Placement Sites	635,100	740,950	846,800
Upland (Sponsor-Provided) Sites	0	21,170	211,700
Deep Ocean Disposal Site	952,650	1,016,160	1,164,350
Potential Future Beneficial Use Placement Sites[4]	0	0	0

1 See Section 1.5.2.2 for description of placement sites.
2 Maximum placement volumes would not be realized across placement locations concurrently.
3 Congress appropriated additional funding in fiscal year (FY) 22 for non-aquatic direct placement of dredged material to cover the costs above the federal standard placement costs for contributing projects, which USACE utilized for non-aquatic direct placement of material from Richmond and Oakland dredging episodes in FY23 and FY24. Additionally, the California State Coastal Conservancy (SCC) recently provided funding to cover the incremental cost for placement of dredge material from Petaluma River and Redwood City Harbor at beneficial use/non-aquatic direct placement sites.
4 Potential Future BU Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.

Key: CY = cubic yard
FY = federal fiscal year
SCC = State of California Coastal Conservancy

24 In recent years, supplemental funding provided by Congress and/or the State of California Coastal Conservancy has covered the costs above the federal standard disposal costs for contributing projects to enable placement of dredge material from Oakland Harbor, Petaluma River, Redwood City, and Richmond Inner Harbor at non-aquatic direct placement sites.

Richmond Harbor

Inner Harbor

For the No Project Alternative, Richmond Inner Harbor would continue to be dredged to depth of 38 feet below MLLW. Richmond Inner Harbor is authorized to be dredged to 41 feet below MLLW; however, due to funding constraints, USACE consistently maintains the depth of the channel at 38 feet below MLLW.

Outer Harbor

Under the No Project Alternative, the Long Wharf and Southampton Shoal portions of Outer Harbor would be dredged every two years using a hopper dredge. Maintenance dredging activities would occur for a period of approximately 10 to 15 days in June. The volume of dredged material generated by the Outer Harbor Channel would range between 85,000 and 730,000 CY per episode; the average volume of dredged material for the 10-year planning horizon would be approximately 125,000 CY per year if Richmond Outer Harbor is dredged every year, and 250,000 CY/episode if dredging occurs every other year.

San Pablo Bay/Mare Island Strait

The Pinole Shoal Channel would be dredged every two years using a hopper dredge under the No Project Alternative. Maintenance dredging activities would occur for a period of approximately five to 15 days in June. The volume of dredged material generated by the Pinole Shoal Channel would range between 60,000 and 560,000 CY per episode; the average volume of dredged material for the 10-year planning horizon would be approximately 190,000 CY per episode if dredging occurs every other year.

Napa River Channel

Under the No Project Alternative, Lower Napa River Channel and Upper Napa River Channel would be dredged to 9 feet below MLLW, rather than the authorized depths of -15 feet and -10 feet, respectively.

Table 2-7. No Project Alternative Summary

Channel	Placement Site	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	SF-DODS[1,2]	Clamshell	N/A	1	10	750,000	1,225,000	750,000
Redwood City Harbor: Channels	SF-11[1]	Clamshell	N/A	1	10	180,000	650,000	180,000
Redwood City Harbor: San Bruno Shoal	SF-11[1]	Hopper	N/A	Infrequent (as needed)	1	30,000	30,000	5,000
Richmond Inner Harbor	SF-DODS[1,2]	Clamshell	N/A	1	10	300,000	630,000	300,000
Richmond Outer Harbor	SF-10/SF-11[1]	Hopper	N/A	2	5	250,000	730,000	125,000
San Francisco Main Ship Channel	SF-17, SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
San Pablo Bay (Pinole Shoal)	SF-10[1]	Hopper	Clamshell	2	5	190,000	560,000	95,000
Suisun Bay Channel and New York Slough	SF-16[1]	Clamshell	N/A	1 and emergency episodes as needed[3]	10	165,000	425,000	165,000
Napa River	Upland (sponsor-provided) Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000
Petaluma: River Chanel	Upland (sponsor-provided) Site	Cutterhead-pipeline	Clamshell	4–7	2	150,000	210,000	30,000
Petaluma: Across the Flats	SF-10[1]	Clamshell	N/A	3	3	70,000	70,000	20,000
San Rafael Creek	SF-11[1]	Clamshell	N/A	4–6	3	110,000	280,000	35,000

[1] Non-aquatic beneficial use site outside of work windows as mitigation.
[2] Congress appropriated additional funding in FY22 for direct upland placement of dredged material to cover the costs above the federal standard placement costs for contributing projects, which USACE utilized for non-aquatic direct placement of material from Richmond and Oakland dredging episodes in FY23 and FY24.
[3] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 cy each per year.

Key: CY = cubic yard
FY = federal fiscal year
N/A = not applicable

2.3.3 Beneficial Use: Diversion from Deep Ocean Disposal (Alternative 1)

This alternative proposes to implement the No Action Alternative/No Project Alternative scenarios, except that a federal project otherwise slated for ocean disposal at SF-DODS may be split between placement in-Bay and at an non-aquatic beneficial use site to achieve additional BUDM while maintaining the same cost. In taking this approach, at the Bay-wide programmatic level, this alternative proposes to increase placement of dredged sediment at non-aquatic beneficial use sites from approximately 0 percent (No Action Alternative/No Project Alternative) to five to 20 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 10 to 40 percent; and to increase in-Bay placement from approximately 30 to 40 percent to 35 to 55 percent at in-Bay sites annually[25]. The remaining placement category percentage ranges would remain the same as No Action Alternative/No Project Alternative. The percentages of material going to each category vary depending on the level of maintenance dredging required and the federal channel being diverted from SF-DODS.

This alternative was constructed by identifying the opportunities to divert material from deep ocean disposal, i.e., which channels' previous Federal Standard Base Plan sites were SF-DODS under the No Action Alternative/No Project Alternative, including Oakland Inner and Outer Harbor and Richmond Inner Harbor. The RDMMP details the alternative formulation process in Section 4. Formulation of Alternatives. Based on the cost estimates developed through the RDMMP's cost engineering process (see Section 2.2), the optimal split for each channel between in-Bay placement and non-aquatic beneficial use placement was determined by matching the combined cost of the two placements with the cost of disposal at SF-DODS. Based on the volume to be placed at in-Bay and non-aquatic beneficial use sites from each channel, it was then determined which channel would be the more efficient split to pursue based on the current economic conditions, or whether pursuing both would be a viable option. The current cost estimates suggest that it is more effective to use Richmond Inner Harbor, which produces a higher percentage of beneficial use placement than Oakland (55 percent in-Bay to 45 percent non-aquatic beneficial use split for Richmond Inner Harbor, rather than 65 percent in-Bay to 35 percent beneficial use split for Oakland Inner and Outer Harbor). However, it is feasible that a different federal channel, such as Oakland, may be the source of the diversion in the future due to different economic and market conditions, equipment availability, technical feasibility, or environmental acceptability. Therefore, for the purposes of this EA/EIR, different potential scenarios for meeting the Federal Standard Base Plan may occur under Alternative 1 by using hopper dredging to increase placement at in-Bay/upland sites and to provide flexibility in achieving the split[26]. To mitigate for entrainment impacts to longfin smelt from hydraulic dredging, this alternative includes BUDM as a minimization measure to reduce the impacts to longfin smelt from hopper dredging.

The minimum amount of BUDM that would be required to offset impacts to longfin smelts will be calculated using the CDFW formula and conversion factors, including restoration costs and the unit cost of sediment to divert material to beneficial use sites. The CDFW formula is (USACE and Regional Water Board 2015):

[25] All efforts will be made to beneficially use material if feasible. If BU sites are not available or feasible, USACE will place material at the Federal Standard Base Plan site(s) assigned under the No Action Alternative.

[26] Hopper dredges can place sediment at non-aquatic BU or upland sites if the hopper dredge has pumpoff infrastructure.

$$Acres\ mitigation\ required = \frac{800\ acres *\ Pump\ Volume}{3.0\ million\ acre - feet}$$

The CDFW formula is used to calculate the acres of restored wetland necessary to adequately mitigate for the Central Valley and State Water Projects entrainment impacts from hydraulically pumping to extract water from the Delta. This formula is also appropriate for SF Bay dredging since it results in similar impacts to delta smelt and longfin smelt (i.e., entrainment resulting from extracting material via hydraulically pumping water).

For hopper dredging, the actual pump volume in acre-feet during dredging events will be used to solve the equation for acreage of habitat restoration required. In this case, that pump volume in the equation is a formula that includes pump rate, which is the minutes of pump time multiplied by the pump rate to get the volume of water pumped during that dredging episode, in units of acre-feet. The dredging formula is:

$$Acres\ mitigation\ required = \frac{800\ acres *\ Volume_{water\ pumped\ by\ hopper\ dredge}}{3.0\ million\ acre - feet}$$

Then the acres of mitigation are converted to a volume of sediment that would be sent to a beneficial use site by multiplying the acres of mitigation required by the cost of mitigation credits ($1,325,000 per acre), divided by the incremental cost of BUDM between the Federal Standard Base Plan placement site (for the channel in which the impact is occurring) and beneficial use at a tidal wetland restoration site. This is then multiplied by a factor of 2 to account for project uncertainty. The resulting formula is:

$$Volume\ BUDM = \frac{acres\ mitigation\ required\ \times\ \$1{,}325{,}000\ \text{per acre}}{Cost_{Increment}\ per\ cubic\ yard} \times 2$$

A multiplier of 2 was used to account for uncertainty in the timing of restoration, likely distance of the impact sites from the beneficial use site(s), temporal losses in aquatic resource functions, and the likelihood of success of the restoration activities at the beneficial use site(s). This multiplier is consistent with Regional Water Board permit requirements for compensatory mitigation of dredge and fill impacts under § 230.93(f)(2) of the State Supplemental Dredge and Fill Guidelines when mitigation is offsite and will take a relatively long time (over 10 years) to fully develop ecosystem functions and values. See Section 3.3.4.1 for more discussion of the basis of calculations.

Using this formula and choosing an example of total pump volume of approximately 1,168 acre-feet to hopper dredge both Pinole Shoal and Richmond Outer Harbor, the amount of BUDM needed to minimize entrainment impacts on longfin smelt would be approximately 45,000 CY. Under this alternative, it is anticipated that each year, a minimum of approximately 115,000 CY of material will be beneficially used at non-aquatic direct placement sites to restore tidal wetland habitat used by longfin smelt (see Table 2-8).[27] Accordingly, the amount of Non-aquatic BUDM to restore longfin smelt habitat in this alternate is over two times the volume needed to minimize entrainment impacts to longfin smelt.

[27] Other fish species, including salmonids, Pacific herring, and Dungeness crab may also benefit from creation of nursery grounds from beneficial use.

For a detailed description of all the dredging sites under Alternative 1, please refer to the discussion of the No Action Alternative/No Project Alternative Section 2.3.2 and to Tables 2-8 and 2-9. Alternative 1 has more BUDM than the No Action Alternative/No Project Alternative.

Table 2-8. Estimated Potential Placement Volume Summary for Alternative 1

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-aquatic Direct Placement Sites (Tidal Wetland Restoration Sites)	112,850	135,420	451,400
Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	90,280	225,700
In-Bay Placement Sites	789,950	947,940	1,241,350
Upland (Sponsor-Provided) Sites	0	22,570	225,700
Deep Ocean Disposal Site	225,700	789,950	902,800
Potential Future Beneficial Use Placement Sites[3]	0	0	0

1 See Section 1.5.2.2 for description of placement sites.
2 Maximum placement volumes would not be realized across placement locations concurrently.
3 Potential Future Beneficial Use Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available on these sites to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.

Key: CY = cubic yard

Table 2-9. Alternative 1 Example Implementation Summary

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	SF-DODS[2]	Clamshell	N/A	1	10	750,000	1,225,000	750,000
Redwood City Harbor: Channels	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
Redwood City Harbor: San Bruno Shoal	SF-11[2]	Hopper	Clamshell	Infrequent (as needed)	1	30,000	30,000	5,000
Richmond Inner Harbor	SF-11[2] Non-aquatic BU Site	Clamshell	Hopper Cutterhead-pipeline	1	10	160,000 140,000	335,000 295,000	160,000 140,000
Richmond Outer Harbor	SF-11[2]	Hopper	Clamshell	1	10	210,000	730,000	210,000
San Francisco Main Ship Channel	SF-17, SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
San Pablo Bay (Pinole Shoal)	SF-10[2]	Hopper	Clamshell	1 and advance dredging as needed	10	150,000	560,000	150,000
Suisun Bay Channel and New York Slough	SF-16[2]	Clamshell	N/A	1 and emergency episodes as needed[3]	10	165,000	425,000	165,000
Napa River	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Petaluma: River	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	4–7	2	150,000	210,000	30,000
Petaluma: Across the Flats	SF-10[2]	Clamshell	Cutterhead-pipeline	3	3	70,000	70,000	20,000
San Rafael Creek	SF-11[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000

[1] Placement sites can vary over the 10-year dredging cycle and are provided as one example of how this alternative can be executed.
[2] Non-aquatic beneficial use site outside of work windows as mitigation.
[3] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 CY each per year.

Key: BU = beneficial use
CY = cubic yard
N/A = not applicable

2.3.4 Beneficial Use: Regional Optimization, Leverage Hopper Dredging (Alternative 2)

This alternative proposes to increase hopper dredging in the Bay to offset the increased cost of beneficial use to achieve more BUDM than Alternative 1 and the No Action Alternative/No Project Alternative. Hopper dredging can be increased to include Richmond Inner Harbor or Oakland Harbor, or a mixture of both projects. Placement with a hopper dredge is usually limited to in-Bay sites as the government dredge, the *Essayons*, is unable to place material upland. Therefore, BUDM volume from another project using a clamshell or hydraulic dredge with pumpoff capability would be required. Ultimately, this alternative proposes to increase BUDM placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 20 to 30 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent; and to increase in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 50 to 60 percent. The other category percentage ranges remain the same as for the No Action Alternative/No Project Alternative. These percentages at the Bay-wide, programmatic level may vary depending on the level of maintenance dredging required and which channels are dredged hydraulically for material placement at in-Bay sites. This alternative in the RDMMP identifies that Richmond Inner Harbor would be dredged hydraulically to allow most of Oakland Harbor to be placed at an non-aquatic beneficial use site. This is one example of how to execute the navigation program in line with the theme of this alternative (Table 2-10). However, it is possible that hydraulic dredging could occur in other channels (e.g., Oakland Inner and Outer Harbor) in exchange for mechanical dredging in others for non-aquatic beneficial use (e.g., Richmond Inner and/or Outer Harbor) to execute the program differently than above in the future due to different economic and market conditions, technical feasibility, or environmental acceptability.

This alternative was constructed by first identifying the least-cost dredging method and placement site combination for each channel. In most cases, the least-cost options were in-Bay sites, and the least-cost dredging methods were hydraulic dredging where technically feasible. However, since this would result in nearly all dredged sediment being placed at in-Bay sites, a cost effectiveness analysis was done to determine which channels should be diverted from in-Bay placement to non-aquatic beneficial use placement. This approach used the cost difference between each channel’s BUDM placement and least-cost placement site option and resulted in the selection of the most cost-effective channels to be diverted to non-aquatic beneficial use. BUDM placement was prioritized over ocean disposal as the diversion destination to maximize beneficial use and avoid ocean disposal. Importantly, this alternative also sought to achieve cost parity with the No Action Alternative/No Project Alternative, like Alternative 1, but at the regional scale. As such, the maximum volume of sediment was diverted to non-aquatic beneficial use that kept the regional cost the same as the No Action Alternative/No Project Alternative. In doing so, it represents the regionally optimal approach (i.e., maximum BUDM, minimum ocean disposal, and equal cost to the No Action Alternative/No Project Alternative).

This breakdown is one example of how to execute this alternative at the regional scale (Table 2-10). While some channels can achieve cost savings by placing dredged material at a different in-Bay site than its placement site under the No Action Alternative/No Project Alternative (e.g., San Pablo Bay [Pinole Shoal]), the bulk of the cost savings comes from Richmond Inner Harbor and a portion of Oakland

Harbor, which would use hydraulic (hopper) dredging and would place dredged material at an in-Bay site. This contrasts with the No Action Alternative/No Project Alternative, in which both channels would be mechanically dredged and transported to SF-DODS for ocean disposal. This cost savings is then applied to other channels and reaches to cover the additional cost of taking material to beneficial use sites (i.e., the most expensive option). In the example listed in Table 2-10, the cost savings is applied to the majority (approximately 70 percent) of Oakland Harbor and a portion (approximately 20 percent) of Suisun Bay Channel. Suisun Bay Channel, while clean, can only send approximately 20 percent to beneficial use due to suitability concerns resulting from the historical Port Chicago explosion at the nearby Military Ocean Terminal Concord, and the possibility of unexploded ordnance in the sediment.

This EA/EIR evaluates hydraulic dredging in channels other than those listed in the example above in exchange for mechanical dredging in others for non-aquatic beneficial use to provide flexibility to execute the program differently than above due to technical feasibility or environmental acceptability, or if the economic conditions change and other combinations become more cost-effective. Due to constraints on hopper dredge scheduling described in Section 2.3.1.1 Dredge Equipment and Methods, the additional hopper dredging in Richmond Inner Harbor and Oakland Harbor would occur between December and February. Given this is outside the LTMS NMFS BiOp, this alternative would adhere to the requirement to send that same volume of material dredged outside the window to BU from the channels planned for BU placement. Under this alternative, approximately 510,000 CY on average would be hopper dredged outside the NMFS BiOp's established environmental work window. In return, this alternative would place 575,000 CY at BU sites, on average. Thus, this alternative is consistent with and exceeds the NMFS BiOp's requirements.

This alternative includes BUDM, which will minimize potential longfin smelt population impacts from entrainment through habitat creation. The quantity of BUDM needed to offset longfin smelt impacts would be calculated as described in Alternative 1 above. Under Alternative 2, the amount of beneficial use needed to minimize entrainment impacts on longfin smelt for hopper dredging in Oakland Harbor Richmond Inner and Outer Harbor, and Pinole Shoal, would be approximately 125,000 CY. Under this alternative, it is anticipated that each year, a minimum of approximately 450,000 CY of material will be beneficially used at non-aquatic direct placement sites to restore tidal wetland habitat used by longfin smelt (see Table 2-10). Accordingly, the amount of non-aquatic BUDM to restore longfin smelt habitat in this alternative is over three times the required volume needed to minimize entrainment impacts to longfin smelt.

For a detailed description of all the dredging sites under Alternative 2, please refer to the discussion of the No Action Alternative/No Project Alternative Section 2.3.2 and Table 2-10 and Table 2-11.

Table 2-10. Estimated Potential Placement Volume Summary for Alternative 2

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-aquatic Direct Placement Sites (Tidal Wetland Restoration Sites)	451,400	609,390	677,100
Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	90,280	225,700
In-Bay Placement Sites[3]	1,128,500	1,263,920	1,354,200
Upland (Sponsor-Provided) Sites	0	22,570	225,700
Deep Ocean Disposal Site	0	0	225,700
Potential Future Beneficial Use Placement Sites4	0	0	0

1 See Section 1.5.2.2 for descriptions of placement sites.
2 Maximum placement volumes would not be realized across placement locations concurrently.
3 Noting that in-Bay placement volumes suggest potential to exceed LTMS agency goals, the RDMMP acknowledges that at the triennial LTMS review, if the average in-Bay disposal volume from the prior three years exceeds the in-Bay targets plus the 250,000-cy contingency, the LTMS agencies will initiate consideration of allocations.
4 Potential Future BU Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.
Key: CY = cubic yard

Table 2-11. Alternative 2 Example Implementation Summary

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	Non-aquatic BU site	Clamshell	Cutterhead-pipeline	1	10	525,000	860,00	525,000
	SF-11[2]	Hopper	Clamshell	1	10	225,000	365,000	225,000
Redwood City Harbor: Channels	SF-11[2]	Clamshell	N/A	1	10	180,000	650,000	180,000
Redwood City Harbor: San Bruno Shoal	SF-11[2]	Hopper	Clamshell	23	1	30,000	30,000	5,000
Richmond Inner Harbor	SF-11[2]	Hopper	Clamshell	1	10	300,000	630,000	300,000
Richmond Outer Harbor	SF-10[2]	Hopper	Clamshell	1	10	210,000	730,000	210,000
San Francisco Main Ship Channel	SF-17, SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
San Pablo Bay (Pinole Shoal)	SF-9[2]	Hopper	Clamshell	1 and advance dredging as needed	10	150,000	560,000	150,000
Suisun Bay Channel and New York Slough	SF-16,[2] Non-aquatic BU site	Clamshell	N/A	1 and emergency episodes as needed[3]	10	115,000 50,000	295,000 130,000	115,000 50,000
Napa River	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000
Petaluma: River	Upland (sponsor-provided) Site,	Cutterhead-pipeline	Clamshell	4–7	2	150,000	210,000	30,000

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
	Non-aquatic BU Site							
Petaluma: Across the Flats	SF-10[2]	Clamshell	Cutterhead-pipeline	3	3	70,000	70,000	20,000
San Rafael Creek	SF-9[2]	Clamshell	N/A	4–6	3	110,000	280,000	35,000

[1] Placement sites can vary over the 10-year dredging cycle and are provided as one example of how this alternative can be executed.
[2] Non-aquatic beneficial use site outside of work windows as mitigation.
[3] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 CY each per year.

Key: BU = beneficial use
CY = cubic yard
N/A = not applicable

2.3.5 Beneficial Use: Cost Share Opportunity (Alternative 3)

This alternative proposes building on Alternative 2 (2.3.4) and taking more sediment to non-aquatic beneficial use sites within the WRDA 2020 Section 125a threshold to more easily justify the cost share of the BUDM incremental cost for O&M budgets. At the Bay-wide programmatic level, this alternative proposes to increase BUDM placement from approximately 0 percent (No Action Alternative/No Project Alternative) to 35 to 45 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent; and to increase in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 35 to 45 percent. The other category percentage ranges remain the same as the No Action Alternative/No Project Alternative. This alternative is not a candidate to be the Federal Standard Base Plan given it is not the least-cost alternative, but it would be feasible with non-federal funding for 35 percent of the incremental cost above the Federal Standard Base Plan given that the benefits are qualitatively justified.

This alternative was built upon the regional optimization of Alternative 2, with the level of increased BUDM calculated as the 25 percent threshold identified in WRDA 2020 Section 125a, which is described as the point at which the federal share of the incremental cost share (i.e., 65 percent of the incremental cost) is 25 percent above the Federal Standard Base Plan cost (see Section 1.1 for definition and description of the Federal Standard Base Plan). This authority delineates between simpler, qualitative articulation of benefits below the threshold, and more comprehensive, quantitative articulation of benefits above the threshold to justify the federal investment from the O&M budget on the incremental cost of beneficial use. The alternative, therefore, uses this 25 percent federal share of the incremental cost above the Federal Standard Base Plan to determine what level of BUDM can be justified using the simpler, qualitative approach described above. This amount provides information on the approximate amount of additional BUDM volume that can be achieved in a relatively straightforward fashion. For more information, see the WRDA 2020 section of the RDMMP. The specific volumes from each channel are described as an example of how this alternative can be executed in Table 2-12.

This alternative includes BUDM, which will minimize potential longfin smelt population impacts from entrainment through habitat creation. The quantity of BUDM needed to offset longfin smelt impacts would be calculated as described in Alternative 1 above. Under Alternative 3, the amount of BUDM needed to minimize entrainment impacts on longfin smelt would be approximately 85,000 CY. Under this alternative, it is anticipated that each year, a minimum of approximately 800,000 CY will be beneficially used at non-aquatic direct placement sites to restore tidal wetland habitat used by longfin smelt (see Table 2-12). Accordingly, the minimum amount of Non-aquatic BUDM to restore longfin smelt habitat in this alternate is over nine times the required volume. Additional BUDM placement concepts (e.g., non-aquatic direct placement, nearshore strategic placement, elevation augmentation/marsh spraying, and/or water column seeding) and sites may be considered by USACE under this alternative.

For a detailed description of all the dredging sites under Alternative 3, please refer to the discussion of the No Action Alternative/No Project Alternative Section 2.3.2, and to Table 2-12 and 2-13.

Table 2-12. Estimated Potential Placement Volume Summary for Alternative 3

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-aquatic Direct Placement Sites (Tidal Wetland Restoration Sites)	789,950	970,510	1,015,650
Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	90,280	225,700
In-Bay Placement Sites	789,950	902,800	1,015,650
Upland (Sponsor-Provided) Sites	0	22,570	225,700
Deep Ocean Disposal Site	0	0	225,700
Potential Future beneficial use Placement Sites[3]	0	0	0

1 See Section 1.5.2.2 for description of placement sites.
2 Maximum placement volumes would not be realized across placement locations concurrently.
3 Potential Future Beneficial Use Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.
Key: CY = cubic yard

Table 2-13. Alternative 3 Example Implementation Summary

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	1	10	750,000	1,225,000	750,000
Redwood City Harbor: Channels	SF-11[2], Non-aquatic BU Site	Clamshell	N/A; Cutterhead-pipeline	1	10	100,000 80,000	360,000 290,000	100,000 80,000
Redwood City Harbor: San Bruno Shoal	SF-11[2]	Hopper	Clamshell	Infrequent (as needed)	1	30,000	30,000	5,000
Richmond Inner Harbor	SF-11[2]	Hopper	Clamshell	1	10	265,000	555,000	265,000
	Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	1	10	35,000	75,000	35,000
Richmond Outer Harbor	SF-10[2]	Hopper	Clamshell	1	10	195,000	680,000	195,000
	Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	1	10	15,000	50,000	15,000
San Francisco Main Ship Channel	SF-17 SF-8	Hopper	N/A	1	10	255,000 90,000	455,000 160,000	255,000 90,000
San Pablo Bay (Pinole Shoal)	SF-9[2]	Hopper	Clamshell	1 and advance dredging as needed	10	140,000	520,000	140,000
	Non-aquatic BU Site	Clamshell	N/A	1 and advance dredging as needed	10	10,000	40,000	10,000
Suisun Bay Channel and New York Slough	SF-16,[2] Non-aquatic BU Site	Clamshell	N/A	1 and emergency episodes as needed[3]	10	115,000 50,000	295,000 130,000	115,000 50,000

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Napa River	Upland (Sponsor-Provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000
Petaluma: River	Upland (Sponsor-Provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	4–7	2	150,000	210,000	30,000
Petaluma: Across the Flats	SF-10[2]	Clamshell	Cutterhead-pipeline	3	3	70,000	70,000	20,000
San Rafael Creek	SF-9[2] Non-aquatic BU Site	Clamshell	N/A; Cutterhead-pipeline	4–6	3	65,000 45,000	165,000 115,000	20,000 15,000

[1] Placement sites can vary over the 10-year dredging cycle and are provided as one example of how this alternative can be executed.
[2] Non-aquatic beneficial use site outside of work windows as mitigation.
[3] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 cy each per year.

Key: BU = beneficial use
CY = cubic yard
N/A = not applicable

2.3.6 Beneficial Use: Maximized (Alternative 4)

This alternative proposes placing all suitable material at non-aquatic beneficial use sites, including a portion of sediment being placed at nearshore strategic placement beneficial use sites designed to leverage tidal and wave energy to transport sediment from shallow subtidal placement areas to existing intertidal mudflats and marshes. Alternative 4 can also be executed with the volume of sediment placed at the nearshore strategic placement beneficial use sites being placed at non-aquatic beneficial use sites instead.

At the Bay-wide programmatic level, this alternative proposes to increase BUDM from approximately 0 percent (No Action Alternative/No Project Alternative) to 65 to 75 percent; to increase beneficial use nearshore strategic placement from approximately 0 percent (No Action Alternative/No Project Alternative) to five to 15 percent; to decrease deep ocean disposal from approximately 45 to 55 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent; and to decrease in-Bay placement from approximately 30 to 40 percent (No Action Alternative/No Project Alternative) to 0 to 10 percent. The other category percentage ranges remain the same as No Action Alternative/No Project Alternative. This alternative is not a candidate to be the Federal Standard Base Plan given that it is not the least-cost alternative and would require non-federal funding for the full incremental cost above the Federal Standard Base Plan, or for 35 percent of the incremental cost given the benefits justify and quantitatively exceed the incremental cost under the WRDA 2020 Section 125a cost-sharing authority. Currently, no non-federal entity has been identified for such a programmatic-wide-scale partnership. However, USACE remains open to the possibility should any non-federal entity express such interest or for any partnerships on a project-by-project or year-by-year basis.

This alternative was constructed based on maximizing the amount of suitable material for non-aquatic beneficial use and nearshore strategic placement beneficial use. All channels capable of supplying dredged material for beneficial use do so under this alternative, including placement of MSC sand directly on Ocean Beach for beach nourishment (see Ocean Beach Onshore section of the RDMMP for more details). The alternative outlines the amount of BUDM that would be achievable given the more comprehensive, quantitative articulation of benefits above the threshold to justify federal investment from the O&M budget on the incremental cost of BUDM placement. Additionally, should the federal investment not be deemed justified, it is still possible to execute this alternative if non-federal partners are willing to fund the full 100 percent of the incremental cost for BUDM placement above the Federal Standard Base Plan. For more information, see the WRDA 2020 section of the RDMMP. The specific volumes from each channel are described as an example of how this alternative can be executed in Table 2-14.

Alternative 4 includes BUDM, which will provide habitat and species benefits, consistent with the objectives of the project.

For a detailed description of all the dredging sites under Alternative 4, please refer to the discussion of the No Action Alternative/No Project Alternative in Sections 2.3.2 and 2.3.2.2 for No Action Alternative/ Project Alternative and to Table 2-14 and Table 2-15. Additional BUDM placement concepts (e.g., non-aquatic direct placement, nearshore strategic placement, elevation augmentation/marsh spraying, and/or water column seeding) and sites may be considered by USACE under this alternative. Potential impacts related to use of these sites are disclosed on a broad level in Chapter 3 because these sites may become authorized placement sites within the 10-year planning horizon for this document. Use of these sites by USACE would be conditioned upon the completion of supplemental environmental review under NEPA and/or CEQA, and acquisition of required environmental approvals from resource and regulatory agencies. The ability of USACE to use a given site for placement would be dependent on the accessibility of the site to different dredge equipment, types of dredged material authorized for placement at the site, cost, and other parameters.

Table 2-14. Estimated Potential Placement Volume Summary for Alternative 4

Placement Locations[1]	Minimum Volume (CY/year)	Average Volume (CY/year)	Maximum Volume (CY/year)[2]
Existing Beneficial Use Sites			
Non-aquatic Direct Placement Sites (Tidal Wetland Restoration Sites)	1,467,050	1,602,470	1,692,750
Nearshore Strategic Placement Site: SF-17 (Ocean Beach Nearshore Placement Site)	112,850	270,840	338,550
Transitional Placement Sites			
SF-8, San Francisco Bar Channel Placement Site	0	0	225,700
In-Bay Placement Sites	0	135,420	225,700
Upland (Sponsor-Provided) Sites	0	22,570	225,700
Deep Ocean Disposal Site	0	0	225,700
Potential Future Beneficial Use Placement Sites[3]	112,850	203,130	338,550

[1] See Section 1.5.2.2 for description of placement sites.
[2] Maximum placement volumes would not be realized across placement locations concurrently.
[3] Potential Future BU Site Types include: Nearshore Strategic Placement Sites, including Water Column Seeding Sites, and Elevation Augmentation/Marsh Spraying Sites. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR.
Key: CY = cubic yard

Table 2-15. Alternative 4 Example Implementation Summary

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Oakland: Inner and Outer Harbor	Non-aquatic BU Site, Future BU Placement Site[2]	Clamshell	Cutterhead-pipeline	1	10	650,000 100,000	1,060,000 165,000	650,000 100,000
Redwood City Harbor: Channels	Non-aquatic BU Site, Future BU Placement Site[2]	Clamshell	Cutterhead-pipeline	1	10	80,000 100,000	290,000 360,000	80,000 100,000
Redwood City Harbor: San Bruno Shoal	Non-aquatic BU site	Hopper	Clamshell	Infrequent (as needed)	1	30,000	30,000	5,000
Richmond Inner Harbor	Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	1	10	300,000	630,000	300,000
Richmond Outer Harbor	Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	1	10	210,000	730,000	210,000
San Francisco Main Ship Channel	SF-17, Onshore BU Site	Hopper	Not Applicable	1	10	260,000 85,000	465,000 150,000	260,000 85,000
San Pablo Bay (Pinole Shoal)	Non-aquatic BU site	Clamshell	Not Applicable	1 and advance dredging as needed	10	150,000	560,000	150,000
Suisun Bay Channel and New York Slough	SF-16[3] Non-aquatic BU Site	Clamshell	Not Applicable	1 and emergency episodes as needed[4]	10	115,000 50,000	295,000 130,000	115,000 50,000
Napa River	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead-pipeline	Clamshell	6–11	2	110,000	165,000	20,000

Channel	Placement Site[1]	Likely Dredge Method	Alternate Dredge Method	Dredging Recurrence (years)	Dredging Episodes over 10-Year Cycle	Average Volume per Episode (CY)	Maximum Volume per Episode (CY)	Average Annual Volume over 10-Year Cycle (CY)
Petaluma: River	Upland (sponsor-provided) Site, Non-aquatic BU Site	Cutterhead	Clamshell	4–7	2	150,000	210,000	30,000
Petaluma: Across the Flats	SF-10[3], Non-aquatic BU Site	Clamshell	Cutterhead-pipeline	3	3	70,000	70,000	20,000
San Rafael Creek	Non-aquatic BU site	Clamshell	Cutterhead-pipeline	4–6	3	110,000	280,000	35,000

[1] Placement sites can vary over the 10-year dredging cycle and are provided as one example of how this alternative can be executed.
[2] Use of potential future beneficial use sites would be subject to completion of required environmental review and permitting approvals from resource and regulatory agencies. The ability of USACE to use a given site for placement would be dependent on the accessibility of the site to different dredge equipment, types of dredged material authorized for placement at the site, cost, and other parameters.
[3] Non-aquatic beneficial use site outside of work windows as mitigation.
[4] USACE does not anticipate performing more than three emergency dredging episodes consisting of less than 30,000 cy each per year.

Key:
BU = beneficial use
CY = cubic yard
N/A = not applicable
USACE = US Army Corps of Engineers
SF-10 = San Pablo Bay placement site
SF-16 = Suisun Bay placement site
SF-17 = Ocean Beach demonstration site

2.4 Proposed Action/Proposed Project

The requirement for review under NEPA is triggered by a “major federal action.” (42 U.S.C. § 4336e(10)). The Proposed (federal) Action described in this section would meet the purpose and need described in Chapter 1, which is to allow maintenance dredging of the federal navigation channels in SF Bay consistent with the goals and adopted plans of the LTMS, while adequately protecting the environment, including listed species.

Under CEQA, a detailed and stable project description (Proposed Project) is fundamental to the purpose of the study, which is to identify and analyze impacts from the Proposed Project. The CEQA Guidelines defines the types of information that must be included in an EIR project description. The project description must include the specifics of the Proposed Project, the project site and its surroundings, but does not need to include extensive detail beyond what is needed to evaluate environmental impacts (CEQA Guidelines Section 15124).

The Proposed Action/Proposed Project is the phased implementation of the USACE Federal Standard Base Plan alternatives – the No Project Alternative, Alternative 1, and Alternative 2. The No Project Alternative, Alternative 1 (diversion from ocean disposal), and Alternative 2 (regional optimization) are all least cost, while Alternative 3 (cost-share opportunity) and Alternative 4 (maximum BUDM) are progressively more expensive. Of the three least cost options that are candidates to be the Federal Standard Base Plan, the No Project Alternative results in the most ocean disposal and least BUDM, and Alternative 2 results in the most BUDM and the least ocean disposal. As described previously, Alternative 3 and Alternative 4 are not least cost and, therefore, do not qualify to be the Federal Standard Base Plan. If non-federal funding becomes available or incremental cost-sharing opportunities present themselves, USACE will seek to implement Alternatives 3 or 4, when practicable. Figure 2-5 provides an overview of the differing dredged material disposal/placement details across alternatives, with hatched bars indicating the potential maximum range of sediment placement options for each alternative. Figure 2-6 provides more detail on cost share scenarios for the percentage range of combined BUDM for each alternative; the red line indicates the least Federal Standard Base Plan threshold.

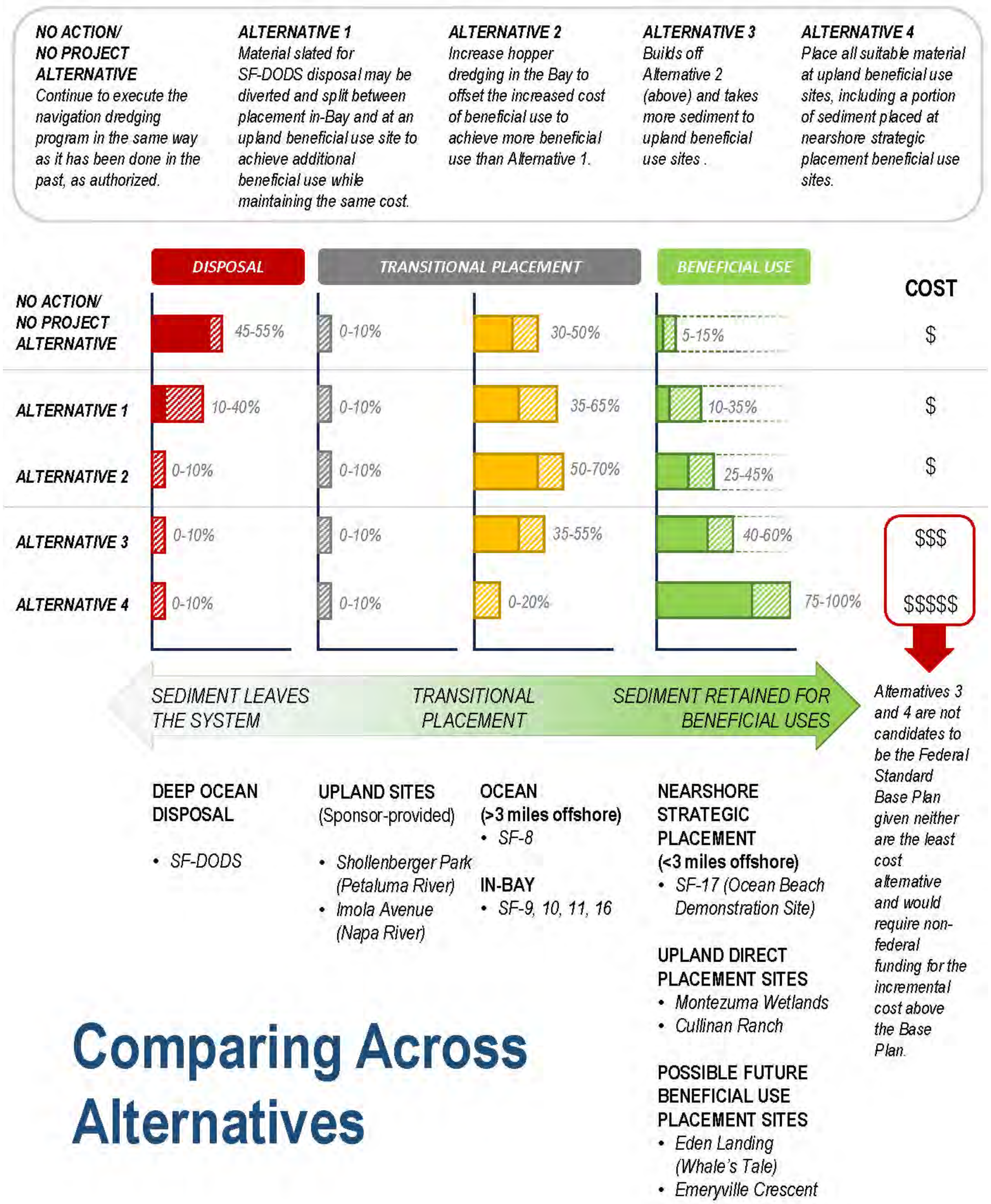


Figure 2-5. Comparison of Dredged Material Disposal and Placement Across Alternatives

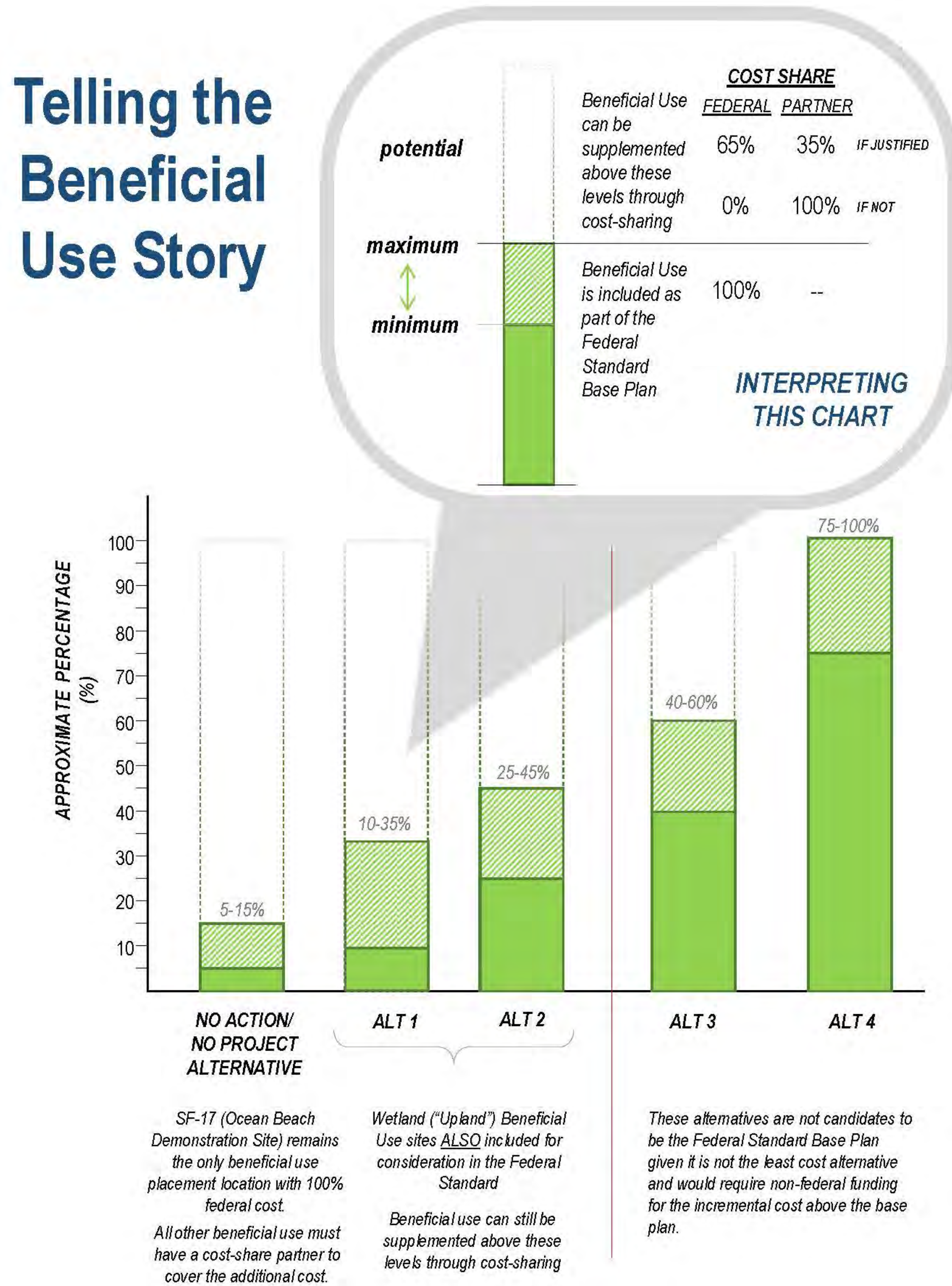


Figure 2-6. Summary of Alternatives and Example of Cost-sharing Mechanism Described in All Alternatives.

The proposed phased implementation is as follows:

- **2025, No Project Alternative:** Continuing the No Project Alternative allows USACE the time necessary to appropriately plan for and implement the changes required for Alternative 1 and eventually Alternative 2.
- **2026–2027, Alternative 1:** The earliest USACE would be able to implement Alternative 1 would be in 2026.
- **2027–2034, Alternative 2:** The earliest USACE would be able to implement Alternative 2 would be in 2027. This time is necessary to allow USACE to work to expand the capacity of its hopper dredges, including using the West Coast Hopper Dredging contract.

The potential environmental impacts associated with each of the alternatives that compose the Proposed Action/Proposed Project are analyzed in Chapter 3 of this EA/EIR. The impacts of the phased Proposed Action/Proposed Project as a whole are also addressed in Chapter 3.

The implementation schedule for the alternatives included in the Proposed Action/Proposed Project will be determined by project need - which can vary from year to year - and by USACE's available dredging equipment. The implementation schedule and associated mitigation measures for the Proposed Action/Proposed Project must be approved by the Regional Water Board through the issuance of the WQC/WDR.

2.5 Alternatives Considered but Eliminated from Further Consideration

Several other alternatives to the Proposed Action/Proposed Project were identified and evaluated during project planning and development but were eliminated from detailed analysis and are therefore not analyzed in detail in this EA/EIR.

These alternatives were eliminated from analysis because one or more of the following criteria apply, as discussed for each alternative below:

- It is ineffective (it would not achieve overall project purpose, need, and objectives).
- Its implementation would not minimize effects on human/environmental resources.
- It is technologically infeasible.
- Its implementation is remote or speculative.

2.5.1 No Maintenance Dredging

Under this potential alternative, USACE would cease all maintenance dredging of the federal navigation channels in SF Bay, which would eventually leave the channels unnavigable for commerce and recreation. This alternative was eliminated from further consideration because it would not meet the purpose, need, and objectives of the project to maintain safe navigation of all the federal navigation channels and would be expected to have significant economic and safety impacts.

2.5.2 Maintenance Dredging of Select Federal Channels

Under this scenario, USACE would conduct maintenance dredging for some, but not all, of the federal navigation channels in SF Bay during the 10-year planning period to reduce the impacts from maintenance dredging. This would include maintenance dredging of fewer channels than what is currently proposed in the alternatives. This would leave the unmaintained channels unusable, limiting navigation in the Bay and creating navigation hazards, which increase the risks of groundings and oil spills. Like the No Maintenance Dredging of All Channels alternative discussed above, this alternative was eliminated from further consideration because it would not meet the purpose and need of the project to maintain safe navigation of all the federal navigation channels and it would be expected to have significant negative economic and safety impacts.

2.5.3 Eliminate the Use of Hydraulic Dredging

Under this scenario, USACE would cease use of hydraulic equipment for any maintenance dredging. This alternative is not feasible. Primarily, this alternative would not allow for dredging of the San Francisco Harbor MSC, which requires use of a hopper dredge because it is the only type of dredge that can safely operate at this channel, as explained under Section 2.3.1.1. In addition, mechanical dredging can be three times as expensive and take 10 times as long as hopper dredging. Such increases in time and cost would limit USACE's ability to complete dredging of all the federal channels and result in increased impacts from the length of dredging required. For instance, the increase in duration of dredging could potentially increase the amount of dredging occurring outside of work windows which would have detrimental impacts on fish species. Therefore, even if only in-Bay channels were considered, implementation of this alternative would lead to the same issues as in Section 2.5.2, as funding for dredging is limited nationally and such a significant increase would mean that some channels would not be dredged. This scenario would not be feasible for the reasons stated above. Therefore, this alternative was eliminated because it would not meet the overall purpose and need of the project to maintain safe navigation of all the federal navigation channels.

2.5.4 Eliminate the Use of Mechanical Dredging

Under this scenario, USACE would use hydraulic equipment only for maintenance dredging of the federal navigation channels in SF Bay. This alternative is not feasible because it would limit USACE's ability to complete maintenance dredging of all the channels because of channel features (e.g., depth, sediment characteristics, and environmental conditions), current placement practices, and costs. Increased use of hydraulic dredge equipment could also increase the likelihood of entrainment of protected fish species. Therefore, this alternative was eliminated because it would not meet the overall purpose and need of the project.

2.5.5 Screening Water Intakes on US Army Corps of Engineers Hopper Dredges

Under this scenario, USACE would consider the addition of screens to the grating at the bottom of the drag heads and the water intake doors on top of the drag heads on hopper dredges to protect small fish from being entrained. CDFW established a velocity criterion of 0.2 foot per second to protect small fish from being impinged.

USACE’s hopper dredges *Essayons* and *Yaquina* use drag heads that require velocities of 15 to 20 feet per second throughout the drag head, suction, and discharge piping to ensure sediments remain suspended. These velocities are up to 50 times greater than the 0.2 foot per second approach velocity recommended to prevent impingement of delta smelt (NMFS 2022). Attaching a pipe or screen to reduce velocities to meet CDFW’s criterion would be extremely impractical or unworkable for the following reasons:

- The dredge operates at varying water depths, in heavy sea states, over undulating bottom contours, all of which change the angle of the drag head with respect to the drag arm, requiring a robust, flexible connection between the screen appendage and drag head.
- The screen appendage would need to be very large to achieve an open area sufficient to reduce water velocity to 0.2 foot per second (i.e., 165 square feet for the *Yaquina* and 595 square feet for the *Essayons*).
- The screen support would need to be of sufficient strength to withstand the severe environment in which the drag arms operate. The drag arms operate in a very physical environment, often physically impacting with the dredge's bottom, sideshell, and/or davit/cradle when being breasted-in/out. The drag arms often experience impact with floating and submerged debris such as logs, rope, cable, chain, etc.
- The appendage would add significant weight to the drag arm, jeopardizing sufficiency of the drag arm lifting infrastructure.
- Sediment would create blockage on the screens, and it would be extremely impractical to create a crossflow or to stop dredging every few minutes to clean the screens.

Therefore, this alternative was eliminated from further consideration as technologically infeasible.

2.5.6 Modification of the Federal Navigation Channels

USACE considered modification of the federal navigation channels, including realignment of the channels to different location(s), and the institution of scouring systems or other structural channel modifications. These alternative options were eliminated because they are outside the current scope of USACE’s maintenance program for the existing federally authorized channels. Moreover, such an undertaking would require years of study, modeling, and more funding than USACE currently has available in its budget. Realigning channels and other options considered here would result in an unacceptable level of impact on benthic and aquatic habitats. The degree of environmental impact and the time necessary to implement this alternative were inconsistent with the basic project objectives, so this alternative was eliminated from consideration.

2.5.7 Additional Areas Requested for Inclusion During the Scoping Process

During the public scoping period held in accordance with CEQA, several commentors suggested adding federally authorized and other navigation channels to the list of channels included in USACE’s alternatives for O&M dredging. Review of Mare Island Strait (a portion of San Pablo Bay) was requested during scoping and was added to the analysis area for alternatives. The channels listed below were considered by USACE but not included in alternatives:

- Sausalito navigation channel was considered but is currently not included among the alternatives because this is not a federally authorized navigation channel.
- Redwood Creek (referred to in scoping comment as “Redwood City Creek) is encompassed within Redwood City Harbor and included in this EA/EIR; the Redwood Creek portion was unintentionally omitted in the version of the study area figure provided in the NOP.
- Advance maintenance dredging at Bulls Head Reach portion of Suisun Bay Channel (O&M dredging for Suisun Bay Channel is included in alternatives).
- The Richardson Bay (Marinship Channel) portion of San Francisco Harbor is dredged infrequently and is not anticipated for O&M dredging during the 10-year planning period; therefore, it is not included among the alternatives.
- Islais Creek portion of San Francisco Harbor is dredged infrequently and is not anticipated for O&M dredging during the 10-year planning period; therefore, it is not included among the alternatives.
- Santa Fe Channel portion of Richmond Harbor is dredged infrequently and is not anticipated for O&M dredging during the 10-year planning period; therefore, it is not included among the alternatives.
- Suisun Slough is dredged infrequently and is not anticipated for O&M dredging during the 10-year planning period; therefore, it is not included among the alternatives.
- Jack Maltester (San Leandro Marina) was removed per scoping comment questioning why this was included but not Suisun Slough Channel, since neither channel were planned for dredging.

3.0 Environmental Setting and Environmental Analysis

This chapter describes the scope of analysis in this EA/EIR, including a description of resources not applicable to the project alternatives and those considered in detail. It describes the regulatory and environmental setting for each resource area carried forward and discusses impacts and mitigation measures (where relevant) for resources that may be impacted by the project alternatives.

3.1 Scope of Environmental Analysis

This chapter describes the environmental setting and the environmental impacts of key resource categories associated with the alternatives as well as avoidance and mitigation, where applicable, to reduce potential impacts.

The environmental setting sections provide an environmental baseline of each resource category, describing the conditions in the study area at the time this document was prepared. The environmental conditions described in these environmental setting sections constitute the baseline physical conditions against which impacts are assessed. The CEQA Guidelines, Section 15125, describe the baseline as “the physical environmental conditions in the vicinity of the project, as they exist at the time the NOP is published, or if no NOP is published, at the time environmental analysis is commenced.” Because maintenance dredging of the federal navigation channels has occurred on a regular basis for several decades, USACE’s maintenance dredging and impacts are considered part of the existing physical conditions that comprise the baseline. Accordingly, USACE’s existing maintenance dredging practices, as represented by the No Action Alternative and No Project Alternative, and the environmental impacts of these practices, are part of the baseline conditions to which the impacts of the action alternatives are compared.

The environmental analysis discussion provides an analysis of the potential environmental impacts that could result from implementing the No Action Alternative and No Project Alternative compared to Alternatives 1 through 4. Impacts from dredging, transport of dredged material, and placement[28] of dredged material are evaluated. Specific analysis of dredged material placement is limited to the existing placement sites listed in Section 1.5.2.2. Where possible, potential impacts associated with the use of future placement are broadly discussed; however, use of these sites by USACE would be conditioned upon completion of a separate, site-specific supplemental environmental review under the NEPA and/or CEQA, and acquisition of required environmental approvals from resource and regulatory agencies.

For each navigation channel, the average dredge volume per episode and the number of dredging episodes over the 10-year cycle was used to obtain the total volume to be dredged for each channel over the 10-year cycle covered by this EA/EIR. These total volumes were then used to calculate the range of placement volumes for each placement category, as shown in Tables 2-4, 2-6, 2-8, 2-10, 2-12 and 2-14. To evaluate the greatest impact for a given year, it was assumed that all channels would be dredged within that year using its average volume per dredge episode. The average volume per episode was used

[28] Evaluation of placement for BU sites is not included in this analysis, because placement activities have been, or will be, evaluated under separate permitting processes. Potential impacts from placement at non-beneficial use sites, including in-Bay placement and deep ocean disposal, are included in this analysis.

because it is unrealistic to assume that the maximum volume per dredge episode would be dredged for all channels within the same year. Impact analysis for each resource area generally followed this method and details and deviations from this approach are discussed in resource area sections below.

3.1.1 Resources Not Applicable to the Project Alternatives and/or Not Considered in Detail

Section 3.1.1 of the 2015 EA/EIR provided a detailed discussion of the resources that were not considered in detail in the previous study. That analysis has not changed. Therefore, the following resources were determined to not be present in the study area or would not be impacted by proposed maintenance dredging activities and are not considered in detail in this study: Aesthetics and Visual Resources, Agriculture, Energy, Forestry Resources, Minerals, Noise, Population and Housing, Public Services, Seismicity, Recreational Resources, Regional Growth, Socioeconomics, Utilities, and Wildfire Impacts (See Table 3-1).

Table 3-1. Resources Not Applicable to the Project Alternatives and/or Not Considered in Detail

Resource Area	Notes
Aesthetics and Visual Resources	Aesthetics and visual resources related to scenic views in and around San Francisco Bay and the Pacific Ocean may be slightly degraded during dredging and placement activities from the presence of dredge equipment and turbidity produced during dredging and placement activities. These potential impacts would be temporary and would occur in locations where dredging and placement activities have occurred regularly in the past. Additionally, the waters of San Francisco Bay currently and historically include similar uses and equipment, such as ferry terminals, ports, barges, and industrial and commercial shipping operations that are part of the existing visual landscape. In this context, impacts to aesthetics and visual resources from alternatives would be negligible. Some possible, including Bel Marin Keys, are presently used for agriculture. Use of future beneficial use placement sites would be conditioned upon the completion of supplemental environmental review under NEPA and/or CEQA, and acquisition of required environmental approvals from resource and regulatory agencies.
Agriculture	The proposed dredging and dredged material placement activities would be in offshore waters, waters in San Francisco Bay, and at sites approved for the placement of dredged materials. Agricultural resources are not present in the channels or existing placement areas and, therefore, would not be impacted by dredging and placement activities. Some possible future beneficial use placement sites, including Bel Marin Keys, are presently used for agriculture. Use of these sites by USACE would be conditioned upon the completion of supplemental environmental review under NEPA and/or CEQA, and acquisition of required environmental approvals from resource and regulatory agencies.
Energy	Alternatives would not require substantially more energy than USACE's historic and current maintenance dredging operations in San Francisco Bay; dredging and placement activities would require the use of fossil fuels for the operation of vessels and equipment, which would be similar to USACE's historic and current maintenance dredging operations in San Francisco Bay.
Forestry Resources	There are no forested areas in or adjacent to dredging or existing placement locations; therefore, there would be no impacts to forestry resources.

Resource Area	Notes
Minerals	Alternatives would not involve construction or operation of any facilities on or adjacent to any land-based mineral resource areas delineated on land use plans and, therefore, would not result in the loss of availability of a land-based mineral resource. Sand is mined from the San Francisco Bay for industrial and agricultural uses. USACE's continued maintenance of the federal navigation channels, and placement of dredged materials under any of the alternatives, would not adversely impact sand mining because activities would not interfere with sand mining. Sediments in the San Francisco Main Ship, Pinole Shoal, and Suisun Bay channels are primarily sand, and the Federal Standard Base Plan placement sites for each of these channels is in water and adjacent to or very near the channels. USACE's continued maintenance dredging and placement activities would not be expected to deplete sand mineral resources, because dredged material would be redeposited relatively close to the location where it was removed.
Noise	Most of the federal navigation channels are not near sensitive receptors (e.g., residences, schools, and hospitals). Commercial and recreational ship traffic is an ambient noise source at the federal navigation channels. Several of the channels (e.g., Richmond Harbor, Oakland Harbor) are also in areas with surrounding commercial and industrial operations that are additional sources of ambient noise; noise from dredging at these locations would not be expected to exceed ambient conditions. Noise during transport of dredged materials would not be noticeable in the context of other vessel traffic in San Francisco Bay. Sensitive receptors may be near the San Rafael Creek, Napa River, and Petaluma River federal channels. Noise from dredging equipment such as an excavator and a dredging ship can generate noise levels of approximately 78 to 82 A-weighted decibels (dBA), which is below the Federal Transportation Authority guidelines for assessment of noise impacts for construction activities, namely, 90 dBA equivalent continuous sound level over a 1-hour period for residential land uses; 100 dBA equivalent continuous sound level over a 1-hour period for commercial/industrial areas (FTA 2018).[1]
Population and Housing, Public Services	Alternatives would not result in construction or modification of residences or commercial facilities, and would not require a large workforce; therefore, alternatives would have no adverse effect on population, housing, or public services.
Seismicity	Alternatives would not contribute to or directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, the area or based on other substantial evidence of a known fault, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides.
Recreation Resources	Alternatives would not involve the construction of recreation facilities, would not create demand for new recreational facilities, and would not result in increased use and deterioration of existing recreational facilities. Dredging and placement activities may delay or temporarily impede recreational watercraft, but there would be sufficient room at most locations for recreational vessels to maneuver around dredge equipment. Therefore, impacts would be negligible. Notifications to mariners and navigational warning markers are used as needed to prevent navigational hazards during dredging and placement activities. Additionally, maintenance dredging provides long-term positive effects for small craft by allowing for safe navigation. The SF-17 placement site is near the outer boundary of the National Park Service's Golden Gate National Recreation Area. Use of SF-17 as a placement site is not anticipated to result in adverse impacts or physical degradation of existing recreational resources, change in use of existing recreational resources, or any potential harm to the integrity of the Golden Gate National Recreation Area's cultural and natural resources. Indirect beneficial effects to recreational activities are likely from use of the SF-17 placement site through potential to feed sediment toward Ocean Beach and reduce ongoing shoreline erosion in the area.

Resource Area	Notes
Regional Growth	Alternatives would not result in any new residences or infrastructure that could facilitate growth in the San Francisco Bay Area. Maintenance dredging, transport, and placement would not require the expansion of water or energy conveyance or require construction of new roads. Alternatives would not remove any existing obstacles to growth.
Socioeconomics	USACE's maintenance dredging of the federal navigation channels provides beneficial socioeconomic impacts to maritime commerce and the regional economy by maintaining navigability of the channels and access to local ports and harbors.
Utilities	Proposed dredging and dredged material placement activities would not result in the expansion of landfills or facilities that treat or convey wastewater, stormwater, or potable water. Alternatives would not create residences or commercial facilities that would increase the service population in the San Francisco Bay Area. Maintenance dredging of the federal channels to previously dredged depths and use of existing placement sites would not disturb existing utilities.
Wildfire Impacts	Alternatives would not affect areas or lands classified as very high fire hazard severity zones, nor would they substantially impair an adopted emergency response plan or emergency evacuation plan; exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire; require the installation or maintenance of associated infrastructure that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment; or expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes.

[1] General Assessment Construction Noise Criteria equivalent sound level for 1-hour duration.

Key: CEQA = California Environmental Quality Act
dBA = A-weighted decibels
NEPA= National Environmental Policy Act
SF-17 = Ocean Beach Nearshore Placement Site
USACE = US Army Corps of Engineers

3.1.2 Resources Considered in Detail

The resources discussed in detail in the sections that follow are:

- Air quality, climate change, and greenhouse gases
- Biological resources
- Cultural and tribal resources
- Geology, soils, and sediment quality
- Hazards and hazardous materials
- Hydrology and water quality
- Land use and planning
- Hazards and hazardous materials
- Transportation and traffic, including navigation

3.1.3 Approach to Environmental Analysis

Each resource section is presented as follows:

- **Environmental Setting** describes the existing environmental conditions in the study area. The region of influence varies by resource and is defined, where appropriate, for each resource.
- **Regulatory Setting** describes the federal, state, and local regulatory framework applicable to implementation of the project alternatives. Applicable federal, state, and local regulatory requirements specific to each resource area are presented in Chapter 3.
- **Methodology and Thresholds for Significance** discusses the scope considered in the analysis, the approach to the analysis, and those areas where none of the alternatives would have an impact and which are, therefore, not discussed in more detail in that section.
- **Impacts and Mitigation Measures** sections provide analysis of direct, indirect, and cumulative or, under NEPA reasonably foreseeable impacts, and a full description of the mitigation measures that are recommended or required to reduce project impacts. Direct, indirect, and cumulative impacts or, under NEPA, reasonably foreseeable were evaluated. Direct impacts are the primary effects that are caused by the alternative and occur at the same time and place. Indirect impacts are secondary effects that are reasonably foreseeable and caused by the alternative but occur at a different time or place. Cumulative impacts result from the incremental impact of a proposed project when added to other past, present, and reasonably foreseeable future actions (see below for further discussion of cumulative impacts). NEPA only requires the analysis of reasonably foreseeable impacts 42 U.S.C. § 4332(C)(i). Reasonably foreseeable impacts are those that provide sufficient information for meaningful consideration, but agencies are not required to engage in speculative analysis. N. Plains Res. Council, Inc. v. Surface Transp. Bd., 668 F.3d 1067, 1078-1079 (9th Cir. 2011)

Significance criteria for each resource topic were used to assess the severity of the environmental impacts of the Proposed Project alternatives and, for CEQA compliance purposes, determine when mitigation measures to avoid or mitigate the significant impact may be required. Unlike CEQA, NEPA does not have specific impact thresholds that are used to assess the significance of impacts on a given resource topic, but rather states that when considering whether an adverse effect of the Proposed Action is significant, agencies shall examine both the context of the action and the intensity of the effect. In assessing context and intensity, agencies should consider the duration of the effect. Agencies may also consider the extent to which an effect is adverse at some points in time and beneficial at others.

The significance criteria presented in this chapter are primarily adapted from Appendix G of the CEQA Guidelines and relevant agency thresholds. Where possible, significance criteria are based on state or federal standards. Different significance criteria are identified for NEPA and CEQA when warranted because different regulatory standards or compliance requirements apply to USACE, a federal agency, and the Regional Water Board, a state agency. In addition, because of differences between NEPA and CEQA guidance, a significant impact under CEQA does not necessarily equate to significant impact under NEPA.

In each resource section, discussion of impacts is organized according to the impact type. Under each impact type title, impacts are analyzed for each alternative, and a determination of the level of the impact under NEPA and CEQA is presented. Where impacts would be the same for one or more alternatives, the impact discussion for these alternatives is combined to avoid redundancy.

Impacts analyzed under NEPA are classified as beneficial, negligible, less than significant, or significant, which are defined as follows: A beneficial impact would generally be regarded as an improvement over current conditions. A negligible impact would cause a slight adverse change in the environment, but one that generally would not be noticeable. A less-than-significant impact would cause an adverse change in the environment that would likely be noticeable but does not meet or exceed the defined significance criteria. A significant impact would cause a substantial adverse change in the environment that would exceed the defined significance criteria.

Impacts analyzed under CEQA are classified as having no impact, less-than-significant impact, less-than-significant impact with mitigation, or potentially significant impact. CEQA specifically refers to effects and impacts as synonymous referring to them as a “physical change,” and directs the lead agency to focus its analysis on the project’s potential to cause an “adverse change in any of the physical conditions within the area affected by the project” (14 California Code of Regulations Sections 15358, 15378, 15382). CEQA does not specifically recognize beneficial effects as an impact. Avoidance or mitigation measures are identified to reduce the project’s impacts, where feasible. Mitigation measures in this EA/EIR are formulated to be consistent with NEPA and the CEQA Guidelines Section 15370.

The discussion of cumulative impacts provides an analysis of cumulative impacts of the project, taken together with other closely related past, present, and reasonably foreseeable future projects producing related impacts. Per NEPA, only reasonably foreseeable impacts are considered. 42 U.S.C. § 4332(C)(i). Similarly, CEQA considers cumulative impacts in reference to two or more individual effects that, when combined, are considerable; or that compound or increase other environmental impacts (CEQA Section 15355). Table 3-2 identifies the past, present, and reasonably foreseeable programs, projects, and policies considered in the cumulative analysis. The list of projects generally includes those near the federal channels or placement sites (i.e., those that could result in overlapping impacts, such as navigation and air quality), or other projects along SF Bay that could result in overlapping impacts on resources such as biological resources and water quality. A significant cumulative impact would occur when the project would make a “cumulatively considerable incremental contribution” to an overall significant cumulative impact. If an overall cumulative impact would not be significant, even when the project would make a cumulatively considerable incremental contribution to the cumulative impact, then it is determined that the project would not cause a significant cumulative impact. For this document, it was found that neither the NEPA reasonably foreseeable impacts analysis nor the CEQA cumulative impacts analysis determined there would be significant impacts from the project. Therefore, for simplicity, as cumulative impacts require consideration of reasonably foreseeable impacts, cumulative impacts analysis can be read as the NEPA analysis of reasonably foreseeable impacts for the remainder of the document.

Table 3-2. Programs, Projects, and Policies Included in Cumulative or Reasonably Foreseeable Impact Assessment

Project Number	Project Name/Location	Status/Anticipated Timeline	Project Summary	Relevancy	Entity
1	Non-federal Maintenance Dredging in San Francisco Bay	Ongoing	More than 100 marinas, ports, and berthing slips are maintenance dredged in the San Francisco Bay/Estuary. Most of the non-federal maintenance projects are along the shorelines and in the tributaries of the Estuary.	Ongoing maintenance dredging activities by non-federal entities occurring throughout San Francisco Bay; approximately 560,000 CY per year.	Non-federal dredgers
2	San Francisco Bay and Delta Sand Mining Project	Undergoing permit review and CEQA review.	The State Lands Commission is developing a supplemental EIR for reissuance of authority to permit underwater commercial harvesting of sand from lease areas under the jurisdiction of the State Lands Commission within San Francisco Bay and the western Delta for an additional ten years. Current permits, issued in 2015 by BCDC, authorized 1.426 million CY of mining annually through 2025.	Proposed continuation of commercial harvesting of sand from specified areas in Central San Francisco Bay and in Suisun Bay for use in the construction industry.	BCDC, CSLC
3	South Bay Salt Pond Restoration	Ongoing	Begun in 2003, this a 50-year effort to restore South Bay wetlands, expand Bayside public access and provide for flood management. Various portions of the project have been completed, are under construction or implementation, in planning, or proposed.	Wetland restoration project in South San Francisco Bay that includes potential future placement sites for BUDM.	USACE, USFWS, Valley Water, SCC, CDFW,
4	Cullinan Ranch Restoration Project	Monitoring	A 1,500-acre tidal marsh restoration project along the northern shore of San Pablo Bay in Solano and Napa counties. Project also includes the Cullinan Ranch BUDM project.	Tidal marsh wetland restoration adjacent to San Pablo Bay and existing placement site for BUDM.	USACE, SCC

Project Number	Project Name/Location	Status/Anticipated Timeline	Project Summary	Relevancy	Entity
5	Bel Marin Keys Unit V	Planning and Conceptual Design	Phase two of the Hamilton Wetland Restoration Project: This project adds 1,600 acres including 900 acres of tidal wetlands and 680 acres of non-tidal and freshwater wetlands, as well as upland, subtidal, and non-wetland tidal habitats, for a total acreage of approximately 2,600 acres for the expanded site. The project will provide for ecosystem and wetland restoration through BUDM, and for recreation, and involves the construction of new, improved, and containment levees, intertidal berms, and excavation of two tidal inlet channels.	Wetland restoration in San Pablo Bay and potential future placement site for BUDM.	USACE, SCC
6	South San Francisco Bay Shoreline Study Phase 1 Project	Under Construction	A multi-purpose flood-risk management, ecosystem restoration, and recreation project in San Jose, CA. The project manages reduces flood risks, restores 2,900 acres of tidal wetlands, and improves recreation in the area.	Wetland restoration project near potential beneficial use sites for dredged material placement.	USACE, USFWS, SCC, Valley Water
7	Brooklyn Basin Marina Expansion Project	In Progress	Modification of previously approved 2009 EIR for Brooklyn Basin. Project is the development of land and water for residential, boating, commercial, and public space and facilities.	Work will require in-water development for a marina expansion.	Port of Oakland
8	Oakland Harbor Turning Basins Widening	Authorized in WRDA 2024, awaiting construction appropriations	Widening the existing turning basins at the Oakland Seaport to allow vessels to turn around more efficiently and safely upon entering and exiting the Oakland Harbor.	In-water work in San Francisco Bay. Dredged material from the project will be placed at appropriate landfills and at a beneficial use site for the protection, restoration, or creation of aquatic wetland habitats as either foundation (non-cover) or cover material.	Port of Oakland and USACE

Project Number	Project Name/Location	Status/Anticipated Timeline	Project Summary	Relevancy	Entity
9	San Francisco Bay Strategic Shallow-Water Placement Pilot Project	Constructed 2023–monitoring underway	Beneficial use material from the federal channel at Port of Redwood City was placed in the eastern shallows of South San Francisco Bay, offshore of the marsh complex in Eden Landing Ecological Reserve at an area referred to as Whale’s Tail, in December 2023.	Pilot project recently implemented by USACE for nearshore strategic placement of dredged material, and potential future placement site for BUDM.	USACE, SCC
10	Napa River Salt Marsh Restoration Project	Monitoring	Restored and enhanced 6,800 acres of former salt ponds to tidal marsh and managed ponds. Now complete, the project provides fish and wildlife benefits and public access, including signage and benches.	Wetland restoration project near existing non-aquatic beneficial use sites for dredged material placement.	SCC

Key: BCDC = San Francisco Bay Conservation and Development Commission
BUDM = beneficial use of dredged material
CEQA = California Environmental Quality Act
CSLC = California State Lands Commission
EA = Environmental Assessment
EIR = Environmental Impact Report
SCC = California State Coastal Conservancy
USACE = US Army Corps of Engineers
USFWS = US Fish and Wildlife Service
Valley Water = Santa Clara Valley Water

3.1.4 Approach to Impacts Assessment Associated with the Proposed Action/Proposed Project

As discussed in Chapter 2, the Proposed Action/Proposed Project is comprised of a phased implementation of the No Project Alternative, Alternative 1, and Alternative 2. USACE intends to follow the schedule described in Section 2.4. The final requirements for project implementation, including potential mitigation for project environmental impacts, will be set forth in the WQC/WDR permit issued by the Regional Water Board. The environmental impacts and proposed mitigation measures for the Proposed Action/Proposed Project are discussed in detail in this chapter.

USACE plans to continue the No Project Alternative in 2025 to allow time to implement and complete all the planning steps required for Alternatives 1 and 2, including this NEPA/CEQA document. The earliest USACE could implement Alternative 1 is 2026, with Alternative 2 beginning as early as 2027. USACE understands and shares the LTMS's priorities to increase BUDM, and thus supports Alternatives 1 and 2 to achieve those goals as the Federal Standard Base Plan.

In the event of unforeseen circumstances beyond the control of USACE, such as the lack of equipment availability and variations in sediment quality and quantity that prevent execution of the Proposed Action/Proposed Project, USACE will address those possibilities in the annual 404(b)1 alternatives analysis, and if required, subsequent NEPA or CEQA documentation in addition to coordination with the other LTMS agencies, as applicable. Unforeseen circumstances are by their nature not reasonably foreseeable and cannot be analyzed without speculation.

In assessing the potential environmental impacts of the Proposed Action/Proposed Project, it is assumed that USACE will proceed with a phased implementation approach as described above. The impact analysis of the Proposed Action/Proposed Project as a whole takes into consideration the phased implementation approach by considering the impacts described within the No Project Alternative for the first year, Alternative 1 for the next one to two years, approximately, and Alternative 2 for subsequent years to analyze the effect over the entire 10-year period.

3.2 Air Quality, Climate Change, and Greenhouse Gas Emissions

The discussion of climate change within Section 3.2 is only included as it is required by CEQA. It is not relevant to the NEPA analysis nor considered in the FONSI determination.

Proposed maintenance dredging and placement activities would burn fossil fuels, resulting in emissions that have the potential to impact air quality and contribute to greenhouse gas emissions. The combustion of fuel releases pollutants into the atmosphere that can adversely impact air quality and may add to global climate change considerations. The movement of dredged material from a dredge location to a placement location would also generate emissions through the use of barges, scows, and/or pipelines.

Air quality is defined by ambient air concentrations of specific pollutants determined by the USEPA to be of concern with respect to the health and welfare of the public. For this analysis, air quality impacts are assessed against national standards for ambient air quality and hazardous air pollutants (HAP) as well as contributions to greenhouse gas (GHG) emissions.

Ambient air quality refers to the atmospheric concentration of a specific pollutant that occurs at a particular geographic location. Ambient air quality concentrations are generally reported as a mass per unit volume (e.g., micrograms per cubic meter of air) or as a volume fraction of the air (e.g., parts per million by volume). The ambient air quality concentrations at a particular location are determined by the interactions of emissions, meteorology, and chemistry. Emission considerations include the types, amounts, and locations of pollutants emitted into the atmosphere. Meteorological considerations include wind and precipitation patterns affecting the distribution, dilution, and removal of pollutant emissions. Chemical reactions can transform pollutant emissions into other chemical substances.

The major pollutants of concern, called “criteria pollutants,” are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), total suspended particulate matter less than or equal to 10 (PM_{10}) and 2.5 ($PM_{2.5}$) micrometers in aerodynamic diameter, and lead (Pb). USEPA has established National Ambient Air Quality Standards (NAAQS) for these pollutants, which are presented in Appendix D.

A design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS. Design values are relevant because they provide baseline air quality levels for the given area. The most recently published design values based on current ambient monitoring levels (2022) for the SF Bay Area are compared to the federal or California ambient air quality standards (AAQS), whichever is more stringent, in Appendix D. Design values are computed based on monitoring data and published annually by USEPA's Office of Air Quality Planning and Standards and reviewed in conjunction with the USEPA Regional Offices (USEPA 2024).

HAPs are pollutants for which there are no NAAQS but are still regulated under the federal Clean Air Act because of their potentially adverse effects on human health and the environment. Also known as “air toxics,” these pollutants are comprised of a wide array of organic and inorganic compounds (e.g., formaldehyde, acetaldehyde, benzene, toluene, acrolein, 1,3-butadiene, xylene, lead, naphthalene, propionaldehyde). HAPs are generated by mobile sources through the incomplete combustion of fuel as well as through the evaporation of hazardous components of the fuel.

GHGs are gases that trap heat in the atmosphere. Both natural processes and human activities generate these emissions. Each GHG is assigned a global warming potential (GWP), which is its ability to trap heat, and is standardized to carbon dioxide (CO_2), which has a GWP value of 1.0. A GHG is multiplied by its GWP to calculate the total equivalent emissions of carbon dioxide. The accumulation of GHGs in the atmosphere regulates the Earth’s temperature. Global warming observed over the past 50 years is due primarily to human-induced emissions of heat-trapping gases. These emissions come mainly from the burning of fossil fuels (coal, oil, and gas), with contributions from forest clearing, agricultural practices, and other activities.

3.2.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential air quality impacts from the alternatives.

3.2.1.1 Federal

Federal regulations applicable to air quality are discussed in the following sections.

Clean Air Act

The Clean Air Act (CAA) (42 U.S.C. § 7401 *et seq.*) as amended, is a federal law that regulates air emissions from all sources, both stationary and mobile, to reduce and control air pollution in the United States. The CAA calls for state, local, federal, and tribal governments to implement the CAA in partnership to reduce pollution to safeguard public health and welfare, and the productive capacity of its population. For criteria pollutants, the law requires USEPA to establish health-based national air quality standards (i.e., NAAQS) to protect people with an "adequate margin of safety."

States are responsible for developing enforceable state implementation plans (SIP) to meet the NAAQS. In California, local air quality management districts produce air quality plans to ensure the air quality in their local jurisdictions and work with the California Air Resources Board, a state agency, to produce the SIP for California. In addition to ensuring NAAQS are not exceeded within a given state, each SIP must also prohibit or mitigate emissions that significantly contribute to air quality problems in a downwind state. USEPA provides guidance and technical assistance to assist state planning, issues national emissions standards for new stationary sources, and reviews state plans to ensure that they comply with the act. Pre-construction permits are required for major new and modified stationary sources. In the project area, the Bay Area Air Quality Management District (BAAQMD) serves as the CAA permitting authority.

3.2.1.2 State

State regulations applicable to air quality are discussed in the following sections.

California Clean Air Act

The California Clean Air Act (California Code of Regulations, Title 13, Div. 3 and California Code of Regulations, Title 17, Div. 3) allows the California Air Resources Board (CARB) to set standards for criteria pollutants in California that are more stringent than the NAAQS and includes the following additional contaminants: visibility-reducing particles, hydrogen sulfide, sulfates, and vinyl chloride. The BAAQMD has the responsibility to monitor ambient air pollutant levels throughout the basin, and to develop and implement strategies to attain the applicable federal and state standards. The San Francisco Bay Area Air Basin (SFBAAB) is currently classified as non-attainment for the one-hour state ozone standard as well as for the federal and state eight-hour standards. Additionally, the SFBAAB is classified as non-attainment for the state 24-hour and annual arithmetic mean PM_{10} standards, as well as the state annual arithmetic mean and the national 24-hour $PM_{2.5}$ standards. The SFBAAB is unclassified or classified as attainment for all other pollutant standards.

In December 1999, the BAAQMD adopted its initial CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans, as a guidance document to provide lead government agencies, consultants, and project proponents with uniform procedures for assessing air quality impacts and preparing the air quality sections of environmental documents for projects subject to CEQA. The BAAQMD CEQA Guidelines is an advisory document, and local jurisdictions are not required to use the methodology outlined therein. The document describes the criteria that the BAAQMD uses when reviewing and commenting on the adequacy of environmental documents. It recommends thresholds for use in determining whether projects would have significant adverse environmental impacts, identifies methodologies for predicting project emissions and impacts, and identifies measures that can be used to avoid or reduce air quality impacts. BAAQMD updated quantitative thresholds of significance for its CEQA Air Quality Guidelines in 2010 and published its latest (as of October 2024) version of its CEQA Guidelines in April 2022 (BAAQMD 2022). The 2023 BAAQMD CEQA Guidelines provide BAAQMD-recommended procedures for evaluating potential air quality impacts during the environmental review process consistent with CEQA requirements.

The guidelines specify recommended thresholds of significance for construction and operational criteria air pollutants and precursor emissions (volatile organic compounds [VOC] and nitrogen oxide [NOx] are precursors for ozone formation), GHG emissions, and risks and hazards associated with toxic air contaminants from an individual project and cumulative impacts. The applicable criteria pollutants thresholds are outlined in Table 3-5.

Commercial Harbor Craft Regulation

Since the original adoption of the Commercial Harbor Craft regulation in 2008 and its amendments in 2010, owners of commercial harbor craft vessels have replaced older engines with newer and cleaner engines. In 2022, additional amendments were adopted to expand the applicability of the regulation to more vessel types and require cleaner upgrades and new technology. Compliance dates for engine upgrades depend on the vessel category and the model year of the engine. All types of tugs, including tow boats used in the Proposed Project, have phase-in requirements starting in 2024 through 2029, depending on current engine model year, to upgrade to Tier 4 engines with diesel particulate filters. Dredges, barges, and workboats have phase-in requirements for any pre-Tier 1 and Tier 1 engines, starting with the first group, which were completed by the end of 2023. Tier 2 and higher engines would be subject to phase-in requirements in 2028 through 2031 to upgrade to Tier 4 engines with diesel particulate filters. Newly acquired vessels have zero-emission requirements. Starting in 2023, all commercial harbor craft were required to use renewable diesel. In 2024, 15-minute idling limits for all commercial harbor craft took effect.

The *Yaquina's* engines are from 2008 and the *Essayons* are from 2012. Therefore, the *Yaquina* would need to have Tier 4 engines installed by December 31, 2028, and the *Essayons* by December 31, 2029. Currently, there are no commercially available dredges with Tier 4–compliant engines. USACE would likely seek extensions to compliance until the new (or rebuilt) *Essayons* and *Yaquina* can be brought into service.

3.2.2 Environmental Setting

The project's region of influence (ROI) is the SFBAAB, which encompasses all or portions of the following nine counties: Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco. The ROI is within the jurisdiction of the BAAQMD. While the LTMS program planning area included small portions of Sacramento and San Joaquin counties, the study area is limited to the SFBAAB because almost all project activities would occur within the SFBAAB. USACE, the Regional Water Board, USEPA, and BCDC identified additional placement sites as possible future BUDM sites as described in Section 1.5.2.2. Environmental review processes have not been completed for these sites and there is insufficient information available to fully analyze the potential impacts of placing dredged material at these locations in this EA/EIR. Therefore, this assessment does not include the potential use of the future placement sites identified in Section 1.5.2.2. Use of these sites would be conditioned upon the completion of supplemental environmental review and required regulatory approvals.

The environmental setting constitutes the baseline physical conditions used to determine whether implementation of the Proposed Project would cause changes in air pollutant emissions that would result in significant air quality impacts according to applicable thresholds. It is important to note that because the project and its alternatives involve continuation of an existing operation, the projected impacts are compared to the impacts that have occurred under the existing dredging program, as described in Section 2.3.2, the No Action Alternative/No Project Alternative.

3.2.2.1 San Francisco Bay Area Air Basin Climate

The SFBAAB has a complex terrain consisting of coastal mountain ranges, inland valleys, and bays, which distort normal wind flow patterns. The Coast Range splits wind flows, resulting in a western coast gap (Golden Gate) and an eastern coast gap (Carquinez Strait), which allows air to flow in and out of the SFBAAB and the Central Valley. The SFBAAB is characterized by a Mediterranean-type climate, with mild, wet winters and warm, dry summers.

Climate change impacts have been ongoing in the region, with a 1.7-degree Fahrenheit (°F) maximum temperature increase since 1950, and an approximately 8-inch SLR in the last 100 years. Climate impacts that are forecast for the region in the future include an increase in ambient air temperatures of 3 to 4.5°F by year 2050 and between 5.5 to 8°F by year 2100. Warming average temperatures, regardless of total precipitation level changes, will cause droughts to become longer and more severe and, coupled with development in the wildland-urban interface, increased fire risk. The Bay Area will be severely impacted by SLR and, when combined with high tides and storms, by extreme flooding. Between 2020 and 2050, the region is projected to see between 0.20 and 1.16 feet of SLR, and between 0.53 and 5.46 feet by year 2100 (USACE, CPR, and CWBI 2024).

3.2.3 Methodology and Thresholds of Significance

Per the requirements of CEQA, the Proposed Project and its alternatives are compared to an established baseline to assess the net change in emissions that would result from implementing a Proposed Action. For this analysis, the average annual volume of dredged material was used for each site, and the furthest transit distance for each placement site type was used to generate a conservative scenario for a representative activity/emissions envelope. This envelope is defined as a year when every site would be dredged. This is not an actual schedule scenario but presents a realistic, conservative situation to evaluate the alternatives. Because the principal difference in the No Action Alternative and No Project Alternative is based on select locations being dredged every year versus every two years at two sites, the air quality analysis has adopted the No Action Alternative as the baseline against which Proposed Project alternatives are compared. For CEQA analysis, the No Project Alternative remains the same as the No Action Alternative since the emissions evaluated would occur in a hypothetical year when all locations are dredged and represents a conservative assessment of the maximum air quality impacts under this alternative.

The air emissions for the alternatives are primarily defined by two factors: the variation in use of specific dredging equipment (hopper vs clamshell was used in this analysis), and the variation in placement sites selection. These variations across the alternatives are used as the primary basis for evaluating differences in emissions. Additionally, dredge equipment operations were evaluated with updated information on equipment used, emission factors and transit lengths. Much of the dredge equipment updates came from the Port of Oakland 2020 Emission Inventory and CARB Commercial Harbor Craft data. As a result, the No Action Alternative was recalculated to provide a realistic baseline against which the action alternatives are evaluated to ascertain the net change in emissions, and these data are presented in Table 3-3. The average dredging volume for each location was used for the one-year envelope (Appendix D, Baseline Alternative Tab), which represents a total dredge volume of 2,650,000 CY. This envelope is approximately 20 percent greater than the actual average annual dredging volume for the sites over the 2015 to 2022 period and so represents a more conservative emissions profile. The dredging volume for the No Action Alternative and No Project Alternative established the one-year baseline envelope; this volume was subsequently used in the analysis of all other alternatives. Placement sites were based on the average percentages of placement site types used as described in Section 3.2.4.1 for the No Action Alternative. As with the action alternatives analyzed, the maximum distance was used for each placement site transit.

Table 3-3. Annual Air Emission Estimates for Dredging and Placement Site Transit, All Sites Dredged in One-Year Envelope for the No Action Alternative

Activity	VOCs/ROG, Tons[1]	CO, Tons	NOx, Tons	PM_{10}, Tons	$PM_{2.5}$, Tons
Dredging	4.75	26.95	83.52	2.67	2.53
Transit	4.79	35.75	94.98	3.51	3.40
TOTAL	**9.55**	**62.67**	**178.50**	**6.18**	**5.93**

[1] VOCs, as defined in the federal CAA, are equivalent to reactive organic gas (ROG) defined here and are hereafter referenced as VOCs.

Key: CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter
ROG = reactive organic gas
VOC = volatile organic compound

Each alternative was analyzed based on the percentage of use of dredge equipment, which varied by alternative, and the transits to placement sites. Table 3-4 presents the variation of dredging equipment use across the alternatives.

Table 3-4. Use of Dredging Equipment by Alternative

Alternative	Clamshell (Mechanical) %[1]	Hopper (Hydraulic) %
No Action Alternative/No Project Alternative	69	31
Alternative 1: Beneficial Use—Diversion from Deepwater Disposal	71	29
Alternative 2: Beneficial Use—Regional Optimization	52	48

Alternative	Clamshell (Mechanical) %[1]	Hopper (Hydraulic) %
Alternative 3: Beneficial Use—Cost Sharing	62	38
Alternative 4: Beneficial Use—Maximized	85	15

[1] Clamshell dredging was used to represent both clamshell and cutterhead dredging. Cutterhead dredging represent a small quantity of the total volume of dredging, and emissions associated with pumping to near/shore locations is minimal in comparison to clamshell operations. As a result, substituting with clamshell dredging provides a reasonable estimation of total cutterhead dredging emissions.

In order to achieve flexibility for the proposed alternatives, dredging volumes were not segregated by specific placement sites with individual transit distances; instead, the greatest distance for each placement site type was used. Table 3-5 denotes the transit distances used for placement site types. The differences in emissions between the placement areas historically used (No Action Alternative and No Project Alternative) and the increase in use of non-aquatic beneficial use locations (Alternatives 1 through 4) were estimated and compared to CEQA thresholds to determine level of significance.

Table 3-5. Maximum Transit Distances (One-Way) for Each Placement Site Location

Placement Location	Dredging Equipment Used	Maximum Transit Distance (nautical miles)
In-Bay placement sites	Clamshell (Mechanical)	41.2
In-Bay placement sites	Hopper (Hydraulic)	41.2
Nearshore strategic placement sites	Hopper (Hydraulic)	5.2
Potential future nearshore strategic placement sites	Clamshell (Mechanical)	4.8
Ocean placement sites	Hopper (Hydraulic)	1.5
Deep ocean disposal	Clamshell (Mechanical)	63.5
Upland (sponsor-provided) sites	Clamshell (Mechanical)	3.2
Non-aquatic direct placement sites	Clamshell (Mechanical)	64.3

Maintenance dredging under any alternative would be conducted with mechanical dredges, hopper dredges, and cutterhead-pipeline dredges. Methods used to transport dredged material would include hopper dredges, barges or scows, and pipelines. Clamshell dredging was used as a surrogate for cutterhead-pipeline dredging because cutterhead dredging represents a small amount of the total volume and the clamshell operations emissions are sufficient to cover the pump emissions for the nearshore pipeline as well. The analysis considered CEQA Appendix G thresholds as well as the BAAQMD thresholds when evaluating significance under CEQA. Based on these thresholds, the impacts would be significant if the project:

- Conflicts with or obstructs implementation of an applicable air quality plan.
- Violates any air quality standard or contributes substantially to an existing or projected air quality violation.
- Results in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors).
- Exposes sensitive receptors to substantial pollutant concentrations.

- Results in other emissions (such as those leading to odors) adversely affecting a substantial number of people.

The BAAQMD CEQA Thresholds of Significance provide comparative reference thresholds for considering whether a project would have an air quality impact and recommend procedures for evaluating potential air quality impacts. The analysis in this EA/EIR was conducted in accordance with the BAAQMD CEQA Guidelines (BAAQMD 2022). As the BAAQMD thresholds are stricter than federal thresholds, it can be assumed that if an alternative meets BAAQMD thresholds then federal thresholds are also satisfied, and therefore it is unnecessary to analyze federal thresholds separately in this joint document. The maximum annual criteria pollutant thresholds for ROG and NOx are based on the federal BAAQMD Offset Requirements for ozone precursors for which the SFBAAB is designated as a NAAQS non-attainment area. For PM10 and PM2.5, the federal New Source Review Significant Emission Rate annual limits of 15 and 10 tons per year, respectively, are used as the thresholds (BAAQMD 2022).

A project's emissions would constitute a less-than-significant air quality impact if they meet the net change thresholds for criteria pollutants. The BAAQMD thresholds for criteria pollutants emissions are summarized in Table 3-6. Calculations performed to compare action net change emissions against the CEQA thresholds can be found in Appendix D.

This analysis addresses project emissions of the following air criteria pollutants: ROG, NO_x, PM_{10}, and $PM_{2.5}$. Analysis for SO_2 was not included because the area is in attainment for federal and state AAQS (i.e., NAAQS and California Ambient Air Quality Standards) for SO_2 and therefore, BAAQMD does not have any mass emissions significance thresholds for SO_2. Furthermore, the USEPA requirement to use ultra-low-sulfur diesel fuel makes SO_2 emissions low enough to be considered negligible for impact analyses. CO was excluded because there would be no on road traffic emissions associated with the Proposed Action, the ROI is in attainment, and the design values demonstrate that CO emissions in the region are quite low, all of which indicates that individual actions are unlikely to result in significant impacts. Additionally, Pb was not included as there are no known sources of Pb emissions associated with the action. For the CEQA/NEPA assessment of impacts, only VOCs/ROG, nitrogen oxides, PM_{10} and $PM_{2.5}$ are evaluated, as these criteria pollutants are classified as non-attainment or maintenance for the ROI.

Table 3-6. Bay Area Air Quality Management District Criteria Pollutant Thresholds

Threshold Criteria	ROG[1]	NOx	PM_{10}	$PM_{2.5}$
Average Daily Emissions (lbs/day)	54	54	82	54
Maximum Annual Emissions (tpy)	10	10	15	10

Source: BAAQMD 2022
[1] VOC, as defined in the federal CAA, are equivalent to ROG defined here.
Key: lbs/day = pounds per day
tpy = tons per year
NO_X = nitrogen oxides
PM_{10} = particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter
ROG = reactive organic gas

3.2.3.1 NEPA Thresholds of Significance

There is no numerical threshold prescribed by NEPA for determining significant impacts to air resources from criteria air pollutant emissions. Therefore per NEPA, the action agency must determine the threshold for significant impacts. Adoption of a threshold for compliance with NEPA from Clean Air Act is not possible since operations and maintenance dredging projects are presumed to conform by the Clean Air Act per 40 C.F.R. 93.153(c)(2)(ix). To this end, a determination of significant impacts would be made if the emissions would be intercepted by sensitive receptors (e.g.,

GHG emissions are evaluated separately, as their ROI is global. GHGs can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years. All these gases remain in the atmosphere long enough to become well mixed, meaning that the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions. CO_2 remains in the atmosphere for a very long time; changes in atmospheric CO_2 concentrations persist for thousands of years. The larger the GWP, the more that a given gas warms the earth compared to CO_2 over a given period, which is most commonly defined as 100 years. As examples, methane (CH_4)has a GWP of 25 and nitrous oxide has a GWP of 298. Emissions for these two GHGs are multiplied by their GWP and added to CO_2 emissions to calculate the carbon dioxide equivalent (CO_2e) emissions.

To quantify the difference in GHG emissions from dredging and transiting varying quantities of dredged material at beneficial use and other strategic or onshore sites across the four alternatives, the analysis quantitatively assessed emissions of the three primary GHGs to determine the net change compared to the No Action Alternative and No Project Alternative in Table 3-7.

Table 3-7. Annual Greenhouse Gas Emission Estimates for Dredging and Placement Site Transit, All Sites Dredged in One-Year Envelope for the No Action Alternative

Activity	CO_2 (Tons)	CH_4 (Tons)	N_2O (Tons)	CO_2e (Tons)[1]
Dredging	10,379.37	0.40	0.43	10,518
Transit	8,511.79	40.35	30.34	8,623
TOTAL	**18,891.17**	**0.75**	**0.78**	**19,141**

[1] CO_2e is calculated based on the GWP values of 25 for CH_4 and 298 for N_2O.
Key: CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
N_2O = nitrous oxide

3.2.4 Impacts and Mitigation Measures

For each of the alternatives, the use of non-aquatic direct placement sites increases, with a maximum of 65 to 75 percent of all material dredged evaluated for Alternative 4. Deep ocean disposal is reduced to 0 to 10 percent and for all alternatives. Increased non-aquatic beneficial use and reduced deepwater ocean placement decreases the distance material needs to be transported, reducing emissions.

The net change in the percent of material volume per placement type by alternative is presented in Table 3-8. Material volume percentage would remain the same across all alternatives for nearshore strategic placement and upland (sponsor-provided) site placements.

Table 3-8. Average Net Change in Placement Site Type by Percentage of Total Volume

Alternative	In-Bay Placement	Potential Future Nearshore Strategic Placement	Ocean Placement	Deep Ocean Disposal	Non-aquatic Direct Placement
Baseline: No Action Alternative/No Project Alternative	**35%**	**0%**	**4%**	**48%**	**0%**
Alternative 1	42%	0%	4%	35%	6%
Change	**+7%**	**0%**	**0%**	**-13%**	**+6%**
Alternative 2	56%	0%	4%	0%	27%
Change	**+21%**	**0%**	**0%**	**-48%**	**+27%**
Alternative 3	40%	0%	4%	0%	43%
Change	**+5%**	**0%**	**0%**	**-48%**	**+43%**
Alternative 4	6%	9%	0%	0%	71%
Change	**-29%**	**+9%**	**-4%**	**-48%**	**+71%**

Note: There is no change in dredge material volume percentage among alternatives for nearshore strategic placement or upland (sponsor-provided) placement sites.

As shown in Table 3-8, deep ocean disposal is reduced at greater levels from Alternative 1 through Alternative 4, with a corresponding increase in non-aquatic direct placement sites and in-Bay placement sites (Alternatives 1 through 3). Alternative 4 would result in a decreased percentage of in-Bay placement and an increase in potential future nearshore strategic placement.

3.2.4.1 Impact AQ-1: Potential Violation of Any Air Quality Standard or Contribute Substantially to an Existing or Projected Air Quality Violation

No Action Alternative/No Project Alternative

Because the No Action Alternative represents the current authorized dredging program, it establishes the baseline for the air quality analysis. As the baseline envelope assumes that every location is dredged in a single year, the No Project Alternative is identical to the No Action Alternative for this analysis (the year when every site is dredged under the two-year No Project Alternative program). Dredged volumes evaluated for the baseline are representative of historical activities over the last 10 years, and so there would be no increase of emissions under the No Action Alternative and the No Project Alternative caused by maintenance dredging for each of the channels and so no contributions to an existing or projected air quality violation.

- **NEPA Determination**: Under the No Action Alternative, short and long-term impacts on air quality violations would be less than significant.

- **CEQA Determination**: Under the No Project Alternative short and long-term impacts on air quality violations would be less than significant.

Alternatives 1 Through 4

Table 3-9 presents the emissions from dredging and placement site transits under all alternatives. For hopper dredging, emissions include the hopper dredge *Essayons* performing operationally along with a tender boat, *Becky T*, as well as the *Essayons'*s transit carrying dredged material to placement sites for unloading. The clamshell dredging operations are evaluated using the *Njord* as the representative clamshell dredge. This equipment was used for channel dredging in 2020. As with the *Essayons*, the operation of the *Njord* includes a tender boat (the *Becky T* is again used as the representative tender), and the tugboat *Heidi Bruscoe* is used to evaluate transport of 4,500-CY capacity scows of dredged material to placement sites. Detailed calculations and associated emissions data are contained in Appendix D.

Table 3-9. Total Dredge Operation and Transit Emissions by Alternative, Compared to the Baseline in Tons per Year

Alternative	VOC	NOx	PM_{10}	$PM_{2.5}$
Baseline: No Action Alternative/No Project Alternative	**9.55**	**178.50**	**6.18**	**5.93**
Alternative 1: Dredge Operation Emissions	4.84	82.67	2.63	2.48
Alternative 1: Transit Emissions	4.91	68.20	2.51	2.43
Subtotal	9.75	150.88	5.14	4.92
Alternative 1 Net Change	**+0.20**	**-27.62**	**-1.04**	**-1.01**
Alternative 2: Dredge Operation Emissions	4.06	90.46	3.04	2.90
Alternative 2: Transit Emissions	4.38	81.35	3.00	2.91
Subtotal	8.43	171.82	6.04	5.81
Alternative 2 Net Change	**-1.12**	**-6.68**	**-0.14**	**-0.12**
Alternative 3: Dredge Operation Emissions	4.47	86.34	2.82	2.68
Alternative 3: Transit Emissions	5.02	67.29	2.48	2.40
Subtotal	9.49	153.63	5.30	5.08
Alternative 3 Net Change	**-0.06**	**-24.88**	**-0.88**	**-0.85**
Alternative 4: Dredge Operation Emissions	5.39	77.18	2.34	2.19
Alternative 4: Transit Emissions	5.77	50.07	1.83	1.78
Subtotal	11.16	127.25	4.17	3.97
Alternative 4 Net Change	**+1.62**	**-51.25**	**-2.01**	**-1.96**

The use of clamshell versus hopper dredging varies by alternative, ranging from a minimum of clamshell use under Alternative 2 at 52 percent to a maximum of 85 percent under Alternative 4. This is represented in the VOC emissions, which are the only criteria of pollutant emissions that do not decrease under every alternative. This reflects two analytical variables: the higher emission factor values for the clamshell dredge as compared to the hopper dredge, and the use of the tugboat, which has a higher VOC emission factor than the hopper dredge to transport scows to placement sites. Overall, the implementation of any of the alternatives would result in a net reduction in total emissions as compared to the baseline and would not contribute to an existing or projected air quality violation.

- **NEPA Determination**: Under Alternatives 1 through 4, short and long-term impacts on air quality violations would be less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, short and long-term impacts on air quality violations would be less than significant.

3.2.4.2 Impact AQ-2: Potential Conflict with or Obstruction of Implementation of an Applicable Air Quality Plan

The BAAQMD CEQA Guidelines (BAAQMD 2022), Appendix D lists the following recommended thresholds of significance for climate change:

- Meet the State's goals to reduce emissions to 40 percent below 1990 levels by 2030 and carbon neutrality by 2045, or
- Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).

No Action Alternative/No Project Alternative

As described in Section 3.2.3, the No Action Alternative represents the current authorized dredging program and establishes the baseline for the short-term, direct emissions that would be generated by maintenance dredging and evaluated in the GHG analysis. Dredged volumes evaluated for the baseline are representative of historical activities over the last 10 years, and so there would be no increase of GHG emissions under the No Action Alternative (and the No Project Alternative) caused by maintenance dredging for each of the channels.

There would be no conflict or obstruction of applicable air quality plans under the No Action Alternative and the No Project Alternative caused by maintenance dredging.

- **NEPA Determination**: Under the No Action Alternative, impacts on implementation of applicable air quality plans would be less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts on implementation of applicable air quality plans would be less than significant.

Alternatives 1 through 4

Table 3-10 presents the GHG emissions for each Alternative as compared to the baseline to assess the net change. Emissions are presented as total CO_2e (the sum of CO_2, CH_4 and N_2O emissions) and are listed in metric units. GHG emissions would decrease under all alternatives.

Table 3-10. Total Dredge Operation and Transit Emissions by Alternative, Compared to the Baseline in Metric Tons per Year

Alternative	CO_2e
Baseline No Action Alternative/No Project Alternative	**17,364**
Alternative 1: Dredge Operation Emissions	9,579
Alternative 1: Transit Emissions	5,941
Subtotal	15,519
Alternative 1 Net Change	**-1,845**
Alternative 2: Dredge Operation Emissions	9,240
Alternative 2: Transit Emissions	6,759
Subtotal	15,999
Alternative 2 Net Change	**-1,365**
Alternative 3: Dredge Operation Emissions	9,419
Alternative 3: Transit Emissions	5,899
Subtotal	15,318
Alternative 3 Net Change	**-2,046**
Alternative 4: Dredge Operation Emissions	9,818
Alternative 4: Transit Emissions	4,838
Subtotal	14,656
Alternative 4 Net Change	**-2,709**

The social cost benefit of the reduction in GHGs over the 10-year period was analyzed using the USEPA 2.5 percent cost values for CO_2, CH_4 and N_2O. Alternative 2 was used to quantify the reductions as the reductions would be lowest for this alternative. Table 3-11 presents the reduction ($2,148,311) for Alternative 2.

Table 3-11. Social Cost of Carbon Evaluation for Alternative 2 (Smallest Reduction), 2025–2034

Emission Year	2020 Dollars per Metric Ton[1]			Metric ton/year			Total Cost
	SC: CO_2 2.5%	SC: CH_4 2.5%	SC: N_2O 2.5%	CO_2	CH_4	N_2O	CO_2e
2025	$130	$1,590	$39,972	-1485.12	-0.11	-0.06	($195,540)
2026	$133	$1,657	$40,920	-1485.12	-0.11	-0.06	($200,057)
2027	$136	$1,724	$41,868	-1485.12	-0.11	-0.06	($204,574)
2028	$139	$1,791	$42,816	-1485.12	-0.11	-0.06	($209,092)
2029	$141	$1,857	$43,764	-1485.12	-0.11	-0.06	($212,124)
2030	$144	$1,924	$44,712	-1485.12	-0.11	-0.06	($216,641)
2031	$147	$2,002	$45,693	-1485.12	-0.11	-0.06	($221,162)
2032	$150	$2,080	$46,674	-1485.12	-0.11	-0.06	($225,682)

Emission Year	2020 Dollars per Metric Ton[1]			Metric ton/year			Total Cost
	SC: CO_2 2.5%	SC: CH_4 2.5%	SC: N_2O 2.5%	CO_2	CH_4	N_2O	CO_2e
2033	$153	$2,157	$47,655	-1485.12	-0.11	-0.06	($230,202)
2034	$155	$2,235	$48,636	-1485.12	-0.11	-0.06	($233,238)
10-Year Total Estimated Cost Reduction							**($2,148,311)**

[1] USEPA 2023

Key: SC = social cost
CO2 = carbon dioxide
CO2e = carbon dioxide equivalent
CH4 = methane
N2O = nitrogen dioxide

- **NEPA Determination**: Under Alternatives 1 through 4, short- and long-term GHG emissions would decrease and therefore provide a beneficial impact as compared to the baseline GHG emissions. Implementing any of the project alternatives would not conflict with or obstruct Federal climate action plans or goals.
- **CEQA Determination**: Under Alternatives 1 through 4, there would be no impact on air quality, as implementing any of the alternatives would not conflict with or obstruct state or local climate action plans or goals.

3.2.4.3 Impact AQ-3: Potential for Exposure of Sensitive Receptors to Substantial Pollutant Concentrations

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

The maintenance dredging actions would occur offshore, with placement sites located as far as approximately 55 miles offshore from San Francisco (i.e., SF-DODS). The increased use of beneficial use sites would result in more placement of dredged material near the coastline, and so would represent the greatest possibility of vessel operation emissions reaching onshore localities. Sensitive receptors are individuals most susceptible to poor air quality: children, the elderly, and individuals with serious pre-existing health problems affected by air quality (CARB 2005). The predominant wind patterns in the area are strongly from the west, with two months of the year (January and December) showing the greatest variety of wind direction patterns. It can be concluded that all emissions in the Bay tend to disperse to the east of the source generating the emissions.

Dredging areas and placement sites are located throughout the Bay Area and offshore. The locations of potential concern would be in the Bay and specifically in areas where placement would occur nearshore. These work areas would be active intermittently, as the dredged material arrives, is deposited, and the vessel departs. In addition to the temporary nature of nearshore air emissions, the State of California has adopted regulations for commercial harborcraft vessel engines. These requirements include the most recent regulation (CARB 2022), which expands the applicability of the regulation to more vessel types and requires cleaner upgrades and new technology. Refer to Commercial Harbor Craft Regulation (Section 3.2.1.2) for description of phased engine upgrade requirements for harbor craft. These improvements not only impact emissions from the harbor craft engaged in maintenance dredging in the near term but will continue to reduce emissions over the 10-year period as more phased-in reductions occur.

- **NEPA Determination:** Under the No Action Alternative, impacts on sensitive receptors would be less than significant. Under Alternative 1, impacts would be reduced over time due to new regulations for harborcraft engines. Under Alternative 2 through 4, potential impacts on sensitive populations would be less than significant compared to the No Action Alternative and would be further reduced by the new requirements for harborcraft engines.
- **CEQA Determination:** Under the No Project Alternative, impacts on sensitive receptors would be less than significant. Under Alternative 1, impacts would reduce over time due to new regulations for harborcraft engines. Under Alternatives 2 through 4, potential impacts on sensitive populations under would be less than significant compared to the No Project Alternative and would also be further reduced by the new requirements for harborcraft engines.

3.2.4.4 Impact AQ-4: Potential to Result in Other Emissions (Such as Those Leading to Odors) Adversely Affecting a Substantial Number of People

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Under all the alternatives, placement of dredged material in the Bay (in-water placement) or at a beneficial use site would result in less-than-significant odor impacts due to the distances involved and regulatory controls. In-water placement submerges materials and beneficial use sites are permitted in facilities where odors are addressed in the permit.

- **NEPA Determination:** Under all alternatives, the odor impacts would be less than significant.
- **CEQA Determination:** Under all alternatives, the odor impacts would be less than significant.

3.2.4.5 Impact AQ-5: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Regional Air Quality

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

The reasonably foreseeable actions in Table 3-2 include several projects that would involve dredging and dredged material placement that could result in the same type of air emissions as the Proposed Project. However, the project alternatives would largely reduce emissions as compared to the No Action Alternative/No Project Alternative Baseline with a small amount of VOCs generated if Alternatives 1 or 4 were implemented. As a result, implementation of either of these alternatives, in addition to the reasonably foreseeable actions, would have a small but negative cumulative impact on air quality. The remaining alternatives would not add to cumulative air emissions, and as a result would not have a negative impact on air quality.

The project would facilitate continued use of federal navigation channels by petroleum-related shipping in San Francisco Bay, which would therefore result in an indirect impact to air quality and greenhouse gas emissions. Large ships associated with the petroleum industry, such as tankers and cargo ships, burn fossil fuels, emitting CO_2 and other GHGs into the atmosphere. In addition, the sustained maintenance and use of the channels by petroleum-related ships supports the existing petroleum-related activities in upland areas, for example, refineries. The emissions from these refineries contribute to local air pollution and global warming, impacting both air quality, climate, and public health in surrounding communities.

- **NEPA Determination:** None of the alternatives, considering reasonably foreseeable actions, would contribute to considerable impacts on regional air quality.
- **CEQA Determination:** None of the alternatives would contribute to cumulatively considerable impacts on regional air quality.

3.3 Biological Resources

This section describes the environmental setting in the study area for biological resources. Existing species, including special-status species, and habitats, including designated critical habitat, are described. The potential impacts of the project alternatives on these resources are analyzed.

3.3.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential biological resources impacts from the alternatives.

3.3.1.1 Federal

Federal regulations applicable to biological resources are discussed in the following sections.

Endangered Species Act

The federal Endangered Species Act (ESA) of 1973 was established to protect and recover imperiled species and the ecosystems upon which they depend. The USFWS and NMFS administer the act. The USFWS has jurisdiction over non-anadromous fish and wildlife species, and NMFS has jurisdiction over anadromous fish species.

ESA Section 7 states that all federal agencies must ensure that their actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat. Consultation with USFWS or NMFS under Section 7 can be initiated only by federal agency project-related activities and may result in an incidental take statement that authorizes activities that may result in take but would not jeopardize the continued existence of a listed species or adversely modify critical habitat.

In 1998, NMFS issued a BiOp for the LTMS program and its effects on federally listed species under NMFS's jurisdiction at the time the consultation was completed (NMFS 1998). The BiOp was revised in 2015, at which time NMFS determined that the proposed maintenance dredging program for 2015 to 2025 would not jeopardize federally listed salmonid species or green sturgeon (NMFS 2015). In the Letter of Clarification, NMFS clarified that the reasonable and prudent mitigation measures contained in the incidental take statement accompanying the original 2015 NMFS BiOp do, in fact, apply to maintenance dredging in SF Bay (NMFS 2015). USACE will comply with the terms and conditions of the 2015 updated BiOp.

In 1999, USFWS issued a programmatic BiOp for the LTMS program for federally listed species under USFWS's jurisdiction (USFWS 1999). The BiOp concluded that USACE's continued maintenance dredging is not likely to jeopardize the continued existence of the clapper rail, harvest mouse, least tern, pelican, Pacific Coast population of plover, delta smelt, and splittail, and is not likely to destroy or adversely modify designated critical habitat. The 1999 USFWS BiOp specified conversation recommendations, including the establishment of mitigation banks and predator management (USFWS 1999).

In 2023, USFWS issued a BiOp for effects on California least tern from USACE maintenance dredging activities in Oakland Harbor (USFWS 2023). The BiOp specified reasonable and prudent measures that included monitoring and reporting during dredging activities and conservation measures, including implementation of recovery actions and ecological studies.

Since 2011, USACE has been required to consult on impacts on delta smelt during dredging of Suisun Bay Channel and New York Slough because of documented occurrences of entrainment during monitoring of hopper dredge use. Since 2011, USACE has received non-jeopardy opinions from USFWS to maintain Suisun Bay Channel with a hopper or clamshell dredge. In 2024, USFWS issued a BiOp addressing impacts to delta smelt from maintenance dredging activities in Suisun Bay Channel (USFWS 2024). The BiOp concluded that maintenance dredging using mechanical clamshell dredging and sediment testing is not likely to jeopardize the continued existence of the delta smelt or destroy or adversely modify its designated critical habitat.

Longfin smelt was federally listed by USFWS on July 30, 2024 (50 C.F.R. Part 17). USACE reinitiated consultation with USFWS on the 1999 LTMS Programmatic Biological Opinion for the listing of longfin smelt on August 14, 2024. The consultation process was completed with the amendment of the LTMS Biological Opinion, issued on February 7, 2025.

White sturgeon (*Acipenser transmontanus*) currently have no federal special status. In October 2024, USFWS published a 90-day finding indicating that the petition to list white sturgeon warranted further investigation and will be presented in a 12-month finding in 2025.

Magnuson-Stevens Fishery Conservation and Management Act

In response to growing concern about the status of United States fisheries, Congress passed the Sustainable Fisheries Act of 1996 (Public Law 104-297) to amend the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), the primary law governing marine fisheries management in the federal waters of the United States. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect EFH, which includes those habitats on which commercially valuable fish rely throughout their life cycles. It encompasses habitats necessary to allow sufficient production to support a long-term sustainable fishery and contribute to a healthy ecosystem. Fish species managed under EFH by NMFS within the Estuary include, but are not limited to, Pacific salmon, starry flounder, California halibut, northern anchovy, Pacific herring, and Dungeness crab.

In 2011, the LTMS agencies and NMFS completed a programmatic EFH consultation for compliance with this act. The EFH agreement includes a number of conservation measures that enhance the environmental protectiveness of the LTMS program. No further EFH consultation is required for USACE maintenance dredging in SF Bay performed in accordance with the provisions established through the formal programmatic federal EFH consultations for the LTMS (USACE and USEPA 2011).

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) of 1918 prohibits the take of protected migratory bird species through killing, capturing, selling, trading, or transport without prior authorization. This includes feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 C.F.R. pt. 21). The law is administered by USFWS.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) (16 U.S.C. §§ 1361-1421h) of 1972 prohibits take or import any marine mammals and/or their products. Under the MMPA, incidental harassment permits may be issued for activities other than commercial fishing that may have negligible effects on marine mammals. Harassment under the MMPA can be either Level A, defined as "any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild" or Level B, defined as "acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." The law is administered by the National Oceanic and Atmospheric Administration (NOAA).

Clean Water Act

See Sections 1.2.1.1 and 1.6.1.3 for discussion of the CWA, including previous and planned project permitting. Sections 401 and 404 of the CWA provide protections for wetland and tidal habitats occurring in the study area and which could be affected by maintenance dredging and placement activities. These habitats are described in Section 3.3.2.1.

Executive Order 11990: Protection of Wetlands

This EO 11990, signed in 1977, requires federal agencies to minimize destruction of wetlands when managing lands, administering federal programs, and undertaking construction. Agencies are also required to consider the effects of federal actions on the health and quality of wetlands. The EO is administered by USACE.

Executive Order 13112: Invasive Species

This EO 13112 addresses the introduction of invasive species and mandates controlling the spread of invasive species that have already been introduced. The EO required creation of the Invasive Species Council to deal with invasive species. EO 13112 revoked the preceding EO 11987 on Exotic Organisms. This EO is administered by the National Invasive Species Council.

3.3.1.2 State (California Endangered Species Act)

The California Endangered Species Act (CESA) states that all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation, will be protected or preserved. CDFW will work with all interested persons, agencies, and organizations to protect and preserve such sensitive resources and their habitats.

CESA prohibits the take of any species of wildlife designated by the California Fish and Game Commission as endangered, threatened, or as candidate species. CDFW may authorize the take of any such species if certain conditions are met (California Fish and Game Code, Chapter 1.5, Sections 2050-2115.5 and accompanying regulations under California Code of Regulations, Title 14, Chapter 6, sections 783.0-787.9).

The programmatic BiOps issued by NMFS and USFWS for the LTMS program do not address incidental take of state-listed species. There has been no clear and explicit waiver of federal sovereignty with respect to CESA. Accordingly, as a federal agency, USACE is not required to seek incidental take authorization or other authorization under CESA. In issuing a WQC/WDR, however, the Regional Water Board must comply with CESA.

3.3.2 Environmental Setting

The project area covers the SF Bay (broken up into South Bay and Central Bay), San Pablo Bay, Suisun Bay, as well as tributary rivers and the Pacific Ocean (Figure 1-2). This section is divided into two key sections: 1) general habitat descriptions based on project area location; and 2) key sensitive species, both aquatic and upland.

3.3.2.1 Habitat

The Estuary is tidally influenced, and receives fluvial inflow from key waterways, including the Delta, Napa River, Petaluma River, and Guadalupe River. There are multiple habitat types found within the Estuary ranging from subtidal to supratidal, including deepwater channels, shallow-water shoals, intertidal features such as mud flats, sand flats, beaches, and intertidal wetlands ranging from saltmarsh to freshwater wetlands.

Subtidal habitat, which has variable size mobile sediments (e.g., clay, silt, sand, gravel, and cobble), are strongly affected by tidal currents, which then directly influence the flora and fauna that occupy these habitats (e.g., sturgeon, striped bass, halibut, and some marine mammals). The clay/silt material, or mud, is the main deposit in the Estuary. Sediment distribution in SF, San Pablo, and Suisun bays is thought to have been significantly influenced by hydraulic mining in the Sierra Nevada during the Gold Rush in the mid-to-late 19th century. During this period, miners washed large amounts of clay and silt into Central Valley streams, which converted vast extents of open water to tidal marsh habitat (Atwater et al. 1979, Krone 1977).

Intertidal unvegetated habitats such as beaches, mud flats, and sand flats are intertidal areas with sparse vegetation and are generally exposed between the MLLW to mean tide level. Beaches are where sand flats extend above the mean tide level. Mud flats are more common than sand flats and beaches in the Estuary and capture suspended sediments as well as provide protection to upland shoreline and banks from wave energy. Beaches, mud flats, and sand flats provide habitat for numerous invertebrate species, are used by many different types of aquatic species for multiple life stages and are important foraging and roosting habitat for shorebirds during low tide conditions (USACE and Regional Water Board 2015). Pacific cordgrass (*Spartina foliosa*) is an important native species in the tidal marshes and mudflats and contributes to the base of the food chain in the SF Bay and provides important habitat where aquatic and wildlife species hide from predators, forage, and nest.

Tidal marshes are found along the margins of the South Bay, San Pablo Bay, Suisun Marsh, Delta channels, and at the confluence of rivers to the above waters. These habitats provide conditions that allow for highly productive and diverse ecological communities. The dominant vegetation in saltwater tidal marshes includes saltgrass (*Distichlis spicata*) and pickleweed (*Salicornia virginica*), while freshwater tidal marshes are dominated by cattails (*Typha* sp.) and tules (*Schoenoplectus acutus*). Invasive *Spartina* changes the physical structure and plant communities with resulting degradation of biodiversity and habitat. Tidal marshes play a critical role in providing cover, forage, and nursery areas for many sportfish and special-status fishes, such as Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*Oncorhynchus. mykiss*), delta smelt (*Hypomesus transpacificus*),) longfin smelt (*Spirinchus thaleichthys*), green sturgeon (*Acipenser medirosris*), and white sturgeon (*Acipenser transmontanus*). Tidal marshes also provide important nesting, resting, foraging and escape cover habitat for terrestrial wildlife species. Special-status birds and mammals found in tidal marshes include Ridgway's rail (*Rallus longirostris obsoletus*), black rail (*Laterallus jamaicensis*), and salt marsh harvest mouse (*Reithrodontomys raviventris*) (USACE and Regional Water Board 2015).

The open bay habitat in SF Bay is subdivided into deep bay habitat and shallow bay habitat. Deep bay habitat includes areas deeper than 18 feet below MLLW and is used by fishes such as California halibut (*Paralichthys californicus*) and sturgeon, waterbirds like surf scoters (*Melanitta perspicillata*) and brown pelicans (*Pelecanus occidentalis*); and marine mammals like Pacific harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*). Shallow bay habitat lies between the MLLW and 18 feet below MLLW. Species such as Pacific herring (*Clupea pallasii*), northern anchovy (*Engraulis mordax*), crabs, and shrimp, and anadromous fish use the shallow bay habitat. This habitat is in the depth range of many diving birds, and therefore provides important avian foraging habitat. Marine mammals such as Pacific harbor seals also forage in this habitat type. Eelgrass (*Zostera marina*) grows in areas of shallow bay habitat. Eelgrass is important for species like Pacific herring, which deposit their eggs on the grass blades, and to California least tern (*Sternula antillarum browni*), which forage on small fish within the eelgrass (USACE and Regional Water Board 2015).

The San Francisco Harbor Main Ship Channel is located west of the Golden Gate Bridge and includes Pacific Ocean subtidal habitats in open coastal waters off the coast of San Francisco, with depths greater than 50 feet below MLLW. Subtidal habitat with depths from 20 to 50 feet below MLLW are located at the Ocean Beach Nearshore Placement Site (SF-17) and SF-8. The nearshore placement site is intended for beach nourishment and includes intertidal beach habitat. These habitats support a diverse range of marine life, including benthic invertebrates, plankton, fish, birds, and marine mammals. The SF-DODS is in the open ocean approximately 55 nautical miles west of San Francisco. Within this habitat, three biological communities exist. The shallow pelagic community, which includes sea birds, marine mammals, migratory fish, and pelagic invertebrates; the deepwater pelagic community, inhabited by fish and invertebrates adapted to deepwater conditions, along with some marine mammals that dive to great depths for foraging; and the continental slope benthic community, populated by fish and invertebrates specifically adapted to deep sea conditions (USACE and Regional Water Board 2015).

3.3.2.2 Special Status Species

Delta Smelt

Delta smelt were listed as threatened under the federal ESA on March 5, 1993 (58 Federal Register (FR) 12854) and designated critical habitat for the species was designated on December 19, 1994 (59 FR 65256). Delta smelt critical habitat includes all water and submerged land below ordinary high water and the entire water column bounded by and contained within Suisun Bay, Goodyear, Suisun, Cutoff, First Mallard, and Montezuma Sloughs, with the downstream boundary at the Carquinez Bridge.

A 12-month finding on a petition to reclassify the delta smelt as an endangered species was completed on April 7, 2010 (75 FR 17667). After reviewing all available scientific and commercial information, the USFWS determined that reclassifying the delta smelt from threatened to endangered was warranted but was precluded by other higher priority listing actions (5 FR 69222). The USFWS annually reviews the status and uplisting recommendations for delta smelt during its Candidate Notice of Recovery process, and each year the delta smelt has been recommended for uplisting from threatened to endangered. Delta smelt were listed as threatened under CESA on December 9, 1993, and reclassified as endangered on January 20, 2010.

Delta smelt mainly occupy habitat in the north Delta, including Liberty Island and the adjacent reach of the Sacramento Deepwater Shipping Channel (Sommer and Mejia 2013), Cache Slough to its confluence with the Sacramento River, and the Sacramento River from that confluence downstream to Chipps Island, Honker Bay, and the eastern part of Montezuma Slough. These areas have a year-round presence of fresh to low-salinity water that is comparatively turbid and of a tolerable water temperature. The Napa River is the only location outside of the critical habitat boundaries that may be used often enough to be considered a seasonal habitat rather than a transient one (USFWS 2024).

The relative abundance of delta smelt has dramatically declined since the 1970s. The CDFW Fall Midwater Trawl (FMWT) delta smelt annual catch at 100 index stations has been zero every year between 2018 and 2022. The Townet Survey and FMWT abundance indices collapsed in the early 2000s. During the past decade, the index has continued to decrease and the most recent values for three of the four indices, FMWT, the Townet Survey, and 20-millimeter (mm) survey, were zero. Environmental and biotic changes from human activities have caused the decline in delta smelt populations, including decades of habitat and food web changes and marginalization by non-native species that prey on or outcompete delta smelt. Climate change has affected habitat conditions and survival of delta smelt through increased water temperatures, salinity intrusion, decreased delta inflows, and extreme droughts (USFWS 2024).

Delta smelt spawn in freshwater to slightly brackish water habitats under tidal influence, and volitionally move ‘downstream’ into brackish water habitat. Most spawning occurs from February through May in various places from the Napa River and locations to the east including much of the Delta. Eggs hatch and larvae enter the planktonic stage primarily from March through May, and most individuals have metamorphosed into the juvenile life stage by June or early July. Most of the juvenile fish continue to rear in habitats from Suisun Bay and Marsh and locations east principally along the Sacramento River-Cache Slough corridor (Moyle et al. 2010). Suisun Bay and Marsh have fresh to low-salinity water year-round that is relatively turbid with temperatures that are tolerable to delta smelt. Delta smelt appear to have some affinity for surface water habitat (Bennett and Burau 2015; Mitchell et al. 2017), but delta smelt are not limited to surface waters (Feyrer et al. 2013).

Longfin Smelt

The longfin smelt (*Spirinchus thaleichthys*) Bay-Delta distinct population segment (DPS) was determined by the USFWS to be warranted for listing as a threatened or endangered species under the ESA on April 2, 2012, but the listing was precluded by higher priority listing actions. On October 7, 2022, USFWS published a proposed rule that would find the longfin smelt, Bay-Delta DPS as an endangered species under the ESA. Longfin smelt was federally listed as endangered on July 30, 2024, with an effective date of August 29, 2024. The longfin smelt was listed as a threatened species throughout its range in California by CDFW on June 26, 2009, under CESA.

Longfin smelt populations occur along the Pacific Coast of North America, and the San Francisco Estuary represents the southernmost population. Longfin smelt generally occur in the Delta; in Suisun, San Pablo, and San Francisco bays; and in the Gulf of the Farallones, just outside SF Bay.

Longfin smelt are pelagic forage fish that have a facultatively anadromous life history, meaning migration to the ocean is not required to complete their life cycle (Moyle 2002). Some longfin smelt remain in the Estuary for their entire life cycle (Merz et al. 2013; Rosenfield and Baxter 2007), while an unknown portion make their way to the ocean sometime during the late spring or summer of their first year of life (age 0), and may remain there for 18 months or longer before returning to the Estuary and Delta to spawn (77 FR 197566). A larger portion of longfin smelt enter the coastal ocean during their second year of life (age-1) and remain there for three to seven months until they re-enter the Delta to spawn in fall or early winter (Rosenfield and Baxter 2007). Most of these age-1 longfin smelt move to coastal waters in July and August, possibly to escape warm water temperatures or to obtain food (Moyle et al. 2010; Rosenfield and Baxter 2007).

Longfin smelt spawn in fresh or low-salinity water in the Delta (Grimaldo et al. 2017), as they reach adulthood in their second year (Moyle 2002). They migrate upstream to spawn during late fall through winter, with most spawning from December through April, peaking in January and February (California Department of Fish and Game [CDFG] 2009). Preferred spawning conditions, in which offspring survival is favorable, are dependent on the amount of freshwater outflow and the location of the low-salinity zone because the variation affects the location of salinities that are suitable for spawning.

Recent studies suggest hatching and early rearing occurs in a much broader region and higher salinity (2 to 12 ppt) than previously recognized (Grimaldo et al. 2017) and includes portions of South SF Bay (Lewis et al. 2020). Longfin smelt appear to spawn in the low-salinity zone where brackish and freshwaters meet (Grimaldo et al. 2017), and in tidal wetlands of South SF Bay and San Pablo Bay when hydrological conditions favor spawning in more seaward regions (Lewis et al. 2020). Longfin smelt presence in San Pablo Bay, Central Bay and South Bay is dependent on Delta outflow/hydrology as well as life history stage. The distribution of larvae and early juveniles (age 0) tracks salinity field when present (Dege and Brown 2004). Therefore, in high delta outflow years, longfin smelt would be expected to be farther downstream.

Longfin smelt larvae are most abundant in the water column usually from January through April (Reclamation 2008). Larval longfin smelt rear in low-salinity to brackish water at salinities of 2 to 12 ppt (Grimaldo et al. 2017), in tidal wetlands of San Pablo Bay (Sonoma Creek, Napa River, and Petaluma River), and South SF Bay (Alviso Marsh and salt pond restoration areas) (Hobbs et al. 2015; Lewis et al. 2020).

Larval longfin smelt are concentrated in Suisun and San Pablo Bays in December through May (Robinson and Greenfield 2011). Juveniles gradually move seaward as they grow and as water temperatures increase in the late spring and early summer (Rosenfield and Baxter 2007; Tobias and Baxter 2023). Tobias and Baxter (2023) showed the probability of presence for longfin smelt in multiple locations in the Estuary for age-0, age-1 and age-2 fish. For age-0 longfin smelt in Suisun Bay, the probability of presence increases starting in March or April and continues to increase until they reach age 1+. The probability of presence of longfin smelt in Suisun Bay is lowest for age-1+ fish in August and September, and lowest for age-2+ fish in June through December. For San Pablo Bay, age-0 longfin smelt have the highest probability of presence in May and June, with the lowest probability of presence in September. Age-1 longfin smelt in San Pablo Bay are less likely present in July through October, while age-2 fish have the lowest probability of presence in June through December.

The probability of occurrence for longfin smelt in Central SF Bay increases for age-0 fish, with a peak in July, and begins to decrease as they approach age-1. The lowest probability of presence of age-1 longfin smelt in Central SF Bay is most likely July through September; for age-2+ fish, the lowest probability of occurrence is June through December. The probability of presence of age-0 longfin smelt in South SF Bay increases starting around October and continuing into January, then the age-1 longfin smelt probability of presence decreases until November as age-2+ fish increase in probability of presence through February. The probability of presence of age-2+ longfin smelt then decrease until May (Tobias and Baxter 2023).

Seasonal patterns in abundance and occurrence in the nearshore ocean suggest that the population is at least partially anadromous (Garwood 2017; Rosenfield and Baxter 2007), and the detection of longfin smelt within the Estuary throughout the year suggests that anadromy is one of several life history strategies or contingents in this population. Geochemical analysis of longfin smelt otoliths has provided further evidence of longfin smelt using several life history strategies (Lewis et al. 2019). Adults move upstream into the Delta to spawn typically in September through November, resulting in lower densities in the Estuary in the fall months.

Green Sturgeon

The southern DPS of North American green sturgeon (*Acipenser medirostris*) was listed by NMFS as threatened on April 7, 2006 (71 FR 17757), with critical habitat designated on October 9, 2009 (74 FR 52300). Critical habitat in marine waters includes areas within the 60-fathom isobath from Monterey Bay to the US-Canada border. Coastal bays and estuaries in California that have been designated as critical habitat include San Francisco, San Pablo, and Suisun Humboldt Bays. In freshwater, critical habitat includes the mainstem Sacramento River from the Sacramento I-Street Bridge upstream to Keswick Dam (including the Yolo and Sutter Bypass areas and the lower American River), the Feather River downstream of the Fish Barrier Dam, the Yuba River downstream of the Daguerre Point Dam, and the Delta. Green sturgeon are categorized as a California species of special concern.

Green sturgeon reach maturity around 14 to 16 years of age and can live to be 70 years old, returning to their natal rivers every three to five years for spawning (Van Eenennaam et al. 2005). Adult green sturgeon move through the Delta from February through April (Heublein 2006; Kelly et al. 2007). Following their initial spawning run upriver, adults split into two out-migration groups. The “early” out-migration group migrate immediately back downstream through the Delta during May through June, and the “late” out-migration group hold for a few weeks to months in the upper river before moving back downstream during November through January (Colborne et al. 2022; Heublein et al. 2009; Vogel 2008).

Adult and subadult green sturgeon frequently congregate in the Estuary during summer and fall (Lindley et al. 2008). Specifically, adults and subadults may reside for extended periods in the central Delta as well as in Suisun and San Pablo Bays, presumably for feeding, because bays and estuaries are preferred feeding habitat rich in benthic invertebrates (e.g., amphipods, bivalves, and insect larvae). Juveniles are believed to use the Delta for rearing for the first one to three years of their lives before moving out to the ocean and are likely to be found in the main channels of the Delta and the larger interconnecting sloughs and waterways, especially within the central Delta and Suisun Bay and Marsh.

White Sturgeon

White sturgeon (*Acipenser transmontanus*) was categorized as a California species of special concern and currently have no federal special status. In October 2024, USFWS published a 90-day finding indicating that the petition to list white sturgeon warranted further investigation and will be presented in a 12-month finding in 2025. CDFW received a petition to list white sturgeon as threatened under CESA on November 29, 2023, and submitted their petition evaluation to the California Fish and Game Commission in March 2024 stating that there is sufficient scientific information to indicate that listing white sturgeon as threatened may be warranted. On June 19, 2024, the California Fish and Game Commission approved white sturgeon as a candidate species for listing under CESA, and found sufficient scientific evidence that the species may warrant listing. Candidate species for listing under CESA are granted full protections during the review process. Both non-spawning adults and juveniles can be found throughout the Delta year-round (California Department of Water Resources et al. 2013; Moyle 2002; Radtke 1966). When not undergoing spawning or ocean migrations, adults and subadults are usually most abundant in brackish portions of the Delta (Kohlhorst et al. 1991). Information on trends in adults and juveniles suggests that numbers are declining (Moyle 2002).

Salinity tolerance increases with increasing age and size (McEnroe and Cech 1985), allowing white sturgeon to access a broader range of habitat in the Estuary (Israel et al. 2009). During dry years, white sturgeon have been observed following brackish waters farther upstream, while the opposite occurs in wet years (Kohlhorst et al. 1991). Adult white sturgeon tend to concentrate in deeper areas and tidal channels with soft bottoms, especially during low tides, and typically move into intertidal or shallow subtidal areas to feed during high tides (Moyle 2002). These shallow-water habitats provide opportunities for feeding on benthic organisms, such as opossum shrimp, amphipods, and even invasive overbite clams, and small fish (Israel et al. 2009; Kogut 2008). White sturgeon also have been found in tidal habitats of medium-sized tributary streams to the Estuary such as Coyote Creek and the Guadalupe River in the South Bay and Napa and Petaluma Rivers and Sonoma Creek in the North Bay (Leidy 2007).

Central California Coast Coho Salmon

Central California Coast coho salmon (*Oncorhynchus kisutch*) are listed as endangered under the ESA and endangered under the CESA. They range from Baja California, Mexico, north to Alaska, and southwest to Japan (McGinnis 2006). Coho salmon have a simple 3-year anadromous life cycle, rearing in fresh water for up to 15 months before migrating to the ocean. Coho salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn. The Central California Coast coho salmon evolutionarily significant unit (ESU) occurs from Punta Gorda in Northern California south to, and including, the San Lorenzo River in central California (Weitkamp et al. 1995). Coho generally return to their natal streams between November and December. This species has been extirpated from tributaries of SF Bay; therefore, coho are rare in SF Bay.

Chinook Salmon

There are four distinct runs of Chinook salmon (*Oncorhynchus tshawytscha*) that migrate through the Estuary into the Delta and Central Valley Rivers.

- The **Sacramento River winter-run Chinook salmon ESU** was listed by NMFS as threatened under the ESA on August 14, 1989 (54 FR 32085) but was reclassified as endangered on January 4, 1994 (59 FR 440). Critical habitat was designated on June 16, 1993 (58 FR 33212). Winter-run Chinook salmon critical habitat includes the portion of the Sacramento River from Keswick Dam to Chipps Island, all waters westward from Chipps Island to the Carquinez Strait Bridge, and all waters of San Pablo Bay; all waters of the Bay north of the San Francisco-Oakland Bay Bridge have been designated as critical habitat for winter-run Chinook salmon. Winter-run Chinook salmon were listed as endangered under CESA on September 22, 1989.
- The **Central Valley spring-run Chinook salmon ESU** was listed by NMFS as threatened under the ESA on September 16, 1999 (64 FR 50394) and reaffirmed as threatened on June 28, 2005. Critical habitat was designated on September 2, 2005, and encompasses the lower Feather River; the Sacramento and Yuba rivers; Beegum, Battle, Clear, Cottonwood, Antelope, Mill, Deer, Butte, and Big Chico creeks; the north Delta (the central and south Delta were excluded); and Suisun, San Pablo, and north San Francisco bays (70 FR 52488). Spring-run Chinook salmon were listed as threatened under CESA on February 5, 1999.
- The **Central Valley fall-/late-fall-run Chinook salmon ESU** was determined by NMFS to comprise a single ESU. On March 9, 1998 (63 FR 11481), NMFS issued a proposed rule to list fall-run Chinook salmon as threatened, but determined the species did not warrant listing and identified it as a candidate species (64 FR 50393, September 16, 1999). It was then changed to a species of concern in 2004. CDFW also determined that Central Valley fall-/late fall-run Chinook salmon are a California species of special concern.

Adult Chinook salmon migrate upstream, including through the project area in most months of the year, with winter-run migrating mostly between November through June, spring-run migrating through mostly between January through August, fall-run from July through December, and late fall-run from October through December. Juvenile winter-run Chinook salmon migrate through the Delta and Estuary between

October and May, while spring-run Chinook salmon migrate throughout the spring and into June. Fall-run and late fall-run Chinook salmon migrate through the Delta and Estuary from January through June as young-of-year, and a small number migrate as yearlings between November and April.

Central Valley Steelhead

The Central Valley steelhead DPS (originally identified as an ESU) was listed as threatened by NMFS (63 FR 13347, March 19, 1998). Resident rainbow trout were previously included as part of the protected fish, but in January 2006, NMFS directed that only the anadromous form should be listed as threatened, and the resident form did not warrant listing (71 FR 834, January 5, 2006). Critical habitat was designated to include the lower Feather River; Battle, Cottonwood, Antelope, Mill, Deer, Big Chico, and Butte creeks; Sacramento, Yuba, American, Cosumnes, Mokelumne, Calaveras, San Joaquin, Merced, Tuolumne, and Stanislaus rivers; and the Delta (70 FR 52488, September 2, 2005).

Adult migration timing in the Delta ranges from July until May, with peaks at both the beginning of the spawning season as migrants move to their natal streams (all well upstream from the project area), and at the end of the season, in May, as some post-spawn kelts emigrate back to the ocean (Moyle 2002). The Estuary is used as a short-term out-migration corridor for juvenile steelhead. Delta exit is monitored at the Chipps Island with most passage occurring between January and June (Reclamation 2008; Aasen 2011, 2012).

Central California Coast Steelhead

Central California Coast steelhead DPS (originally identified as an ESU) was federally listed as threatened on August 18, 1997. As with the Central Valley steelhead, both resident and anadromous forms were included in the initial ESU, but only the anadromous form was listed. Critical habitat is designated to include all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays. Also included are all waters of San Pablo Bay westward of the Carquinez Bridge and all waters of SF Bay from San Pablo Bay to the Golden Gate Bridge. Central California Coast steelhead is a CDFW species of concern.

Central California Coast steelhead adults typically migrate between December and April and spawn shortly after reaching their natal spawning habitat. In the project area, this includes tributaries of SF Bay, including the watersheds of the Petaluma and Napa rivers, and several tributaries of the South Bay. Eggs hatch into alevins after incubating for approximately 25 to 35 days depending on water temperature (Shapovalov and Taft 1954). Alevins remain in the gravel for two to three weeks until they emerge as fry. Smolts outmigrate to the ocean usually in the late winter and spring and may extend into the early summer.

Lamprey

There are two lamprey species that are California species of special concern and are found in the Estuary–Pacific lamprey (*Entosphenus tridentatus*), and western river lamprey (*Lampetra ayresii*). These lamprey species are both anadromous, spawning and rearing in freshwater before returning to the ocean.

Pacific lamprey adults migrate, mostly at night, through the Estuary from late fall through the summer, and juvenile outmigration through the Estuary peaks with high flow events in the fall through spring (Hanni 2006). Spawning occurs in rivers and streams generally between March and July, with eggs incubating for less than two months. Larvae, or ammocoetes emerge burrow in fine sediment in off-channel habitat and rear for three to seven years, when they then metamorphose into to the juvenile phase and migrate towards the ocean.

Little is known about the life history of Western river lamprey, particularly in California (Moyle et al. 2015). Adults migrate upstream to tributary streams primarily from the fall through the late winter months, with spawning likely occurring in February through May (Beamish 1980, Moyle 2002). As with Pacific lamprey, after hatching, ammocoetes drift downstream before burrowing into fine sediments and rear for several years until metamorphosing into the juvenile phase. Juveniles outmigrate from May through July (Moyle 2002).

Leatherback Turtle

The leatherback turtle (*Dermochelys coriacea*) was listed by NMFS as endangered on June 2, 1970 (35 FR 8491). Critical habitat was designated to include the coastal waters adjacent to Sandy Point, St. Croix, US Virgin Islands. In January 2012, additional critical habitat was designated to provide protection along the west coast of the United States (77 FR 4170) and includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello, east of the 3,000-meter depth contour (including the SF-DODS). The Western Pacific population feeds along the California coastline and is estimated to be declining at a rate of 5.6 percent per year (Oceana 2021).

California Least Tern

The California least tern (*Sterna antillium*) is state and federally listed as endangered. This bird species feeds on small fish in shallow estuaries and lagoons and breeds in California from mid-May to August. California least terns are known to nest at the former Naval Air Station in Alameda and use the middle harbor of Oakland Harbor for foraging and roosting. They have been observed foraging along the shoreline of the Naval Air Station in Alameda and in Ballena Bay from May through August. In August, this species migrates from the SF Bay Area to overwinter in the southern United States (H.T. Harvey and Associates 2012; USACE and Regional Water Board 2015).

California least terns were first observed at MWRP in 2005 and since that time Montezuma Wetlands, LLC, has been working with CDFW and USFWS to create nesting habitat for this species outside of the area that would be impacted by BUDM placement activities. This species has continued to nest at MWRP every year since it was first observed (EcoBridges Environmental 2023). Montezuma Wetlands, LLC, is responsible for coordinating with CDFW and USFWS on any potential impacts on California least terns at MWRP (USACE and Regional Water Board 2015).

Western Snowy Plover

The Pacific Coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) is federally listed as threatened and is one of two subspecies of snowy plover in North America. The Pacific Coast population, which consists of approximately 2,000 individuals, breeds along the United States Pacific

Coast from southern Washington to Baja California, Mexico. Habitat degradation caused by human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations has resulted in a decline in active nesting areas and in the size of the breeding and wintering populations. This species is a colonial nester that inhabits sandy coastal beaches and spits, sparsely vegetated coastal dunes, salt pans or pond levees, beaches at creek or river mouths, and shores of large alkali lakes. The nesting season is March through the third week of July. This species returns to successful nesting sites each year. Western snowy plovers forage for invertebrates on wet sand areas of intertidal zones, in dry, sandy areas above high tide lines, on salt pans and along the edges of salt marshes and salt ponds (72 FR 54279; USACE and Regional Water Board 2015).

Ocean Beach provides suitable habitat for western snowy plovers and overwintering plovers have been monitored there by the National Park Service since 1994. Nesting of western snowy plovers has not been observed at Ocean Beach. Ocean Beach is not designated critical habitat for this species, but in 2008 the National Park Service established a Snowy Plover Protection Area at this location, which provides a protection zone for western snowy plovers overwintering there (SFPUC 2012).

Ridgway's Rail

The Ridgway's rail (*Rallus obsoletus*) is federally and state-listed as endangered. This species inhabits tidally influenced salt marsh habitat dominated by cordgrass or gumplant where they forage mainly on invertebrates during low tides. Their range previously extended along the California coast from Humboldt Bay to San Luis Obispo County, but due to habitat loss and degradation, they are currently only found around SF Bay. The breeding season extends from March to August and nesting occurs in the tallest vegetation (particularly cordgrass and marsh gumplant) along tidal sloughs. They are year-round residents of SF Bay, with juveniles dispersing from their natal sites in late summer and early fall (USACE and Regional Water Board 2015).

This species is known to occur in the tidal marsh habitat near the San Rafael Creek Inner Canal Channel. The USFWS considers all potential habitat to be occupied unless species-specific surveys of that year have confirmed absence. To minimize potential impacts, the USFWS BiOp on the LTMS program specifies that dredging activities shall not occur within 250 feet of potential Ridgway's rail habitat during the nesting season (February 1 through August 31) (USACE et al. 1998; USFWS 1999).

Salt Marsh Harvest Mouse

The salt marsh harvest mouse (*Reithrodontomys raviventris*) is federally and state endangered. This species is generally restricted to saline or subsaline marsh habitats around the Estuary and, with some exception, mixed saline or brackish areas in the Suisun Bay Area, as documented by the USFWS in 2013 and more recently in 2021. They are found predominantly in pickleweed and saltgrass but can also move into adjoining grasslands during high tides in the winter months. Habitat loss due to human actions is the greatest threat to the salt marsh harvest mouse. This includes habitat loss due to filling, diking, subsidence, changes in water salinity, non-native species invasions, SLR associated with global climate change and pollution (USFWS 2021).

The MWRP includes suitable salt marsh harvest mouse habitat. Trapping efforts conducted from 2000 to 2023 have confirmed the presence of this species (DiDonato 2023). Salt marsh harvest mouse may also be present at Cullinan Ranch because there is a source population at an adjacent restoration site (Guadalcanal Village). Pre-construction surveys did not document the presence of this species at Cullinan Ranch, however when restoration efforts have established suitable habitat and vegetation cover of at least 75 percent, salt marsh harvest mouse surveys will be conducted every year. It is anticipated that once suitable habitat is established, this species will migrate from Guadalcanal Village to Cullinan Ranch (Ducks Unlimited 2020).

3.3.2.3 Non-Special-Status Fauna

Fish

There are over 100 fish species, both native and non-native, found within and dependent on the Estuary. Many of these species are commercially and recreationally important fish species and could be impacted by dredging. Pacific herring (*Clupea pallasii*), northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), starry flounder (*Platichthys stellatus*), California halibut (*Paralichthys californicus*), jacksmelt (*Atherinopsis californiensis*), topsmelt (*Atherinops affinis*), and white croaker (*Genyonemus lineatus*) are found in the Estuary. The Estuary provides high-quality habitat for reproduction due to abundant food available for adults and larvae. Many of the fish species spawn in the Estuary in spring and summer, with juveniles then moving to the open bay or kelp beds.

Pacific herring, which are managed by CDFW through a California Pacific Herring Fishery Management Plan (CDFW 2019), enter the Estuary to spawn between December and March each year, broadcasting their eggs over kelp, rocks, or other hard structures. After hatching, this species spends the next five to nine months in the Estuary, which provides a safe environment for their early development. During fall and summer, Pacific herring leave the Estuary and school in the open ocean. Northern anchovies, the most abundant fish in the SF Bay, enter the Estuary to spawn in the spring when water temperatures and plankton production rises, and exit in the fall. Northern anchovy can spawn throughout the year, but peak spawning occurs in February and April and may coincide with peak plankton production, which in turn may provide food resources for the larvae (Syderman et al. 2020).

Plankton

The Estuary supports planktonic communities, made up of phytoplankton, zooplankton, and ichthyoplankton. Plankton abundance, growth and distribution are shown to be correlated to sunlight, turbidity, and freshwater inflow (Jassby et al. 2002; NMFS 2007). Zooplankton, commonly consisting of copepods, rotifers, larval bivalves, larval crustaceans, and polychaetes, are free-floating or weak swimmers that are distributed by tides, current and wind. Ichthyoplankton are eggs and larval fish. In the Estuary, these include but are not limited to Pacific herring, northern anchovy, and white sea bass (*Cynoscion nobilis*).

Benthos

Benthic communities in the Estuary are dominated by mollusks and crustaceans that inhabit the substrate and play an important role in maintaining both water and sediment quality. They are prey for fish and invertebrates, and for birds. Many benthic species, particularly mollusks, are often indicators of environmental stress due to their sensitivities to pollutants and contaminants, which accumulate in the substrates, thus resulting in prolonged exposures.

Benthic species are affected by physical factors such as salinity levels and sediment grain size as well as biological factors including competition and predation. Within the project area, there are marine benthic assemblages (offshore), estuarine benthic assemblages, and fresh/brackish assemblages (Delta). Peterson and Vayssieres (2010) found that benthic assemblages in the Estuary do not appear to be geographically static, but may shift spatially with salinity, influenced by hydrologic conditions, without strong fidelity to physical habitat attributes such as substrate composition or location in embayment versus channel habitat. Additionally, the invasion of Asian clam (*Corbula amurensis*) in the Estuary has directly and indirectly affected the benthos, causing significant changes in assemblage structure.

Estuarine (e.g., San Pablo and San Francisco bays) assemblages are dominated by mollusks consisting of ribbed mussel (*Geukensia demissa*), Baltic clam (*Baltic macoma*), overbite clam (*Potamocorbula amurensis*), California hornsnails (*Cerithideopsis californica*), and Bay mussels (*Mytilus* spp.), and crustaceans including California bay shrimp (*Crangon franciscorum*), Dungeness crab (*Metacarcinus magister*), red rock crab (*Cancer productus*), Pacific rock crab (*Cancer antennarius*), and rock crab (*Cancer gracilis*) (SFEP 1992).

3.3.2.4 Aquatic Vegetation

Eelgrass is a foundational species for SF Bay, supporting much of the biodiversity in the bay ecosystem. This native underwater flowering plant, or marine angiosperm, grows on muddy and sandy bottoms in the shallow subtidal areas of the Bay. It provides essential food and habitat for a variety of species. Eelgrass beds serve as nurseries for young fish and foraging areas for many species of fish, invertebrates, and birds. Pacific herring spawn on eelgrass, and other fish species such as salmonid and smelt use eelgrass habitat as juveniles before moving to the open ocean. Not only does eelgrass form the base of a highly productive marine food web, but it is also unique in producing food and oxygen, improving water quality by filtering polluted runoff, absorbing excess nutrients, and storing greenhouse gases such as carbon dioxide. By trapping sediment, stabilizing the ocean floor, and minimizing the force of wave energy, eelgrass beds also reduce coastal erosion. The largest eelgrass beds in the Estuary are found in shallow subtidal regions of San Pablo Bay and Richardson Bay, with smaller beds scattered mainly between Carquinez Strait and Hayward. Multiple eelgrass restoration sites have been established in the Estuary, including in Point San Pablo, Richardson Bay, San Rafael Shoreline, Corte Madera Bay, and in the vicinity of the Inner Richmond Harbor (Merkel & Associates and San Francisco State University 2023).

Eelgrass habitat is a high priority area for conservation and management. Eelgrass is protected under the CWA Section 404(b) (1) “Guidelines for Specification of Disposal Sites for Dredged or Fill Material,” Subpart E, “Potential Impacts on Special Aquatic Sites.” It has also been identified as EFH for various life stages of fish species managed by fishery management plans (FMP) under the Magnuson-Stevens Act, as established by NMFS. The California Eelgrass Mitigation Policy and Implementing Guidelines of October 2014, states a goal of no net loss of eelgrass habitat function in California and provides guidance for conducting surveys, impact assessment, and compensatory mitigation (NOAA Fisheries 2014).

While eelgrass is present near the Richmond Inner Harbor Channel and Oakland Inner Harbor, it does not occur within the channel boundaries. The Richmond Inner Harbor channels are protected by a training wall. Eelgrass grows adjacent to the channel along the training wall. USACE conducts eelgrass surveys within a 250’ buffer before and after maintenance dredging. Although a reduction in turion density (new shoots) has been observed along the channel margin near the training wall, survey crews have not found evidence that dredging caused eelgrass loss due to excessive sedimentation. Seasonal diebacks during winter months are common in eelgrass meadows. Results indicate that eelgrass is primarily affected by freshwater declines or red tides, rather than dredging in areas where sediment stays close to the channel (pers. Comm., Keith Merkel, Merkel & Associates, 2024).

Small patches of eelgrass were reported in the shallow areas of the Oakland Inner Harbor and Outer Harbor in 2021 (Port of Oakland and USACE 2023). Surveys comparing Oakland Harbor's pre- and post-eelgrass studies to a number of reference sites, the results showed an increase in the area of the eelgrass habitat and in the density of the existing beds (Merkel & Associates 2011, 2012; Tierra Data, Inc. 2024a, 2024b).

3.3.2.5 Essential Fish Habitat

EFH, designated through the Magnuson-Stevens Act, includes habitat necessary for the survival of commercially valuable fish species, federally managed under three FMPs: Pacific Groundfish FMP, Coastal Pelagic FMP, and the Pacific Coast Salmonid FMP. These three FMPs would be affected by the project activities.

The Pacific Groundfish FMP was approved and implemented in 1982, with 32 amendments since its inception. The goals of the FMP focus on conservation (i.e., prevent overfishing, rebuild overfished stocks, manage harvest levels, and prevent where practicable, net loss of habitat), economics (maximize economic value of groundfish resources), and utilization (achieve maximum biological yield, promote year-round availability of quality seafood, and promote recreational fishing opportunities), with multiple objectives for each goal. The Pacific Groundfish FMP actively manages 86 species, including starry flounder, dover sole, and multiple rockfish species (Pacific Fisheries Management Council [PFMC] 2023).

The Coastal Pelagic FMP was initially developed for the protection of northern anchovy in 1977, but through 13 additional amendments, expanded to protect habitat for fish species and invertebrates that are associated with open coastal waters. Fish managed under this plan include Pacific herring, northern anchovy, Pacific sardine, Pacific and jack mackerel, as well as invertebrates including squid and krill (PFMC 2024).

The Pacific Salmon FMP was first approved in 1977 and has been amended 23 times since. The FMP covers both wild and hatchery salmon species (Chinook, coho, sockeye, chum, and pink) off the coasts of California, Oregon, and Washington.

3.3.3 Methodology and Thresholds of Significance

USACE evaluates all its operations and maintenance dredging activities for potential impacts to threatened or endangered species. 33 C.F.R. § 336.1(c)(5). This analysis of potential impacts considered whether the project alternatives would have a substantial adverse effect on any species identified as a proposed, threatened, or endangered species under the ESA. Significance of impacts are evaluated based upon the extent, intensity and duration of the impact on the resource. ER 1105-2-100, C-15.

Therefore, an alternative may result in a significant impact if it would directly or indirectly (e.g., through habitat modification) result in a substantial population decline of any proposed, threatened, or endangered species protected under the ESA. Furthermore, a project impact may be significant if it would result in the decline of a non-federally listed species such that populations would fall below self-sustaining levels.

Under CEQA, the analysis of potential impacts of the Proposed Project considered whether the project alternatives would have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, proposed, or listed species under, or otherwise protected by, the ESA or CESA, or where they would otherwise meet the CEQA Guidelines' definition of "endangered or threatened" (14 California Code of Regulations 15380). In addition, Section 15065 of the CEQA Guidelines requires a finding of a significant effect if a project has the potential to "substantially reduce the habitat of a fish or wildlife species," "cause a fish or wildlife population to drop below self-sustaining levels," "threaten to eliminate a plant or animal community," or "substantially reduce the number or restrict the range of an endangered, rare or threatened species."

3.3.4 Impacts and Mitigation Measures

While there are numerous species in the project area, the impact assessment focuses on the most at-risk species, typically those that are listed under the federal and/or state ESA, based on the type of impact.

3.3.4.1 Impact BI-1: Potential Effects on Fish and Benthic Invertebrate Survival Caused by Entrainment

No Action Alternative/No Project Alternative

All forms of dredging have the potential to incidentally remove organisms from the environment with the dredged material, a process referred to as entrainment. Organisms on or in the dredged material, such as snails, clams, or worms, may be entrained, in addition to organisms in the water column near the dredging apparatus. Fish that are smaller, are weaker swimmers, or are sometimes found near the bottom of the channel are more susceptible to dredging entrainment. Neither delta smelt nor longfin smelt are strong swimmers, and they are known to occur at times near the bottom of the water column (CDFG 2009). Based on entrainment data, longfin smelt are the most at-risk State and/or federally listed threatened or endangered species of being entrained during dredging activities.

In addition to occurring in the water column in areas that are dredged, longfin smelt occupy tidal wetland habitat. Recent fish surveys have detected significant numbers (e.g., more than 50) of age-1 and a single age-2 longfin smelt in wetlands restored by BUDM in San Pablo Bay. These surveys were conducted in November and December 2023 when longfin smelt would be expected to move into shallow-water habitats to spawn (Lewis et al. 2025). Though the project may impact longfin smelt due to entrainment, benefits to the species may also be realized when BUDM is incorporated to create and/or restore tidal wetland habitat.

Hopper Dredging: Hopper dredges are seagoing vessels designed to dredge and transport material from navigation channels to open-water placement areas. During active dredging, drag arms are lowered through the water column until they reach the channel bottom. The suction is then turned on, and the drag heads are slowly dragged across the channel bottom by the forward motion of the vessel. Sediment and water are suctioned through the bottom of the drag heads and additional water is suctioned through the doors on the top of the drag heads and deposited in the hopper bin in the vessel's midsection. When the hopper bin is full, the dredge raises the drag arms and moves to a designated placement area to empty the dredged material through large doors at the bottom of the dredge. Hopper dredges provide the ability to work in rough, open waters, the ability to move quickly between project sites under their own power, and the ability to maneuver so as not to interfere with or obstruct other vessel traffic during dredging operations. Hopper dredging also results in shorter dredging operation time and reduced sediment resuspension compared to mechanical dredging. Standard practices to avoid entrainment during hopper dredging are provided in Section 2.3.1.5.

Rearing juvenile and adult longfin smelt have been collected most frequently from deepwater habitats as opposed to shoals during routine Bay study sampling (Rosenfield and Baxter 2007), and this information is useful to assess dredging impacts. By May of most years, young-of-the-year (age-0) longfin smelt begin to reach 40 mm fork length. At this size and regardless of Delta outflow, these approximately 40-mm age-0 longfin smelt are typically distributed throughout the Estuary because they are tolerant of a wide range of salinities from low salinity (and occasionally freshwater) to marine conditions in the Estuary. Distributions of older longfin smelt have only been described coarsely into densities across shoal and channel habitats (less than seven meters and greater than or equal to seven meters depth, respectively; Rosenfield and Baxter 2007). Density was almost always higher in the deeper channel habitats regardless of age class. As dredging tends to occur on the bottom or lower sides of the shipping channels, fish occupying the deeper channel habitats are expected to have greater exposure to dredging impacts.

Although longfin smelt are entrained from hydraulic dredging, the small overall percentage of SF Bay affected and short-term duration of hydraulic dredging are critical factors in limiting these impacts. The percent area of federal navigational channels compared to the preferred habitats of juvenile and adult longfin smelt is less than eight percent, ranging from two to eight percent by region. Often, when population data is limited, habitat is used as a surrogate for population. Therefore, theoretically, if both juveniles and adults are assumed to have uniform densities across the regional area with water depth greater than or equal to 23 feet, then less than eight percent of these life stages would be exposed to dredging in these regions regardless of interannual variations of their abundance in the Estuary.

Note that these spatial impact estimates are very conservative due to following reasons:

- The federal navigational channels include the entire authorized channels, but typically only portions of some channels are dredged during each dredging episode. Historically, approximately 70 to 80 percent of Pinole Shoal, 40 to 50 percent of Richmond Outer Harbor, and around 80 percent of Richmond Inner Harbor have been dredged annually. Since 2017, Pinole Shoal and Richmond Outer Harbor have been dredged in alternating years.
- The hopper dredging operations are short-term and temporary because dredging operations for a given navigation channel would last only a few days to up to just over a month, depending on the dredging volume.

- Juvenile and adult longfin smelt occurring in habitats less than 23 feet deep or in locations other than near the navigation channels or placement sites would be exposed to dredging activities infrequently or not at all.
- Even if longfin smelt are occupying habitat where they may be exposed to dredging it is not certain they would be adversely affected or entrained. Even survey gear designed to monitor fish in the Delta can have a low (i.e., less than one percent [Duarte and Peterson 2021]) and variable (e.g., 18 to 57 percent [Huntsman et al. 2022]) capture probability for juvenile longfin smelt and other fishes (Duarte and Peterson 2021; Huntsman et al. 2022). As such, it is unlikely that 100 percent of longfin smelt that would be in a navigational channel would be entrained.

Fish are believed to be more susceptible to entrainment from hydraulic (i.e., hopper and cutterhead-pipeline) dredging than mechanical (i.e., clamshell) dredging (USACE and USEPA 2024). Under mechanical dredging, pressure waves caused as the dredge is dropped and lifted help push the fish away from the dredge, whereas hydraulic dredges pull the fish towards the dredge. Additionally, less water is removed during mechanical dredging. Demersal fish and crustaceans that live on the bottom are at higher risk of entrainment from both methods. Entrained fish likely would suffer direct injuries that may result in mortality. Green and white sturgeon are also at risk of entrainment, though research into how sturgeon are affected by dredging operations is limited (Balazik and Clarke 2024). Entrained crustaceans that are able to survive would be transported and released with dredged material, which could be in upland locations, or habitats that are less suitable to support the species.

Hopper dredge entrainment monitoring on USACE's dredge *Essayons* has been conducted over multiple years (Novotny et al. 2018; Novotny et al. 2019; Novotny et al. 2024), with ESA-listed species periodically captured in the entrainment monitoring (Table 3-12). Fish entrainment monitoring on the Essayons uses the vessel's existing sampling apparatus which diverts some of the dredge slurry from the dragheads through a sampling pipe equipped with a gate valve to control flow, and then into a basket with steel mesh walls that measures approximately two meters by two meters by three meters. The dredged material is then washed down with a hose and any fish are identified, counted, measured, and released if alive. Invertebrates also are identified and counted. Samples are collected during the beginning (i.e., priming phase), middle, and end (i.e., flushing phase) of the dredge period. Samples are limited to 10 minutes, but may be much shorter (e.g., 30 seconds) depending on the consistency of the dredged material (e.g., silt versus sand) and how quickly the mesh clogs, causing the basket to quickly fill to capacity. At least 80 percent of the hopper loads are monitored, but the proportion of material sampled compared to the entire hopper load is unknown. Additionally, there is a hopper observation area from which the contents of the hopper can be viewed. The water surface of the dredged material within the hopper can be reached with a long-handled net (more than 10 feet with a retrieval cord) once the hopper is full or nearly full. Any fish observed is netted from the hopper and data collected as described above.

Table 3-12. Monitoring Data Showing Recent Key Fish Species Entrained from the *Essayons* Hopper Dredge

Dredge Location	Monitor Year	Dredge Dates	Water Year Type	Species	Number Entrained[1]
Pinole Shoal	2010	6/15–6/21	Above Normal	No listed fish entrained	0
Pinole Shoal	2010	6/15–6/21	Above Normal	Northern anchovy	9
Pinole Shoal	2011	7/15–7/19	Wet	Longfin smelt	3
Richmond Long Wharf	2011	7/19–7/31, 8/11	Wet	Longfin smelt	11
Richmond Long Wharf	2011	7/19–7/31, 8/11	Wet	Northern anchovy	16
Richmond Southhampton	2011	7/27–7/31	Wet	Longfin smelt	1
Richmond Southhampton	2011	7/27–7/31	Wet	Spiny dogfish	1
Richmond Southhampton	2011	7/27–7/31	Wet	Rock sole	9
Richmond Southhampton	2011	7/27–7/31	Wet	California halibut	1
Suisun Bay	2011	8/1–8/10	Wet	Longfin smelt	3
Suisun Bay	2011	8/1–8/10	Wet	Delta smelt	3
Suisun Bay	2011	8/1–8/10	Wet	Northern anchovy	2
Richmond Long Wharf	2016	6/1–6/7	Dry	Longfin smelt	4
Richmond Long Wharf	2016	6/1–6/7	Dry	Northern anchovy	104
Richmond Long Wharf	2016	6/1–6/7	Dry	Brown rockfish	3
Richmond Long Wharf	2016	6/1–6/7	Dry	California halibut	2
Richmond Southhampton	2016	6/1, 6/7–6/15	Dry	Chinook salmon	1
Richmond Southhampton	2016	6/1, 6/7–6/15	Dry	Longfin smelt	8
Richmond Southhampton	2016	6/1, 6/7–6/15	Dry	Northern anchovy	55
Richmond Southhampton	2016	6/1, 6/7–6/15	Dry	Brown rockfish	1
Richmond Long Wharf	2016	10/3–10/7, 10/9–10/10	Dry	Northern anchovy	133
Pinole Shoal	2016	9/26–10/3, 10/8	Dry	Northern anchovy	269
Pinole Shoal	2016	9/26–10/3, 10/8	Dry	California halibut	8
Pinole Shoal	2017	6/1–6/21	Wet	Green sturgeon	1
Pinole Shoal	2017	6/1–6/21	Wet	Longfin smelt	56
Pinole Shoal	2017	6/1–6/21	Wet	Unidentified sturgeon[2]	1
Pinole Shoal	2017	6/1–6/21	Wet	Starry flounder	2
Pinole Shoal	2017	6/1–6/21	Wet	Northern anchovy	112
Pinole Shoal	2017	6/1–6/21	Wet	Brown rockfish	4
Pinole Shoal	2017	6/1–6/21	Wet	California halibut	2
Pinole Shoal	2017	6/1–6/21	Wet	Spiny dogfish	1
Richmond Outer Harbor	2018	6/6–6/17	Below Normal	No listed fish entrained	0
Richmond Outer Harbor	2018	6/6–6/17	Below Normal	Northern anchovy	300

Dredge Location	Monitor Year	Dredge Dates	Water Year Type	Species	Number Entrained[1]
Richmond Outer Harbor	2018	6/6–6/17	Below Normal	Brown rockfish	4
Richmond Outer Harbor	2018	10/1–10/19	Below Normal	Longfin smelt	30
Richmond Outer Harbor	2018	10/1–10/19	Below Normal	Northern anchovy	453
Richmond Outer Harbor	2018	10/1–10/19	Below Normal	Brown rockfish	19
Pinole Shoal	2019	7/31–8/7	Wet	Longfin smelt	1
Pinole Shoal	2019	7/31–8/7	Wet	Northern anchovy	229
No Monitoring Conducted	2020	–	–	–	0
No Monitoring Conducted	2021	–	–	–	0
No Monitoring Conducted	2022	–	–	–	0
Pinole Shoal	2023	7/22–7/31	Wet	Longfin smelt	41
Pinole Shoal	2023	7/22–7/31	Wet	Chinook salmon	1
Pinole Shoal	2023	7/22–7/31	Wet	Northern anchovy	514
Pinole Shoal	2023	7/22–7/31	Wet	Pacific herring	15
Pinole Shoal	2023	7/22–7/31	Wet	Starry flounder	3
Richmond Outer Harbor	2024	6/14–7/1	[3]	Longfin smelt	1
Richmond Outer Harbor	2024	6/14–7/1	[3]	Northern anchovy	12
Richmond Outer Harbor	2024	6/14–7/1	[3]	Pacific herring	1
Richmond Outer Harbor	2024	6/14–7/1	[3]	California halibut	1
Richmond Outer Harbor	2024	6/14–7/1	[3]	English sole	12
Richmond Outer Harbor	2024	6/14–7/1	[3]	Butter sole	1
Richmond Outer Harbor	2024	6/14–7/1	[3]	Spiny dogfish	2
Richmond Outer Harbor	2024	6/14–7/1	[3]	Rockfish (species unknown)	1
Richmond Southhampton	2024	7/1–7/3	[3]	Northern anchovy	5
Richmond Southhampton	2024	7/1–7/3	[3]	Brown rockfish	1
Richmond Southhampton	2024	7/1–7/3	[3]	Pacific sanddab	1

Sources: Novotny et al. 2018; Novotny et al. 2019 ; Novotny et al. 2024
1. The number of fish entrained were those counted from the subset of dredged material monitored.
2. White sturgeon noted in 2023 was likely part of a white sturgeon carcass and not a living fish.
3. Water year type for 2024 has not yet been classified

Northern anchovy, an important commercial species, are often entrained at higher numbers during dredging activities. For many entrainment monitoring samples, often for entire hopper loads, the count of special-status species collected by entrainment monitoring aboard the *Essayons* in SF Bay is zero. Resource agency sampling of fish populations in SF Bay generally yields only relative population indices useful for observing population trends within a species, and actual population estimates have high uncertainty (Newman 2008). No location-specific density estimates are available for these species specifically in the navigation channels. However, there are years of fish surveys collected by CDFW which show relative population abundances throughout the year across all segments of SF Bay (Tobias and

Baxter 2024), which can be used to identify months of the year when hopper dredging is likely to have greater impacts. Results from *Essayons* monitoring are shown in Table 3-12..

The *Essayons* entrainment monitoring data was used in an alternative statistical model for longfin smelt to synthesize fish entrainment across time, space, and species (Lemasson et al. 2022). Longfin smelt were collected too infrequently to assess as a species, and some of the model results were driven by the typically much higher abundance of northern anchovy; this would likely apply to delta smelt as well. More fish, such as anchovy, were captured during flood tides and thus, higher salinity conditions. These results show that both ecological and operational elements can be reliable predictors of regional fish counts in estuaries, and entrainment risk is higher at the beginning and end of a dredging operation. This analysis found that standardizing effort by the area swept was more informative than using the volume of material dredged (Lemasson et al. 2022). Pelagic fish, such as longfin smelt and delta smelt, do not occur in or on the dredge sediment, but rather above it, so sediment volume dredged may not be useful as a predictor of entrainment rates. Entrainment of small fish by the *Essayons* may be more likely to occur when the “doors” located on top dragheads are opened to improve flow through the intake pipes by increasing the water content of the dredge slurry.

As shown in Table 3-12 and described above, the number of juvenile and adult longfin smelt entrained in sampling efforts during hopper dredge operations is highly variable annually and appears to be partially dependent on the degree of Delta outflow as indicated by water year type. More longfin smelt entrained during a wet water year may occur due to higher egg, larval, and juvenile survival; hence, higher entrainment counts may not indicate a larger impact on the population compared to lower entrainment detected during drier years. Instead, the area swept by the dredge of habitats with greater densities of juvenile and adult longfin smelt (greater than or equal to 23 feet) in the federal navigational channels may be a better estimate of impacts on annual populations (Lemasson et al. 2022; Rosenfield and Baxter 2007).

There are six federally maintained channels that could potentially be dredged by a hopper dredge: San Francisco Harbor MSC, Richmond Inner Harbor, and Richmond Outer Harbor, Oakland Inner and Outer Harbor, San Pablo Bay, and San Bruno Channel (Table 3-13). If all these six channels were to be dredged by a hopper dredge, the approximate maximum duration of dredging operations by navigation channel would range from two to 37 days. Longfin smelt are less likely to be present in San Bruno Channel, which is only dredged infrequently. In the past, dredging by the *Essayons* has been constrained by the number of days it is available (approximately 20 days), and time of vessel availability may continue to be the main factor affecting the level of impact rather than volume dredged.

For longfin smelt, the entrainment impacts by hopper dredging were estimated by incorporating a time component (i.e., duration of dredging operations in days) into the areal comparison of preferred habitats versus federal navigational channels for each region. Often, when population data is limited, habitat is used as a surrogate for population. Table 3-13 provides the longfin smelt habitat area affected by hopper dredging and the duration of time in which the habitat area is affected. It is important to note that dredging activities are scheduled to avoid the most sensitive life stages (spawning and incubating eggs).

While San Pablo Bay has the largest percent of longfin smelt habitat area exposed to hopper dredging (8.2 percent) under the No Action Alternative and No Project Alternative, it is only affected for 7.7 percent of the year (28 days) when the maximum volumes are dredged, versus 2.1 percent (No Action Alternative) and 2.6 percent (No Project Alternative, every other year) of the year (8 and 10 days, respectively) when the average volumes per alternative are dredged (Table 3-13). Longfin smelt in Richmond Outer Harbor would have the greatest amount of time exposed to hopper dredging under the No Action Alternative and No Project Alternative, with longfin smelt exposed for 10 percent of the year (37 days) when the maximum volume is dredged. It is important to note that most of the dredging will occur in June through July.

Tobias and Baxter (2023) described the predicted probability of occurrence of longfin smelt based on otter trawl data in the various regions of the Estuary during each month for each life stage (see Section 3.3.2.2). In June through July, the predicted probability of occurrence of age-0 longfin smelt in San Pablo Bay is around 0.2 to 0.21. In Central SF Bay it is approximately 0.24 to 0.3, and in South SF Bay it is 0 (See Figure 3 in Tobias and Baxter 2023). In June through July, the predicted probability of age-1 longfin smelt presence in San Pablo Bay is approximately 0.04 to 0.08, while in Central SF Bay it is approximately 0.06 to 0.09, and in South SF Bay it is around 0 (Tobias and Baxter 2023). In June through July, the predicted probability of age-2 longfin smelt presence in San Pablo Bay, and Central and South SF Bay is approximately 0 (Tobias and Baxter 2023).

Age-0 longfin smelt have the highest risk of entrainment during dredging operations in June and July due to their higher predicted probability of occurrence. Age-1 longfin smelt have substantially reduced probability of occurrence in June and July in all regions of the Estuary and would therefore be entrained in lower numbers. Age-2 fish are at minimal to no risk of entrainment in June and July. Because of the low predicted probability of presence of the three year-classes and the relatively low risk of exposure, there would not be a substantial risk to the longfin smelt population at any of the dredged navigational channels.

Because sturgeon are typically found at the bottoms of channels, they are at risk of entrainment. Since 2011, only one green sturgeon has been entrained in the *Essayons* hopper dredge, and a white sturgeon was detected, but may have already been dead when entrained in the hopper dredge (Table 3-12).

). While not every fish entrained can be observed due to the nature of the sediment, particularly if the sediment is a dense silty material and the amount of time monitoring can physically occur is limited, it is unlikely that many sturgeon were entrained. Swimming strength of sturgeon increases with increasing fish length, so smaller fish are less able to avoid hydraulic intakes than larger fish. However, the likelihood of entraining sturgeon is low overall as even juveniles (i.e., greater than 30 centimeters in length) (Moyle 2002) should be fairly strong swimmers and generally able to avoid being entrained by hopper dredging.

Table 3-13. Estimated Exposure Risk to Longfin Smelt from Hopper Dredging Based on Longfin Smelt Habitat in the San Francisco Estuary[1] Affected and Dredging Duration by Navigational Channel During Each Dredging Event

Alternative	Regional Area with Water Depth ≥ 23 feet at MSL (acres)	Maximum Area of Navigational Channel Dredged (acres)	Estimated Duration of Hopper Dredging (Days for maximum volume)	Estimated Duration of Hopper Dredging (Days vessel available)	Timing of Dredging	Estimated Percent of Longfin Smelt Habitat Exposed to Hopper Dredging	Estimated Percent Time Exposed of Longfin Smelt Exposed to Hopper Dredging (at maximum volume)	Estimated Percent Time Exposed of Longfin Smelt Exposed to Hopper Dredging (for days vessel available)
Navigation Channel: Richmond Outer Harbor — Central Bay Region								
NA	17,304	618	37	9.5	June–July	3.6%	10%	2.9%
NP	17,304	618	37	19[1]	June–July	3.6%	10%	3.4%
Alt 1	17,304	618	37	9.5	June–July	3.6%	10%	2.9%
Alt 2	17,304	618	37	11	June–July	3.6%	10%	2.9%
Alt 3	17,304	618	34	10	June–July	3.6%	9.3%	2.7%
Navigation Channel: Richmond Inner Harbor — Central Bay Region								
Alt 1	17,304	326	17	8	December–February	1.9%	4.6%	2.2%
Alt 2	17,304	326	32	15	December–February	1.9%	8.6%	4.1%
Alt 3	17,304	326	28	13	December–February	1.9%	7.6%	3.6%
Navigation Channel: Oakland Harbor (Inner and Outer) — Central Bay Region								
Alt 2	14,841	1,050	19	12	December–February	7.1%	5.3%	3.2%
Navigation Channel: Pinole Shoal — San Pablo Bay Region								
NA, Alt 1	10,732	879	28	9.5	June–July	8.2%	7.7%	2.1%
NP, Alt 2	10,732	879	28	192	June–July	8.2%	7.7%	2.6%
Alt 3	10,732	879	26	7	June–July	8.2%	7.1%	1.9%

Alternative	Regional Area with Water Depth ≥ 23 feet at MSL (acres)	Maximum Area of Navigational Channel Dredged (acres)	Estimated Duration of Hopper Dredging (Days for maximum volume)	Estimated Duration of Hopper Dredging (Days vessel available)	Timing of Dredging	Estimated Percent of Longfin Smelt Habitat Exposed to Hopper Dredging	Estimated Percent Time Exposed of Longfin Smelt Exposed to Hopper Dredging (at maximum volume)	Estimated Percent Time Exposed of Longfin Smelt Exposed to Hopper Dredging (for days vessel available)
Navigation Channel: San Bruno Channel — South San Francisco Bay Region								
NA, NP, Alts 1–4	25,149	344	2[3]	2	June–July	1.4%	0.5%	0.5%

Source: Rosenfield and Baxter 2007
Notes:
1 Assumes hopper dredging as a likely or alternate method within the Estuary, but does not include the river channels which have a lower likelihood of longfin smelt presence.
2 Under the No Project Alternative, Pinole Shoal and Richmond Outer Harbor would be dredged every other year, therefore longfin smelt in Pinole Shoal and Richmond Outer Harbor would not experience impacts annually.
3 The San Bruno Channel would be dredged infrequently.

Key:
≥ = greater than or equal to
Alt = Alternative
MSC = Main Ship Channel
MSL = mean sea level
NA = No Action Alternative
NP = No Project Alternative

Cutterhead-Pipeline Dredging: Cutterhead dredges have rotating blades or teeth to break up or loosen the bottom material so that it can be suctioned through the dredge and then pushed out through a discharge pipeline directly onto the placement site, which could be a wetland under construction. Consequently, entrained fish likely would suffer physical injury, suffocation, and stranding leading to mortality.

The USACE has used cutterhead-pipeline dredging for the Sacramento and Stockton Deepwater Ship Channel Maintenance Dredging projects, and fish entrainment monitoring for those projects has been conducted since 2006. In the initial years of monitoring, a portion of the dredged material was discharged via pipeline into a “sampling cell” created with an earthen berm. A regulated stream of the slurry was then directed through a small culvert into a cylindrical sampling net where the content could be examined for entrained fish. This method allowed only a small portion of the dredged material (i.e., less than 1 percent) to be sampled, so a portable screening device was developed and that could receive and effectively screen more dredged material directly from the cutterhead (i.e., from about 5 to 28 percent). The screening method for cutterhead-pipeline dredging has been used exclusively from 2009 to the present. No longfin smelt have been detected to date in the cutterhead entrainment monitoring for the Sacramento and Stockton Deepwater Ship Channel Maintenance Dredging project since 2014, and no delta smelt have been detected since 2016. No monitoring has been conducted for any cutterhead dredging in the LTMS program.

A study conducted on Atlantic sturgeon in Virginia assessed juvenile sturgeon survival near cutterhead dredging (Balazik and Clarke 2024). They found that juvenile Atlantic sturgeon were not deterred from the vicinity of the dredging (within 100 meters), had passed the dredge site a minimum of 122 times and had 100 percent survival.

Delta smelt may be more vulnerable to cutterhead dredge entrainment than longfin smelt due to behavioral or distributional (e.g., vertically in the water column) differences between the species, however delta smelt are more frequently found in water that is between four and 15 feet deep and where tidal velocities are lower (Bever et al. 2016; Moyle et al. 1992). Data collected in the Sacramento and Stockton Deepwater Ship Channel Maintenance Dredging suggest that the susceptibility of longfin smelt to entrainment by cutterhead dredging may be low (ICF 2019, 2021; Mari-Gold Environmental Consulting and Nova Aquatic Sciences, 2010, 2012a, 2012b, 2013, 2015, 2016, 2017; SWCA 2008; Tenera Environmental 2015). Under the No Action Alternative and No Project Alternative, cutterhead-pipeline dredging would be used in the Napa River and Petaluma River Channel. The Napa River may periodically support delta and longfin smelt. However, the USFWS work window established for the Napa River between August and January to protect delta smelt would also protect longfin smelt (CDFW 2024).

Clamshell Dredging: Fish entrained by mechanical dredging such as clamshell dredging are likely to suffer injury or suffocation during dredging, resulting in mortality. Stevens (1981) noted that a clamshell dredge bucket creates low-frequency vibrations through splashing as it enters the water and is preceded by a pressure wave as it sinks through the water column; these disturbances should promote active avoidance of the dredge by most fish. Mechanical dredging still may remove demersal fish and benthic organisms that live in or on the sediment.

Very limited data exist regarding potential entrainment effects of clamshell dredging on small fish. Video monitoring by USACE of scows receiving clamshell dredged material from Suisun Bay has detected broken mollusk shells but no fish. Over 50 hours of footage has been reviewed; however, only the surface of the sediment and water could be observed. A pilot study conducted in a marina near Suisun Bay Channel where dredged material was sieved using a screen found that fish could be entrained by a mechanical clamshell dredge, but the only species entrained that was observed was the non-native, demersal yellowfin goby (WRA 2023). Overall, the likelihood of entrainment of the longfin smelt, delta smelt, green sturgeon, and white sturgeon by mechanical dredge is expected to be very low.

Under the No Action Alternative and No Project Alternative, clamshell dredging would be used at Oakland Inner and Outer Harbor, Redwood City (not including San Bruno Channel), Inner Richmond Harbor, Suisun Bay Channel, Petaluma Across the Flats, and San Rafael Creek. If alternate dredging methods are required at other locations, clamshell dredging could potentially also occur at the Napa River, San Bruno Channel, and Petaluma River Channel dredge sites.

Fish Species-Specific Effects: Special-status fish species that could occur in the project area that have the potential to be entrained by dredging activities include delta smelt, longfin smelt, green sturgeon, white sturgeon, and Chinook salmon. Commercially important species that have the potential to be entrained include Northern anchovy, Pacific herring, and Dungeness crab. Although other species, including benthic invertebrates, could be entrained, the number of individuals entrained is not expected to have an impact on their population because their population sizes are not restricted like the listed species, and implementation of the Standard Practices in Section 2.3.1.5 and measures that protect special-status fish species would also protect the commercially important species.

Delta smelt and longfin smelt have the potential to occur in the Suisun Bay year-round, so to avoid or minimize entrainment at the Suisun Bay Channel, only clamshell dredging will occur under the No Action Alternative and No Project Alternative, which complies with the USFWS delta smelt BiOp (USFWS 2024). To further reduce impacts on delta smelt and longfin smelt, dredging will only occur in Suisun Bay Channel between August 1 and November 30, per the USFWS BiOp work window, so eggs and larval delta smelt and longfin smelt would not be affected (USFWS 2024). Juvenile and adult delta smelt and longfin smelt are unlikely to be entrained by a mechanical clamshell bucket due to the pressure wave preceding it as it falls through the water column as described above. However, if a delta or longfin smelt were captured in a clamshell bucket as it was being lowered in the water column, they would have the opportunity to escape through the water vents incorporated into the top of the clamshell bucket. Therefore, less-than-significant impacts on delta smelt and longfin smelt would occur in sites where the species are present and clamshell dredging occurs.

Juvenile longfin smelt, green sturgeon, white sturgeon, and Chinook salmon may occur in the open waters within and adjacent to most of project area including navigation channel and disposal sites if timing and habitat conditions are suitable. As identified above, sites where clamshell dredging will occur, fish are at low risk of entrainment.

At sites where hopper dredging and cutterhead-pipeline dredging will occur, entrainment risks are increased, but entrainment data shows that green and white sturgeon, Chinook salmon, and delta smelt are rarely entrained at the monitored hopper dredging sites. Longfin smelt entrainment is highly variable on an annual basis, partly depending on Delta outflow which affects their abundance and distribution.

Adult Pacific herring swim rapidly, mostly in the deeper channels to reach their shallow spawning habitat in December through March, and the juveniles rear until August through December before migrating to the ocean. Adult herring are at risk of entrainment particularly from hopper dredging, but the weakest life stages, eggs and larvae, are less likely to be in the Main Channel during dredging activities. As shown in the entrainment monitoring results at Richmond Outer Harbor and San Pablo Bay, Pacific herring have rarely been observed, although this may have been due to most dredging occurring during June and July (Table 3-14).

Pacific herring spawn have only been observed 3 out of 15 times when USACE has dredged in Oakland Harbor, Richmond Inner Harbor, or Redwood City Harbor during the November 30 through March 16 time frame since 2015. Despite USACE dredging during the spawning period, including more frequently in recent years, the occurrence of observed spawning in the dredge footprint is still rare. This is because the preferred spawning location for herring are eel grass or rocky substrate which are not commonly found in or near dredging channels. In addition, the decision by USACE to stop dredging near observed herring spawn will protect eggs from entrainment as well as turbidity impacts. The egg stage has been shown to be sensitive to turbidity impacts, however, CDFW notes in the Pacific Herring Management Plan (2019) that “survival of eggs is highly variable, and thus a large number of eggs laid in a given year does not necessarily correlate with a strong year class”.

Demersal fish and invertebrate species (e.g., Pacific staghorn sculpin, Pacific sanddab, Dungeness crab, halibut), which are found on or near the bottom have an increased potential for entrainment during dredging; however, these are not special-status species, nor are they likely population limited. Entrainment is not expected to have a significant effect on their population or species survival.

Under the No Action Alternative, due to the low level of anticipated entrainment at channels where clamshell dredging would occur, negligible impacts on all fish species would be expected. Entrainment would occur from cutterhead dredging, but with likely minimal effects to listed fish species, so cutterhead dredging would result in less-than-significant impacts. Hopper dredging at Richmond Outer Harbor, San Pablo Bay would result in less-than-significant impacts to longfin smelt because there would be a small percentage of longfin smelt habitat affected (thus assuming a similarly low percentage of longfin smelt affected) over a relatively short period of time, and because Standard Practices (see Section 2.3.1.5) would be implemented. Other listed fish are entrained from hopper dredging at significantly lower rates than longfin smelt (Table 3-14), so impacts to other listed fish would be less than significant. Pacific herring are also entrained infrequently, as mentioned above, so impacts would be less than significant under the No Action Alternative. Northern anchovy and other commercially important species are entrained at higher levels, but their populations do not appear to be substantially affected, and therefore the impacts would be less than significant under the No Action Alternative.

Under the No Project Alternative, impacts to fish and invertebrates would generally be less than under the No Action Alternative because Richmond Outer Harbor and San Pablo Bay are dredged less frequently (once every two years) under the No Project Alternative as opposed to every year under the No Action Alternative. However, under the No Project Alternative, impacts to longfin smelt would be significant because of their special status and their higher level of entrainment from more hopper dredging, but impacts to other listed species and commercially and recreationally important marine species are less than significant under the No Project Alternative as explained above.

Mitigation Measure BI-1: Compensatory Mitigation for Longfin Smelt

To compensate for hopper dredging at any in-Bay location, USACE shall annually purchase mitigation credits from an approved mitigation bank or in-lieu fee program or place an equivalent amount of sediment at a permitted upland tidal wetland beneficial use site that would provide habitat for longfin smelt.

Calculation of acres of compensatory mitigation required

The existing CDFW formula from the 2015 EA/EIR and subsequent two 401 WQC/WDRs is used to calculate the compensatory mitigation for entrainment effects of navigation and maintenance dredging using a hopper dredge such as the *Essayons* or a west coast hopper contract dredge on longfin smelt.

The acreage of mitigation required was calculated from an equation that was developed by resource agencies to determine mitigation requirements for other projects with entrainment impacts as a result of pumping water, including the State Water Project (USACE and Regional Water Board 2015) (see Section 2.3.3):

$$Acres\ mitigation\ required = \frac{800\ acres * Volume_{water\ pumped\ by\ hopper\ dredge}}{3.0\ million\ acre-feet}$$

Instead of determining the amount of mitigation required for each channel in advance, as was the past practice, the current approach will instead use the exact volume of water pumped into the hopper dredge for each particular channel in a given dredge year. All this information is recorded by the ship operators and will result in a more accurate assessment of impacts since the actual volume of water pumped varies across projects. In order to show an example of how this formula will work, the following text will use estimated pump hours to show how the mitigation calculation will be performed and give an estimate of the mitigation resulting from channels. In 2023 in Pinole Shoal the Essayons used the pumps for 105.73 hours at a pump rate of 60,000 gallons per minute to field a total pump volume of 380,640,000 gallons which equates to 1,168.14 acre-feet pumped in order to dredge 191,532 CY of sediment.

Calculation of volume of sediment directed to a tidal wetland restoration project

The previous Regional Water Board WQC/WDRs directed USACE to purchase mitigation credits at Liberty Island, a CDFW-approved bank for delta smelt and longfin smelt. However, Liberty Island no longer has available credits for purchase. There is currently one bank available that is approved by CDFW and other state and federal agencies: the North Delta Fish Conservation Bank. This mitigation bank is operational and offers credit purchases or credit reservations as credits become available. However, credits are purchased quickly, making availability limited. (pers. comm., Arn Aarreberg, CDFW, 2024). Should an appropriate mitigation bank come online during this EA/EIR period, USACE may fulfill its obligation for compensatory mitigation by purchasing mitigation credits at the acreage determined by pump volumes. The other option for compensatory mitigation is BUDM.

If mitigation credits are not available for purchase, or USACE determines purchasing credits is not the appropriate course of action, then USACE shall compensate for impacts to longfin smelt and their habitat by BUDM at an upland site that would provide habitat for longfin smelt within SF Bay. That sediment provided for BUDM shall be sediment that would have otherwise been disposed of in-Bay or at deep ocean disposal site SF-DODS. Increasing the amount of BUDM by USACE for tidal marsh restoration through compensatory mitigation will increase the speed at which tidal marshes are restored in the region, thereby increasing the speed at which benefits to longfin smelt are realized. Tidal wetland habitat has been shown to support high numbers of longfin smelt at early life stages (Lewis et al. 2025). The volume of sediment for this method of mitigation shall be calculated through the steps described below.

The next steps of the calculation involved using the cost of tidal wetland mitigation credits and the monetary value of sediment that can be beneficially used to create wetland habitat. To convert acres of wetland creation to a dollar value, the cost of the mitigation was determined to be an average of $1.3 million per acre and relied on three independent data points: 1) the cost of the last available credits at Liberty Island, which were $175,000 per acre; 2) the cost of a recent project at Ravenswood Bay Trail that purchased 0.05 acres at a cost of $75,000 ($1.5 million per acre); and 3) a current purchase price quote of $230,000 for 0.1 acre ($ 2.3 million per acre) at the San Francisco Bay Wetland Mitigation Bank located in Redwood City, California (pers. comm., Max Keech, August 2024).

With the cost of the mitigation established, the volume of material USACE would need to redirect to a beneficial use site was determined based on the incremental cost between a wetland beneficial use site and the proposed Federal Standard Base Plan placement site for each channel in which hopper dredging is proposed. Note that the Federal Standard Base Plan placement site for Oakland Inner & Outer Harbor is split between an non-aquatic beneficial use site and an in-Bay placement site (SF-11). The portion of the channel that would be hopper dredged would be placed at SF-11; thus, SF-11 is listed as that channel's Federal Standard Base Plan placement site. This cost per CY varies depending on the exact channel from which the BUDM will occur and will be determined on a channel-by-channel basis moving forward. This calculation is also consistent with the methodology needed to determine which alternatives meet the Federal Standard Base Plan. A multiplier of 2 was used to account for the likely distance of the impact sites from the beneficial use site(s), temporal losses in aquatic resource functions, and the likelihood of success of the restoration activities at the beneficial use site(s). under § 230.93(f)(2) of the State Supplemental Dredge and Fill Guidelines when the impacts are considered permanent, and the mitigation is offsite and will take a relatively long time (over 10 years) to fully develop ecosystem functions and values. This multiplier is consistent with Regional Water Board compensatory mitigation requirements for dredge and fill impacts under § 230.93(f)(2) of the State Supplemental Dredge and Fill Guidelines when the impacts when the mitigation is offsite and will take a relatively long time (over 10 years) to fully develop ecosystem functions and values. These steps are combined to show the example calculations in Table 3-14. The volume of required BUDM would be:

$$Volume\ BUDM = \frac{acres\ mitigation\ required\ \times\ \$1{,}325{,}000\ \text{per acre}}{Cost_{Increment}\ per\ cubic\ yard} \times 2$$

Actual volumes will depend on total pump time of the *Essayons* to be provided after the dredging is completed.

Table 3-14. Example of Conversion of Estimated Pump Hours to Acres of Mitigation Using the CDFW Formula 1 and Conversions from Estimated Mitigation Acres Volume of Beneficial Use of Dredged Material

Channel	Estimated Pump Volume (acre-feet)	Average Proposed Annual Volume (CY)	Approximate Acres of Compensatory Mitigation Required[1]	Approximate Volume of Required Beneficial Use (CY)[2]
Oakland Inner or Outer Harbor (portion of channel)	1,281	210,000	0.34	35,000
Richmond Inner Harbor	1,829	300,000	0.49	45,000
Richmond Outer Harbor	1,281	210,000	0.34	30,000
Pinole Shoal	915	150,000	0.24	20,000

[1] CDFW formula is 3.0 million acre-feet / 800 acres = volume of water pumped in acre-feet / X acres of mitigation.
[2] The required volume of beneficial use is calculated based on an incremental cost of recent mitigation for each channel
Key: CY = cubic yards

- **NEPA Determination:** No Action Alternative impacts on fish caused by entrainment would be considered less than significant through the implementation of the LTMS windows and other Standard Practices intended to reduce the potential for entrainment.
- **CEQA Determination:** No Project Alternative impacts on fish caused by entrainment would be considered less than significant through the implementation of the LTMS windows and other Standard Practices intended to reduce the potential for entrainment, except with respect to longfin smelt. The No Project Alternative impacts caused by entrainment are considered significant due to impacts to longfin smelt, a CESA-listed species. Impacts are reduced to less than significant with implementation of Standard Practices listed in Section 2.3.1.5 and Mitigation Measure BI-1. For the No Project Alternative, compensatory mitigation is necessary to reduce impacts as specified in Mitigation Measure BI-1. Compensatory mitigation in accordance with Mitigation Measure BI-1 is necessary to mitigate for continued impacts to longfin smelt in a similar manner to what was required under CEQA baseline conditions (see USACE and Regional Water Board 2015 and Provision 10 of Reissued Waste Discharge Requirements and Water Quality Certification for US Army Corps of Engineers, San Francisco District, San Francisco Bay Federal Channel Maintenance Dredging Program, Order No. R2-2020-0011).

Alternative 1

Under Alternative 1 (refer to Section 2.3.3), the likely dredge method at all locations would be the same as the No Action Alternative and No Project Alternative. Because the frequency of dredging under Alternative 1 is the same as the No Action Alternative, entrainment impacts to fish would be the same if the likely dredging methods are employed at all sites. However, compared to the No Project Alternative, impacts to fish under Alternative 1 would be greater at Richmond Outer Harbor and San Pablo Bay because dredging is done annually, versus dredging every two years under the No Project Alternative. Increased BUDM to create tidal wetland habitat is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt.

If alternate dredging methods (see Table 2-9) are used at Richmond Inner Harbor and Petaluma Across the Flats, there could be a change from clamshell dredging (likely method), which has a low risk of entrainment, to either hopper or cutterhead-pipeline dredging (alternate method), both of which have higher risks of entrainment. Dredging activity would apply the appropriate work windows identified in Table 2-2. If the alternate dredging methods are implemented at these sites, there would be an increase in entrainment under Alternative 1 compared to both the No Action Alternative and No Project Alternative.

The likely dredge method at Richmond Outer Harbor, San Pablo Bay, and San Bruno is hopper dredging, and the alternate dredge method is clamshell dredging (see Table 2-9). Additionally, at the Napa River and Petaluma River Channel dredge locations, the likely dredge method is cutterhead, but the alternate method is clamshell dredging, which has a lower entrainment risk. At these sites, if the alternate dredge method is applied, there would be a reduced impact to fish, particularly longfin smelt, caused by reduced entrainment from dredging.

The exposure risk (area of habitat and time exposed to dredging) of longfin smelt to entrainment from hopper dredging would be similar or the same under Alternative 1 compared to the No Action Alternative and No Project Alternative at Richmond Outer Harbor, Pinole Shoal, and San Bruno Channel when the maximum and average volumes are dredged. Richmond Inner Harbor does not have hopper dredging under the No Action Alternative and No Project Alternative, but under Alternative 1 hopper dredging could be applied as an alternate dredge method, so there would be an increase in entrainment risk to longfin smelt under this alternative. However, the risk would involve 1.9 percent of the habitat for 4.6 percent of the year if maximum volumes are dredged, or 2.2 percent of the year if average volumes are dredged (Table 3-15). The remaining sites are similar between the No Action Alternative and No Project Alternative and Alternative 2 (Table 3-15). It is important to note that dredging will occur in June and July at Richmond Outer Harbor and Pinole Shoal, and sometimes between December and February in Richmond Inner Harbor, depending on when the dredging vessel is available.

As described under the No Action Alternative and No Project Alternative, there is a low predicted probability of presence of the three year-classes, and a relatively low risk of exposure, in the Richmond Outer Harbor and Pinole Shoal in June and July. Richmond Inner Harbor would be dredged between December and February. The predicted probability of occurrence of age-1 longfin smelt would range between 0.19 and 0.22, and for age-2 longfin smelt between 0.1 and 0.11 (See Figure 3 in Tobias and Baxter 2023). Therefore, there would not be a significant risk to the longfin smelt population at these locations under Alternative 1.

Alternative 1 incorporates BUDM to restore tidal wetlands as a minimization measure for longfin smelt entrainment impacts as part of the alternative as well as additional BUDM consistent with the objectives of the project. Increasing BUDM for tidal wetland restoration is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt. A recent survey by US Geological Survey (USGS)-contracted fish biologists found that longfin smelt were commonly encountered at tidal wetland sites in the northern portion of SF Bay; these wetland habitats were restored via BUDM (Lewis et al. 2025). In particular, their paper states that,

> *Longfin Smelt was consistently among the most abundant fish species observed in restored habitats. Furthermore, Longfin Smelt catches were highest inside versus outside*

> *of restored habitats at all three North Bay sites, possibly indicating a preference or attraction to restored wetlands. Thus, restored tidal wetlands, including those utilizing dredge, appear to provide shallow-water aquatic habitats that are heavily utilized by Longfin Smelt. Longfin Smelt were also commonly captured in open-water shoal habitats adjacent to restored wetlands, suggesting that the species uses a variety of shallow water habitats that are tidally linked with restored wetlands.* (Lewis et al. 2025: page 4)

Additional research is underway by USGS to document the food availability for longfin smelt and other estuarine species at these restored tidal wetlands. Increasing the amount of BUDM by USACE for tidal marsh restoration through this project will increase the speed at which tidal marshes are restored in the region, thereby increasing the speed at which benefits to the species are realized.

- **NEPA Determination**: Under Alternative 1, impacts from entrainment would be considered less than significant to all fish species with implementation of Standard Practices listed in Section 2.3.1.5. With the inclusion of BUDM to restore tidal wetlands in the alternative, any impacts would be further reduced.
- **CEQA Determination**: Under Alternative 1, impacts from entrainment would be considered less than significant to all fish species with implementation of the Standard Practices listed in Section 2.3.1.5, which include the required conservation measures in the NMFS and USFWS BiOps for all special status species except longfin smelt. Entrainment impacts to longfin smelt under Alternative 1 would also be less than significant with inclusion of BUDM to restore tidal wetlands, which is included in the alternative as a minimization measure.

Alternative 2

Under Alternative 2 (refer to Section 2.3.4), the likely method of dredging would be the same as the No Action Alternative and No Project Alternative at all dredge sites except for Richmond Inner Harbor, which changes to hopper dredging, and for Oakland Inner and Outer Harbor, which keep clamshell dredging but include hopper dredging for a portion of the channel. The increased use of hopper dredging at a specific channel achieves more BUDM. As the increased hopper dredging would be directly tied to increased BUDM to create tidal wetland habitat, the project is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt (see Section 2.3.4).

If the alternate dredging method (See Table 2-11) is used at Petaluma Across the Flats, it would involve a change from clamshell dredging (likely method), which has a low risk of entrainment, to either hopper or cutterhead-pipeline dredging (alternate method), both of which have higher risks of entrainment. Dredging activity would apply the appropriate work windows identified in Table 2-3. If the alternate dredging methods are implemented at these sites, there would be a potential increase in entrainment under Alternative 2 compared to both the No Action Alternative and No Project Alternative.

The likely dredge method at Richmond Outer Harbor, San Pablo Bay, and San Bruno is hopper dredging, but the alternate dredge method is clamshell dredging (Table 2-11). Additionally, at the Napa River and Petaluma River Channel dredge locations, the likely dredge method is cutterhead, but the alternate is clamshell dredging, which, again, has a lower entrainment risk. At these sites, if the alternate dredge method is applied, there would be a reduced impact to fish, particularly longfin smelt, caused by reduced entrainment from dredging.

The exposure risk of longfin smelt to entrainment from hopper dredging would be the same or similar under Alternative 2 at all sites except Richmond Inner Harbor and Oakland Harbor compared to the No Action Alternative and No Project Alternative (Table 3-15). Under the No Action Alternative and No Project Alternative, Richmond Inner Harbor would use clamshell dredging, but under Alternative 2, hopper dredging would be implemented. As a result, there would be an increase in entrainment risk to longfin smelt under Alternative 2, but the risk would involve 1.9 percent of the habitat for 8.6 percent of the year if maximum volumes are dredged, or 4.1 percent of the year if average volumes are dredged (Table 3-15). Similarly, Oakland Inner and Outer Harbor under the No Action Alternative and No Project Alternative would not undergo hopper dredging, but would have hopper dredging under Alternative 2, which would expose 7.1 percent of longfin smelt habitat 5.3 percent of the time when maximum volume is dredged, and 3.2 percent of the time when average volumes are dredged (Table 3-15). It is important to note that most of the dredging will occur in June through July except for the Richmond Inner Harbor and Oakland Inner and Outer Harbor which will be dredged in the December through February, depending on when the dredging vessel is available.

Oakland Inner and Outer Harbor would be dredged during the same general time frame as the Richmond Inner Harbor, so they have the same general predicted probability of occurrence. As described under Alternative 1, because of the low predicted probability of presence of the three year-classes and the relatively low risk of exposure, there would not be a significant risk to the longfin smelt population at all sites under Alternative 2.

Alternative 2 includes BUDM to restore tidal wetlands as a minimization measure for longfin smelt entrainment impacts as part of the alternative, as well as additional BUDM consistent with the objectives of the project. Increasing BUDM for tidal wetland restoration is expected to provide increased rearing habitat and food for juvenile fish of several species, including longfin smelt (see detailed discussion of impacts under Alternative 1 above). Increasing the amount of BUDM by USACE for tidal marsh restoration through this project will increase the speed at which tidal marshes are restored in the region, thereby increasing the speed at which benefits to the species are realized.

- **NEPA Determination**: Under Alternative 2, impacts from entrainment would be considered less than significant to all fish species with implementation of Standard Practices listed in Section 2.3.1.5. With the inclusion of BUDM to restore tidal wetlands in the alternative, any impacts would be further reduced.
- **CEQA Determination**: Under Alternative 2, impacts from entrainment would be considered less than significant to all fish species with implementation of the Standard Practices listed in Section 2.3.1.5, which include the required conservation measures in the NMFS and USFWS BiOps for all special status species except longfin smelt. Entrainment impacts to longfin smelt under Alternative 2 would also be less than significant with inclusion of BUDM to restore tidal wetlands, which is included in the alternative as a minimization measure.

Alternative 3

Under Alternative 3 (refer to Section 2.3.5), the likely method of dredging would be the same as the No Action Alternative and No Project Alternative at all dredge sites except for Richmond Inner Harbor, which adds hopper dredging, and at Richmond Outer Harbor and San Pablo Bay, which add a small portion of the sites as clamshell dredging. The use of hopper dredging achieves BUDM. As the hopper dredging at Richmond Inner Harbor would be directly tied to BUDM to create tidal wetlands, this project is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt (see Section 2.3.5).

If the alternate dredging method (see Table 2-13) is used at Oakland Inner and Outer Harbor, Richmond Inner and Outer Harbor, Redwood City, Petaluma Across the Flats, and San Rafael Creek, there could be a change from clamshell dredging (likely method), which has a low risk of entrainment, to cutterhead-pipeline dredging (alternate method) which has higher risks of entrainment. Dredging activity would apply the appropriate work windows identified in Table 2-3. If the alternate dredging method is implemented at these sites, there would be a potential increase in entrainment under Alternative 3 compared to both the No Action Alternative and No Project Alternative.

The likely dredge method at Richmond Inner Harbor, Richmond Outer Harbor, San Pablo Bay, and San Bruno is or will include hopper dredging, but the alternate dredge method is clamshell dredging (Table 2-13). Additionally, at the Napa River and Petaluma River Channel dredge locations, the likely dredge method is cutterhead, but the alternate is clamshell dredging, which has a lower entrainment risk. At these sites, if the alternate dredge method is applied under Alternative 3, there would be a reduced impact to fish, particularly longfin smelt, caused by reduced entrainment from dredging.

The exposure risk of longfin smelt to entrainment from hopper dredging would be the same or similar under Alternative 3 at all sites except Richmond Inner Harbor compared to the No Action Alternative and No Project Alternative (Table 3-15). Under the No Action Alternative and No Project Alternative, Richmond Inner Harbor would use clamshell dredging, however under Alternative 3, both clamshell and hopper dredging would be implemented. As a result, there would be an increase in entrainment risk to longfin smelt under Alternative 3; however, the risk would involve 1.9 percent of the habitat for 7.6 percent of the year if maximum volumes are dredged or 3.6 percent of the year if average volumes are dredged (Table 3-15). It is important to note that most of the dredging will occur in June through July, except for the Richmond Inner Harbor which will be dredged in the December through February, depending on when the dredging vessel is available.

As described under the No Action Alternative and No Project Alternative, because of the low predicted probability of the presence of the three year-classes and the relatively low risk of exposure, there would not be a significant risk to the longfin smelt population at all sites under Alternative 3, except for Richmond Inner Harbor which will be dredged in the December through February. The predicted probability of occurrence for age-1 longfin smelt based on otter trawl data in Central SF Bay during this time would be around 0.23 in November to approximately 0.2 in January (Tobias and Baxter 2023). The predicted probability of occurrence for age-2 longfin smelt based on otter trawl data in the Central SF Bay during this time would be around 0.1 in November to approximately 0.12 in January (Tobias and Baxter 2023).

Alternative 3 includes BUDM to restore tidal wetlands as a minimization measure for longfin smelt entrainment impacts from dredging, as well as providing additional benefits from BUDM consistent with the objectives of the project. Increasing BUDM for tidal wetland restoration is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt (see the discussion of impacts under Alternative 1). Increasing the amount of BUDM by USACE for tidal marsh restoration through this project will increase the speed at which tidal marshes are restored in the region, thereby increasing the speed at which benefits to the species are realized.

- **NEPA Determination**: Under Alternative 3, impacts from entrainment would be considered less than significant to all fish species with implementation of Standard Practices listed in Section 2.3.1.5. With the inclusion of BUDM to restore tidal wetlands in the alternative, any impacts would be further reduced.
- **CEQA Determination**: Under Alternative 3, impacts from entrainment would be considered less than significant to all fish species with implementation of the Standard Practices listed in Section 2.3.1.5, which include the required conservation measures in the NMFS and USFWS BiOps for all special status species except longfin smelt. Entrainment impacts to longfin smelt under Alternative 3 would also be less than significant with inclusion of BUDM to restore tidal wetlands, which is included in the alternative as a minimization measure for entrainment impacts to longfin smelt.

Alternative 4

Under Alternative 4, the likely method of dredging at most sites would be mechanical dredging, as compared to the No Action Alternative and No Project Alternative, which would result in an overall decrease in fish entrainment. Those sites at which hydraulic dredging would occur, whether as the likely or alternate dredge method, would be in the MSC, Petaluma River Channel and Petaluma Across the Flats, and San Bruno, where the risk to the more sensitive fish species such as longfin smelt are lower. Alternative 4 includes BUDM, which will offset longfin smelt entrainment impacts from dredging, as well as providing additional benefits from BUDM consistent with the objectives of the project. Increasing BUDM for tidal wetland restoration is expected to provide increased rearing habitat and food for juvenile fish of many species, including longfin smelt (see the discussion of impacts under Alternative 1 above).

The exposure risk of longfin smelt to entrainment from hopper dredging would be lower under Alternative 4 compared to the No Action Alternative and No Project Alternative (Table 3-15).

- **NEPA Determination**: Under Alternative 4, impacts from entrainment would be considered less than significant.
- **CEQA Determination**: Under Alternative 4, impacts from entrainment would be considered less than significant. With the inclusion of BUDM to restore tidal wetlands in the alternative, any impacts would be further reduced.

3.3.4.2 Impact BI-2: Potential Effects of Increased Turbidity Caused by Maintenance Dredging and Dredged Material Placement on Special-Status Species, and Commercially Valuable Marine Species

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Prolonged exposure to high levels of suspended sediment and turbidity resulting from dredging and placement of dredged material could create a loss of visual capability in fish in aquatic habitats within the study area. This in turn could lead to reduced feeding capabilities and growth rates, a thickening of gills, potential loss of respiratory function, clogging and abrasion of gills, and increased stress levels, reducing the tolerance of fish to disease and toxicants (Newcombe and Jensen 1996; Waters 1995; Wilber and Clark 2001). Prolonged exposure to suspended sediments has been shown to affect fish behavior, including avoidance responses, territoriality, feeding, and homing behavior. It can cause the movement and redistribution of fish populations. Marine mammal foraging activities may be affected through reduced visibility or the relocation of prey.

A turbid environment may provide some advantages to small fish, which may be able to feed effectively in turbid conditions because the distances over which they react to prey are very short (e.g., a scale of millimeters) (Pangle et al. 2012; Utne-Palm 2002). In contrast, larger species, often predatory ones, often hunt primarily using eyesight. These fish would experience more difficulties in foraging effectively for prey species in highly turbid water. Most juvenile and adult fish are motile enough to avoid areas of unsuitably high turbidity plumes caused by dredging, although eggs and larvae may experience greater impacts. Avoidance of adverse habitat conditions by fish is the most common result of increases in turbidity and sedimentation. Fish will not occupy areas unsuitable for survival unless they have no other option.

Organisms that are associated with muddy bottoms are more tolerant of higher suspended sediment; tolerance of higher suspended sediment decreases with increasing water temperatures or decreasing dissolved oxygen (Hirsch et al. 1978). Hirsch et al. (1978) found that the aquatic organisms they assessed in a dredging study were resistant to the effects of suspended sediment and dredging-induced turbidity. However, some life stages are more sensitive to suspended sediments than others. Pacific herring and northern anchovy eggs could be affected if spawning (November through April for herring, May and June for anchovy) occurred in the area just before or during maintenance dredging activities. Eggs and larval fish are more sensitive to suspended sediments (Kjelland et al. 2015).

During dredging operations, the use of the dredge equipment on the dredged material resuspends sediment into the water column. Hydraulic dredges (i.e., hopper and cutterhead-pipeline) typically results in lower levels of disturbance and resuspension of sediments at a dredging site compared to mechanical (i.e., clamshell) dredges. The placement of dredged material in the aquatic environment also creates a turbidity plume as the dredged material travels downward. USACE studies show that turbidity plumes at placement sites last only 20 minutes, and plume duration is even less during placement of sandy material because its coarse sediments settle out of the water column more quickly than finer sediments (USACE 2003; USACE et al. 1998). Dredging would result in localized and temporary increases in turbidity at both the dredge locations and placement sites.

Table 3-15 shows the maximum volumes dredged for all alternatives for each likely dredging method. Clamshell dredging is the main dredging method used by volume of material dredged under the No Action

Alternative, No Project Alternative, Alternative 1, Alternative 3, and Alternative 4; hopper dredging is used for a slightly higher volume of material dredged than clamshell dredging under Alternative 2. As described earlier, clamshell dredging would have higher levels of resuspended sediments and turbidity than hydraulic dredging.

Table 3-15. Maximum Volume Dredged in Cubic Yards for Each Likely Dredging Method

Dredge Method	No Action	No Project	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Clamshell	3,630,000	3,630,000	3,630,000	2,655,000	3,165,000	4,920,000
Cutterhead	375,000	375,000	375,000	375,000	375,000	375,000
Hopper	1,935,000	1,935,000	1,935,000	2,910,000	2,400,000	645,000

Under the No Action Alternative and No Project Alternative, a maximum annual volume of 1,124,000 CY of material would be placed at in-Bay sites (SF-9, SF-10, SF-11, and SF-16), 421,500 CY at the ocean beneficial use site (SF-17), 281,000 CY at in-water ocean sites, 1,545,500 CY at the SF-DODS, and no material placed at the non-aquatic beneficial use sites. Increased suspended sediment and turbidity would occur during the in-Bay and ocean material placement.

Under Alternative 1, compared to the No Action Alternative and No Project Alternative, dredging activities would be similar. There would be an increase in the maximum in-Bay sediment material placement of up to 409,500 CY spread throughout the four in-Bay placement sites. There would be no change in the volume of material placed in the in-ocean sites, and the sponsor-provided upland sites, and a decrease in SF-DODS material placement by up to 409,500 CY. Under Alternative 1, there would be an increase of 546,000 CY of material placed at the non-aquatic beneficial use sites. Dredging and material placement under Alternative 1 would result in short-term and localized increases in turbidity at both the dredge locations and placement sites; the effects of turbidity to aquatic species would be similar to the No Action Alternative and No Project Alternative.

Compared to the No Action Alternative and No Project Alternative, there would be an increase in the maximum in-Bay sediment material placement of up to 546,000 CY spread throughout the four in-Bay placement sites for Alternative 2. There would be no change in the volume of material placed in the upland (sponsor-provided) sites, in-ocean sites, and ocean beneficial use sites., and a decrease in SF-DODS material placement by up to 1,228,500 CY. Under Alternative 2, there would be up to 819,000 CY of sediment material placed at the non-aquatic beneficial use sites. Dredging and material placement under Alternative 2 would result in short-term, and localized increases in turbidity at both the dredge locations and placement sites and the effects of turbidity to aquatic species would be similar to the No Action Alternative and No Project Alternative.

Under Alternative 3, compared to the No Action Alternative and No Project Alternative, there would be an increase in-Bay sediment material placement of up to 136,500 CY spread throughout the four in-Bay placement sites. There would be no change in the volume of material placed in the upland sponsor-provided sites, in-ocean sites, ocean beneficial use sites, and SF-DODS placement would decrease by up to 1,228,500 CY. Under Alternative 3, there would be a maximum of 1,228,500 CY of sediment placed at the non-aquatic beneficial use sites. Dredging and material placement would result in short-term and localized increases in turbidity at both the dredge locations and placement sites that are similar to the No Action Alternative and No Project Alternative; therefore, the effects of turbidity to aquatic species would be similar to the No Action Alternative and No Project Alternative. The effects of turbidity on aquatic species would be similar to the No Action Alternative and No Project Alternative.

Under Alternative 4, compared to the No Action Alternative and No Project Alternative, there would be a substantial decrease in in-Bay sediment material placement of up to 819,000 CY spread throughout the four in-Bay placement sites. There would be no change in the volume of material placed in the upland sponsor-provided sites, in-ocean sites, ocean beneficial use sites, and SF-DODS placement would decrease by up to 1,228,500 CY. Under Alternative 4, there would be up to 2,047,500 CY of material placed at non-aquatic beneficial use sites and up to 409,500 CY placed at potential future nearshore strategic placement sites.

There would be increased potential for BUDM placement (e.g., non-aquatic direct placement, nearshore strategic placement, elevation augmentation/marsh spraying, and/or water column seeding) under Alternative 4. In general, sediment placed from scows settles rapidly, and any temporary increases in turbidity would be dispersed from the placement area by the broader open water in the Bay (USACE and Regional Water Board 2023). BUDM placement under this alternative could directly result in beneficial effects to water quality by augmenting the local supply of sediment available to support accretion in mudflats and tidal wetlands, which in turn may provide long-term, localized water quality benefits such as filtration functions and associated decrease in turbidity.

Dredging and material placement under all alternatives would result in short-term and localized increases in turbidity at both the dredge locations and placement sites. Temporary sediment plumes caused by in-water material placement could reduce food availability and foraging success for fish and marine mammals in close proximity to the placement sites. However, these species will likely avoid the plumes (USACE et al. 1998) and forage in unaffected areas near the placement sites. Therefore, any temporary reduction in food supply and foraging success would be minor, and there would be no significant long-term effects to pelagic-based food resources because of the rapid recovery predicted in these communities, the small area affected, and the short time frame in which they would be affected.

Total suspended solids levels in the Estuary vary from 10 to more than 100 milligrams per liter (SFEI 2011). In general, higher total suspended solids result in more turbid water. The Estuary and Delta are naturally turbid because wind, waves, and tides cause the resuspension of sediments. Increased sediment concentrations reduce ultraviolet light penetration which decreases aquatic biological productivity. The impact of turbidity on phytoplankton productivity due to decreased light transmission would depend largely on the difference between background turbidity and increased turbidity from dredged material when dredging takes place. Increased turbidity effects from dredging are short-term, minor, and greatly diminished with distance from the activity. In SF Bay, turbidity plumes would be quickly diluted to near or within background particulate concentrations.

No significant long-term effects to pelagic-based food resources are expected because of the rapid recovery expected in these communities and the small area affected relative to the overall volume of pelagic feeding habitat available in Suisun Bay, San Pablo Bay, and SF Bay. The Regional Water Board has implemented the SF Bay Regional Monitoring Program (RMP) for trace substances since 1992. The

SF Bay Regional Monitoring Program with the goal of monitoring water and sediment quality to provide the scientific foundation for managing and improving the health of the SF Bay aquatic ecosystem. USACE is a participant in the RMP and contributes to the program by funding USGS to monitor suspended sediments at an array of locations in the Bay.

Habitat as well as individual fish could be impacted by changes in suspended sediment. Increased turbidity and activity during dredging may disturb marine mammal foraging activities by decreasing visibility or causing the relocation of mobile prey from the area affected by the sediment plume. However, marine mammals would not be substantially affected by dredging operations because of the increased turbidity and dredging disturbance would be short term, and because they forage over large areas of SF Bay and the Pacific Ocean.

Leatherback turtle presence in the study area is rare, even though they have designated critical habitat along the Pacific Coast. Thus, impacts on leatherback turtle and their critical habitat are not anticipated.

- **NEPA Determination**: Under all alternatives, impacts from turbidity on aquatic species would be considered less than significant.
- **CEQA Determination**: Under all alternatives, impacts from turbidity on aquatic species would be considered less than significant.

3.3.4.3 Impact BI-3: Potential Effects on Fish and Marine Mammals Caused by Noise from Dredging Activities

No Action Alternative/No Project Alternative

Mechanical and hydraulic dredges produce a complex combination of repetitive sounds that may be intense enough to cause adverse effects on aquatic organisms though the intensity, periodicity, and spectra of emitted sounds differ among the dredge types and the substrate being dredged. Clamshell dredges have a repetitive sequence of sounds generated by the winches, bucket impact with the substrate, the closing and opening the bucket, and sounds associated with dumping the dredged material into the barge. The most intense sound impacts are produced during the bucket's impact with the substrate, with peak sound pressure levels (SPL) of 124 decibels (dB) measured 150 meters from the bucket strike location (Dickerson et al. 2001; Reine et al. 2002). Underwater noise is also generated by hydraulic dredging equipment, including rotating cutter heads, pumps, propellers, suction pipes, and the drag head contacting the channel bottom. Noise produced by hopper dredges fluctuates; the most intense sounds are produced during loading or unloading. While underway, continuous noise from hopper dredges operating in a variety of environments has been measured to range from 125 to 150 dB (Reine et al. 2012). A hydraulic cutterhead dredge can produce continuous noise in the range of 150 to 170 dB when measured 10 meters from the cutterhead (California Department of Water Resources 2013), with noise levels varying with dredge size and sediment type. This is comparable to underwater noise levels of 160 to 180 dB root mean square (RMS) produced by small boats and ships (Marine Aggregate Levy Sustainability Fund 2009).

The scientific knowledge of the effects of dredge-generated noise and sound waves on fishes is limited and varies depending on the species. Effects may include behavioral changes, neurological stress, and temporary shifts in hearing thresholds. Injury to fish from peak noise (e.g., rupture of swim bladder) is not expected to occur, but behavioral effects (e.g., changes in feeding behavior, fleeing, startle responses) could occur. All fish, listed or otherwise, would experience the same effects. In comparison, commercial shipping vessels can produce continuous noise in the range of 180 to 189 dB (Reine and Dickerson 2014). Although dredging could produce underwater noise, it is comparable to that produced by commercial shipping vessels, which are common in the study area. Juvenile and adult fish likely would avoid areas of noise and disturbance from dredging operations.

For marine mammals, NMFS criteria define exposure to underwater noises from impulse sounds at or above 160 dB RMS and continuous sounds at or above 120 dB as constituting harassment to marine mammals. NMFS has also determined that noises with SPLs above 180 dB RMS can cause injury to cetaceans (whales, dolphins, and porpoises), and SPLs above 190 dB RMS can cause injury to pinnipeds (seals and sea lions). Although noise from dredging (up to 170 dB for cutterhead) can exceed 120 dB level for continuous sounds constituting harassment of marine mammals, it is within the range of ambient noise resulting from commercial shipping and recreational boating within the study area.

- **NEPA Determination**: Under the No Action Alternative, impacts on fish and marine mammals from noise would be considered less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts on fish and marine mammals from noise would be considered less than significant.

Alternatives 1 through 4

Impacts on fish and marine mammals caused by noise would be similar under Alternatives 1 through 4 to the impacts under the No Action Alternative and No Project Alternative.

- **NEPA Determination**: Under Alternatives 1 through 4, impacts on fish and marine mammals from noise under Alternatives 1 through 4 would be less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts on fish and marine mammals from noise under Alternatives 1 through 4 would be less than significant.

3.3.4.4 Impact BI-4: Potential Effects of Maintenance Dredging and Material Placement on Benthic Habitat

No Action Alternative/No Project Alternative

Dredging would directly impact benthic communities through physical disruption and direct removal of benthic organisms. Benthic habitat within the federal channels is highly disturbed because of regular maintenance dredging and the propeller wash of ship traffic. Material that is dredged on an annual basis is typically new material that has redistributed to the dredge sites between dredging operations. Organisms in or immediately adjacent to the dredged channels and placement sites may be lost because of smothering or burial from sediments resuspended in the water column during the dredging.

Critical habitat for delta smelt, green sturgeon, Chinook salmon, leatherback turtle, and EFH for commercially valuable fish species overlaps with some or all of the estuarine/marine portions of the project areas. Benthic habitat can be an important part of critical habitat for some species by providing foraging areas, especially for Chinook salmon and green sturgeon. Because delta smelt feed in the water column, benthic habitat provides less of a function. Similarly, leatherback turtles forage in open waters and do not rely on benthic habitat. The loss of benthic invertebrates during dredging activities may decrease the forage value of critical habitat at the dredge location.

Following sediment-disturbing activities such as dredging or the placement of dredged material, disturbed areas are usually recolonized quickly by benthic organisms (Newell et al. 1998). The species that recolonize first are usually characterized by rapid growth and reproduction rates. Marine benthic invertebrates often colonize disturbed sedimentary habitats via pelagic larvae that settle from the water column. Crustaceans, such as the amphipods that are abundant in SF Bay, brood young to much more advanced stages than pelagic larvae, releasing what are essentially miniature adults into the sediment, and can rapidly colonize adjacent disturbed areas. Recovery may be slower in deepwater channels; therefore, there is potential for some loss of habitat and forage to organisms that use deepwater channels. This potential is minimal because the federal deep-draft navigation channels are in a constant state of disturbance by deep-draft vessels that travel through the channels at a maximum of 15 knots under their own power. The benthos of these highly used channels, which are dredged annually, is in a constant state of disruption. The potential for habitat loss in channels that are dredged less frequently would be slightly greater, but still small due to disruption of benthos from frequent vessel traffic.

Studies have indicated that even relatively large areas disturbed by dredging activities are usually recolonized by benthic invertebrates within one month to one year, with original levels of biomass and abundance developing within a few months to between one and three years (Newell et al. 1998). Following dredging, disturbed areas are recolonized, beginning with mobile and opportunistic species (Lenihan and Oliver 1995; Oliver et al. 1977). These species, characterized by rapid growth and reproduction, may or may not be the same species that were present in the area prior to the disturbance. SF Bay holds more nonindigenous benthic invertebrate species than any other aquatic ecosystem in North America (Cohen and Carlton 1995). The introduced species range from approximately 20 to 80 percent of all species present (Lee et al. 1999), depending on the area of SF Bay; recolonization would likely include nonindigenous species already present in the area.

During in-water placement in SF Bay, benthic organisms would suffer burial followed by prolonged exposure to anaerobic conditions after the dumping has ceased. This would result in mortality of most of the organisms in the burial footprint; however, this would be a short-term effect because benthic habitat is quickly recolonized. The existing benthic communities at the in-Bay placement sites have, over the years, reached an equilibrium that adjusts to the periodic placement of dredged material. Similarly, placement of dredged material (i.e., sand) at SF-17, SF-8, and along beach and intertidal habitat of Ocean Beach would cause temporary disturbance to benthic organisms; however, both the nearshore and the shore environment along the coast of Ocean Beach are dynamic and high-energy environments that experience rapid sediment flux. Organisms that inhabit sandy intertidal and subtidal habitat have adaptations for surviving in areas of high sediment flux. Although placement operations would cause burial of the less mobile benthic community, the impact of those operations will be episodic and short term. Studies on impacts of beach nourishment activities on the invertebrate community have shown that recovery of the benthic community at the beach and intertidal habitat generally takes place on the order of a few weeks to months (USACE 2013c). Disturbance to benthic communities would occur in areas that have been previously dredged. USACE would continue to implement Standard Practices intended to minimize the impacts of dredging and placement on the marine environment, which would further minimize limited-duration impacts. Because of this, and evidence that benthic communities recovery quickly, impacts are anticipated to be less than significant under all alternatives.

Under the No Action Alternative and No Project Alternative, there would be less-than-significant impacts on the aquatic communities resulting from the disturbance to benthic habitat resulting from dredging operations and substrate materials placement.

- **NEPA Determination**: Under the No Action Alternative, impacts caused by a loss of benthic habitat would be less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts caused by a loss of benthic habitat would be less than significant.

Alternatives 1 Through 4

Impacts on fish and benthic invertebrates caused by a loss of benthic habitat would be similar under Alternatives 1 through 4 as would occur under the No Action Alternative and No Project Alternative. As described above for the No Action Alternative/No Project Alternative, studies indicate that even relatively large areas disturbed by dredging activities are usually recolonized by benthic invertebrates within one month to one year, with original levels of biomass and abundance developing within a few months to between one and three years (Newell et al. 1998). Additionally, while placement operations under Alternatives 1 through 4 may cause short-term, episodic burial of the less mobile benthic community, benthic habitats are quickly recolonized.

- **NEPA Determination**: Under Alternatives 1 through 4, impacts caused by a loss of benthic habitat under would be less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts caused by a loss of benthic habitat under Alternatives 1 through 4 would be less than significant.

3.3.4.5 Impact BI-5: Potential Effects Caused by Non-aquatic Beneficial Use of Dredged Material Placement

No Action Alternative/No Project Alternative

Under the No Action Alternative and No Project Alternative, there would be no Non-aquatic BUDM placement unless dredging occurs outside the approved work window or BUDM was used as mitigation for entrainment impacts to longfin smelt under Mitigation Measure BI-1. With the null or limited extent of BUDM upland placement under the No Action Alternative/No Project Alternative, the time required to complete wetland restoration actions in SF Bay (estimated to be two to 25 years faster depending on initial sediment volumes added to reach vegetation establishment elevation [Dougherty et al. 2024]) may be delayed due to sediment needs. Accordingly, the beneficial effects on wetland habitats and species from Non-aquatic BUDM placement contributed by USACE (the largest dredger in the Bay by volume) would not occur under the No Action Alternative and No Project Alternative.

- **NEPA Determination**: Under the No Action Alternative, impacts caused by BUDM placement would be less than significant.

- **CEQA Determination**: Under the No Project Alternative, impacts caused by BUDM placement would be less than significant.

Alternatives 1 Through 4

Alternatives 1 through 4 will contribute substantial dredged material that may be placed at non-aquatic beneficial use sites for wetland restoration in SF Bay, San Pablo Bay, and Suisun Bay. This is expected to occur at Cullinan Ranch and Montezuma Wetlands in the immediate future, while other sites come online. Wetlands are well known to be highly productive, and beneficial use/wetland restoration actions are expected to contribute to food resources used by special-status species including longfin smelt, delta smelt, Chinook salmon, and California least tern and to provide refugia from predators. Additionally, these locations may be important for spawning and rearing for Delta species. For example, longfin smelt have been detected by University of California-researchers either through eDNA or physical trawl sampling at restored wetland sites: Hamilton Wetlands, Sonoma Baylands, and Tolay Creek (Bowen et al. 2024). Although the amount of increased food production or number of additional fish and invertebrates, particularly prey species, that may result from USACE’s contribution of sediment to beneficial use sites is difficult to estimate, those benefits are certain to result from substantially increasing the scale and pace of Bay tidal marsh restorations in response to future changed conditions. Restoring large and small-scale wetlands will provide resiliency to special-status fish and bird populations through consistent availability of high-quality habitat in the future. Restoration of tidal salt marsh habitat will also create additional habitat for salt marsh harvest mouse and Ridgway’s rail.

Water temperatures are expected to significantly increase in the Estuary over time. Temperature changes are projected to be most prominent in Suisun Bay, where the number of days above 22 degrees Celsius (the upper limit for all post-larval life stages) could more than double, forcing age-0 longfin smelt to trade Estuary rearing time for ocean rearing time if they can do so successfully, and forcing delta smelt farther upstream to less suitable rearing habitat. There is high uncertainty about future spawning opportunity for longfin smelt and delta smelt; future conditions could range from unhelpful from a species conservation perspective to potentially catastrophic. As a cold water species at the southernmost portion of its range, the longfin smelt Delta DPS is likely already avoiding water temperatures above its physiological tolerance during the summer months. Further increases in water temperature could mean extended summer-like conditions in which Suisun Bay and the Delta would be inhospitable for the species.

The effects of future increased water surface levels on the Estuary will result in salt- and freshwater marsh losses and salinity intrusion. Many of the marshes currently used by longfin smelt and delta smelt could be inundated and lost by the end of the century, potentially resulting in lower suitability of remaining open-water habitats. The salinity intrusion, if not sufficiently abated by increasing reservoir releases and export reductions (thereby extending already stretched water supplies), would likely shift X2 (i.e., the location in the Delta where the tidally averaged salinity is 2 ppt) eastward. The upstream shift in X2 could lengthen the spawning migration of adult longfin smelt, and the salinity increase could render San Pablo Bay and Suisun Bay more frequently inhospitable to longfin smelt larvae as well as delta smelt juveniles and adults, substantially reducing suitable habitat.

The individual beneficial use sites have accounted for many benefits of wetland restoration through their respective ESA consultations, however, the consideration of future resiliency benefits of wetland restorations to species was likely not included. The beneficial effects on wetland habitats and species from BUDM placement contributed by USACE are expected to accrue not only from the reduction in time required to complete a restoration action (estimated to be 2 to 25 years faster depending on initial sediment volumes added to get to vegetation establishment elevation [Dougherty et al. 2024]), but also because the inherent value of intact and resilient wetland habitat may be expected to increase in the future.

- **NEPA Determination**: Under Alternatives 1 through 4, impacts caused by BUDM placement would be beneficial.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts caused by BUDM placement under would be less than significant.

3.3.4.6 Impact BI-6: Potential Effects Caused by the Resuspension of Contaminated Sediments

No Action Alternative/No Project Alternative

Dredging disturbs aquatic habitats and fish and benthic organisms by resuspending bottom sediments, which recirculates any toxic metals, hydrocarbons, pesticides, pathogens, and nutrients that may be present into the water column. Toxic metals and organics, pathogens, and viruses, absorbed or adsorbed to fine-grained particulates that are in the sediment may become biologically available to organisms either in the water column or the food chain. Most contaminants, however, are not easily released during short-term resuspension because they are tightly bound in the sediments. Dredged sediment from locations such as San Pablo Bay and Suisun Bay Channel typically have a high sand content and do not bind well with contaminants, particularly metals, and therefore do not contain high levels of contaminants.

Sediments are regularly tested, and all dredging is conducted in compliance with water quality standards. USACE will avoid, when possible, areas identified as having sediment that is not suitable for unconfined aquatic disposal (NUAD); if future testing identifies NUAD material that needs to be dredged, it will be placed at upland sites. Sediment bioaccumulation testing will be regularly conducted during dredging activities.

Under the No Action Alternative, annual dredging at most sites is not expected to increase contaminant concentrations above baseline levels. Similarly, under the No Project Alternative, annual or biennial dredging at most sites is also not expected to raise contaminant concentrations beyond baseline conditions.

The Napa River, Petaluma River, and San Rafael Creek sites—located farther upstream—are also dredged every four to six years due to slower sediment deposition rates. As a result, their less frequent dredging is expected to produce similar impacts to more frequent dredging at other locations. The Petaluma Across the Flats site and San Rafael Across the Flats site are dredged approximately every four to six years, as well and is expected to have similar environmental effects as sites dredged annually or biennially.

The San Bruno dredging site, while only dredged every 23 years, has a very small volume (30,000 CY) removed, and would only disturb a small portion of Estuary.

In the 2011 EFH conservation measures for the LTMS program that were agreed upon by NMFS, USACE and USEPA (USACE and USEPA 2011), agreed to collect and analyze residual samples, that is, a 6-inch layer below the permitted overdraft of the sediment surface that is exposed once dredging is complete. If the residual layer contamination exceeds the overlying sediment and thus exceeds trigger values, there will be consideration taken for potential management actions to address the residual contamination on a case-by-case basis.

Any potential short-term resuspension of contaminated sediments would have short-term effects and be localized on aquatic species in contact with the resuspended contaminated sediments. USACE would implement best management practices (BMPs) and comply with water quality protection measures included as conditions to the WQC issued by the Regional Water Board and would continue to implement BMPs to minimize the potential for water quality degradation that could impact aquatic organisms. Thus, impacts on aquatic species would be less than significant.

- **NEPA Determination**: Under the No Action Alternative, impacts caused by a resuspension of contaminated sediments would be less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts caused by a resuspension of contaminated sediments would be less than significant.

Alternatives 1 Through 4

Under Alternatives 1 through 4, impacts on aquatic fauna caused by a resuspension of contaminated sediments would be similar to those under the No Action Alternative and No Project Alternative.

- **NEPA Determination**: Under Alternatives 1 through 4, impacts caused by a resuspension of contaminated sediments would be less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts caused by a resuspension of contaminated sediments would be less than significant.

3.3.4.7 Impact BI-7: Potential Interference of Migratory Passage for Fish, Seabirds, and Marine Mammals

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

There would be no structures such as breakwaters proposed; therefore, there would be no permanent interference with the movement of resident or migratory fish, seabirds, or marine mammals under the No Action Alternative or the No Project Alternative. Additionally, the footprint of each dredging operation and material placement operation is small (affecting a fraction of the channel width) with localized impacts, and the area actively dredged at any one time is very small compared to the total amount of habitat available. Migratory passage for fish, seabirds, and marine mammals could be affected by changes in noise or turbidity, but as described in Impacts B2 and B3, these impacts would be less than significant. Therefore, impacts on migratory passage of aquatic species would be minimal.

- **NEPA Determination**: Under all alternatives, impacts on migratory passage of fish, seabirds, and marine mammals would be considered less than significant.

- **CEQA Determination**: Under all alternatives, impacts on migratory passage of fish, seabirds, and marine mammals would be considered less than significant.

3.3.4.8 Impact BI-8: Potential Effects of Dredging Activities on Roosting, Nesting, and Foraging Avian Species

No Action Alternative/No Project Alternative

Dredging and transportation and placement of dredged material may temporarily disturb foraging and resting avian species, thereby increasing energetic output due to increased flight times and startle response. However, the navigation channels that will be used for the Proposed Project are in areas of existing high human activity. Noise resulting from dredging and the transportation and placement of dredged material would not be expected to exceed ambient conditions, and the disruption from these activities would not likely exceed the existing human disturbance to which birds in these areas are accustomed (USACE and Regional Water Board 2015).

As discussed in Section 3.3.4.2, increased turbidity from dredging and placement of dredged material can result in reduced visibility and could potentially affect foraging success of waterbirds and shorebirds. This disturbance, however, is temporary and localized. USACE studies show that turbidity plumes at placement sites persist for approximately 20 minutes. During the placement of sandy material, the duration of these plumes is even shorter due to the rapid settling of coarse sediments (USACE 2003; USACE et al. 1998). Therefore, birds are not expected to be adversely affected by dredging and placement activities because spikes in turbidity will be temporary and localized, and noise and disturbance from these activities are not expected to exceed existing conditions. Work window restrictions are implemented to further reduce the potential to impact listed species described below.

California Least Tern

Dredging activities occur in areas where ambient noise levels are already elevated due to vessel activity. California least terns that occur in locations where dredging is required to facilitate shipping traffic already experience elevated levels of anthropogenic noise and disturbance. Noise produced from dredging activities is not expected to exceed ambient conditions and is not expected to substantially impact California least terns (H.T. Harvey and Associates 2012). The 1999 USFWS LTMS delta smelt BiOp identifies turbidity as potentially negatively affecting California least tern foraging success by decreasing visual detection of fish species (USFWS 1999). However, given the short duration of turbidity plumes generated by dredging, the overall impact may not be significant (H.T. Harvey and Associates 2012). The work windows for portions of SF Bay are intended to minimize potential impacts from turbidity effects on foraging success during the California least tern nesting season when prey species are at critical life states (USACE et al. 1998). The work window for California least terns from within one mile of the coastline from the Berkeley Marina south to San Lorenzo Creek is August 1 through March 15 each year. If USACE should need to dredge outside the work window for California least tern in any year covered by this EA/EIR, USACE would initiate additional consultation with USFWS to obtain written authorization to work outside the window.

Western Snowy Plover

Noise produced from dredging activities is not expected to exceed ambient conditions and is not expected to substantially impact western snowy plover. Nearshore or upland disposal of dredged material could result in the loss of habitat. Consultation with the USFWS will be required for any placement activities that will result in the loss of suitable western snowy plover habitat, including mudflat foraging habitat (USACE et al. 1998). The Snowy Plover Protection Area on Ocean Beach provides a protection zone for western snowy plovers overwintering there. Beach nourishment in this area would be designed so that it would not interfere with the Snowy Plover Protection Area. Any placement activities at Ocean Beach (SF-17) would be limited to a narrow corridor along the eastern edge of the Snowy Plover Protection Area. Based on historical monitoring and habitat preferences, it was determined that use of this travel corridor would minimize disturbance to western snowy plovers (SFPUC 2012).

Ridgway's Rail

Ridgway's rails are highly sensitive to noise disturbance during the nesting season. This species is known to occur in the salt marsh habitat near the San Leandro Marina and nearby along the Estudillo Canal. They are also known to be present in tidal marsh habitat near the San Rafael Creek Inner Canal Channel. The USFWS considers all potential habitat to be occupied unless species-specific surveys from that year have confirmed absence. To minimize potential impacts, the USFWS BiOp on the LTMS program specifies that dredging activities shall not occur within 250 feet of potential Ridgeway's rail habitat during the nesting season (February 1 through August 31) (USACE et al. 1998; USFWS 1999).

- **NEPA Determination**: Under the No Action Alternative, impacts on avian roosting, nesting, and foraging caused by dredging activities would be less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts on avian roosting, nesting, and foraging caused by dredging activities would be less than significant.

Alternatives 1 Through 4

Under Alternatives 1 through 4, impacts on avian roosting, nesting, and foraging caused by dredging activities would be similar as those under the No Action Alternative and No Project Alternative.

- **NEPA Determination**: Under Alternatives 1 through 4, impacts on avian roosting, nesting, and foraging caused by dredging activities would be less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts on avian roosting, nesting, and foraging caused by dredging activities would be less than significant.

3.3.4.9 Impact BI-9: Potential Disturbance of **Essential Fish Habitat and "Special Aquatic Sites"** Including Eelgrass Beds and Mudflats

No Action Alternative/No Project Alternative, Alternatives 1 and 4

Under one or more FMPs, the entire project area in the Pacific Ocean or Estuary is classified as EFH. The LTMS program's environmental protectiveness is improved by several conservation measures included in the programmatic EFH agreement that was finalized in 2011. For USACE maintenance dredging in SF Bay conducted in compliance with the guidelines specified by the official programmatic federal EFH consultations for the LTMS, no additional EFH consultation is necessary.

Eelgrass beds and mudflats are regarded as special aquatic areas and are subject to jurisdiction by Section 66605 of the McAteer-Petris Act, State Policy for Water Quality Control: State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State (State Procedures) (State Water Resources Control Board 2021), and Section 404 of the CWA. Eelgrass beds and estuaries are also considered “habitat areas of particular concern,” a subset of EFH (see Section 3.3.2.4).

Eelgrass provides essential food and habitat for a variety of species. It also serves as nursery habitat for young fish and foraging areas for many species of fish, invertebrates, and birds. Eelgrass is protected under the CWA Section 404(b) (1) “Guidelines for Specification of Disposal Sites for Dredged or Fill Material,” Subpart E, “Potential Impacts on Special Aquatic Sites” and has been identified as EFH for various life stages of fish species managed by FMPs under the Magnuson-Stevens Act, as established by NMFS. While eelgrass is present near the Richmond Inner Harbor Channel and Oakland Inner Harbor, it does not occur within the dredging channel boundaries.

Eelgrass in areas next to or downstream from dredging operations may be indirectly impacted by turbidity and increased sedimentation. Dredging-related turbidity plumes may temporarily impede light transmission into the water column. Since light penetration in the water column is essential to eelgrass growth and survival, variations in water quality and turbidity can readily impact them. The viability of eelgrass in beds next to dredging activities may also be impacted by sediment that settles on eelgrass blades. However, turbidity effects from dredging are anticipated to be confined and transient, as described in Impact BI-2. Eelgrass surveys before and after dredging suggest that yearly maintenance dredging operations in Oakland Harbor and Richmond Harbor did not appear to be having a negative impact on eelgrass habitat (see Section 3.3.2.4).

Mudflats offer shallow-water habitat for young fish and are vital foraging places for shorebird species. Activities related to placement and dredging for maintenance would not result in the loss of mudflat land. There would be no disturbance to sensitive ecosystems (such marshes and mud flats) that are close to federal navigation channels.

Dredged material placement at SF-DODS would not affect the Gulf of Farallones National Marine Sanctuary; the barge route is south of the sanctuary limit to prevent spillage of scow material in this unique aquatic habitat.

- **NEPA Determination.** The potential impact on EFH or special aquatic sites, including eelgrass beds and mudflats, under the No Action Alternative, No Project Alternative, and Alternatives 1 and 4 would be less than significant.
- **CEQA Determination.** The potential impact on EFH or special aquatic sites, including eelgrass beds and mudflats, under the No Project Alternative, and Alternatives 1 and 4 would be less than significant.

Alternatives 2 and 3

Under Alternatives 2 and 3, hopper dredging would be conducted at Richmond Inner Harbor and Oakland Inner Harbor. Hopper dredging would result in reduced levels of sedimentation than mechanical dredging and thus result in reduced impacts compared to the No Action Alternative and No Project Alternative. There would be less-than-significant impacts to EFH or special aquatic sites, including eelgrass beds and mudflats.

- **NEPA Determination:** The potential impact on EFH or special aquatic sites, including eelgrass beds and mudflats, under Alternatives 2 and 3 would be less than significant.
- **CEQA Determination:** The potential impact on EFH or special aquatic sites, including eelgrass beds and mudflats, under Alternatives 2 and 3 would be less than significant.

3.3.4.10 Impact BI-10: Potential Effects of Dredging Resulting in the Increase Spread of Invasive Non-Native Species

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Under the No Action Alternative and No Project Alternative, dredging vessels would be transported from other locations outside the project area, resulting in the potential to transfer non-native species into the Estuary. Ballast water of vessels can carry larval non-native species, and if the ballast water is released into the Estuary, the non-native larval species have the potential to be released and establish in the SF Bay ecosystem. The USCG requires ships carrying ballast water to implement a ballast water management and reporting program, and, without jeopardizing the safety of the crew, exchange the ballast water with mid-ocean water or use an approved form of ballast water treatment before releasing ballast water in any US port. Dredge equipment would comply with these regulations, as appropriate.

Beneficial use and upland placement site operators are responsible for managing the placement of dredged material in accordance with the requirements of their permits and other regulatory requirements and approvals, including measures to minimize the spread of invasive non-native species.

Because of the regulatory requirements and measures in place, the project would not be expected to cause a substantial spread of invasive non-native species.

- **NEPA Determination:** Under all alternatives, impacts caused by the introduction of invasive non-native species would be considered less than significant.
- **CEQA Determination:** Under all alternatives, impacts caused by the introduction of invasive non-native species under would be considered less than significant.

3.3.4.11 Impact BI-11: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Biological Resources

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

All alternatives would create short-term impacts, if implemented, and have potential to incur cumulative impacts with other regional projects (Table 3-2) to biological resources in the project area. Cumulative biological resources impacts could include increases in fish entrainment of delta smelt, longfin smelt, Chinook salmon, green and white sturgeon, Pacific herring, and northern anchovy. Dredging projects could include negative impacts on foraging and could cause avoidance of habitat due to turbidity. It could also cause behavioral shifts and neurological stress related to noise. Disturbance of benthic habitat and resuspension of contaminated sediments could also negatively impact aquatic species. Minimal impacts could occur to migratory passage of fish, seabird, and mammals. Other regional projects described in Table 3-2, including local dredging projects, would also have similar impacts on biological resources and could result in cumulative impacts. Impacts from the project alternatives would be minimized by compliance with existing regulations and permit requirements from NMFS, USFWS, the Regional Water Board, and BCDC. The quantity of dredging projects by non-federal dredgers is small compared to the volumes dredged and disposed for this project, such that their relative impact on biological resources would also be small compared to project alternatives. Additionally, these other regional projects would be compliant with permitting processes and requirements as required by law and with the necessary measures to mitigate water quality biological resource impacts. The combined cumulative biological impacts of the alternatives and the other projects would not be significant.

With Standard Practices, impacts to delta smelt are avoided, and, therefore, the alternatives will not result in cumulatively considerable impacts on delta smelt for the reasons discussed in Section 3.3.4.1 and is not discussed further.

The probability of longfin smelt population declines resulting from dredging is not anticipated. Entrainment would not result in cumulatively considerable significant impacts to longfin smelt populations. With the continued BUDM placement as mitigation for entrainment impacts from the No Project Alternative and incorporation of BUDM to restore tidal wetlands as a minimization measure for entrainment impacts from the other alternatives, as well as providing more BUDM than is necessary consistent with the objectives of the project, USACE would be contributing to its fair share of measures to alleviate cumulative impacts from entrainment to longfin smelt.

- **NEPA Determination:** Project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts on biological resources.
- **CEQA Determination:** Project alternatives would not contribute to cumulatively considerable impacts on biological resources.

3.4 Cultural and Tribal Resources

This section describes existing conditions for cultural and tribal resources, including applicable plans and policies, and evaluates the potential impacts on these resources from implementation of the alternatives. Although the project alternatives neither propose demolition of existing structures nor introduce elements that could affect the historic setting of the built environment, the maritime landscape includes coastal, nearshore, and shore infrastructure. This analysis, therefore, considers the potential effects of project implementation to archaeological, tribal, and built environment resources.

3.4.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential cultural and tribal resources impacts from the alternatives.

3.4.1.1 Federal

Federal regulations applicable to cultural and tribal resources are discussed in the following sections

National Historic Preservation Act

National Historic Preservation Act (NHPA), as amended (54 U.S.C. § 100101 *et. seq*.) declares the federal policy to protect historic sites and values, in cooperation with other tribal nations, states, and local governments. Subsequent amendments designated the State Historic Preservation Officer as the individual responsible for administering state-level programs.

Submerged Lands Act

The Submerged Lands Act (43 U.S.C. §§ 1301 *et seq*.) established state jurisdiction over offshore lands within three miles of shore. In compliance with this act, the CSLC will receive a copy of this EA/EIR and will have the opportunity to comment on its potential impacts on submerged lands.

Abandoned Shipwreck Act

Administered by the State Historic Preservation Officers, the Abandoned Shipwreck Act (43 U.S.C. §§ 2101–2106) is a federal legislative act that affirms the authority of state governments to manage abandoned shipwrecks on state submerged lands.

3.4.1.2 State

State regulations applicable to cultural and tribal resources are discussed in the following sections.

California Native American Graves and Repatriation Act

PRC Section 5097.9 of the California Native American Graves and Repatriation Act of 2001 details procedures to be followed whenever Native American remains are discovered. It states that no public agency or private party using or occupying public property, or operating on public property, under a public license, permit, grant, lease, or contract made on or after July 1, 1977, shall interfere with the free expression or exercise of Native American religion as provided in the United States Constitution and the California Constitution. It further states that no such agency or party shall cause severe or irreparable damage to any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine on public property, except on a clear and convincing showing that the public interest and necessity so require. This document recognizes the potential for inadvertent discovery of such resources and proposes mitigation for the treatment of human remains and associated or unassociated funerary objects discovered during any soil-disturbing activity.

Human Remains, Criminal Penalties, California Public Resources Code, Section 7051

PRC Section 7051 states that it is a public offense to remove any part of any human remains from any place where it has been interred, or from any place where it is deposited while awaiting interment or cremation, with intent to sell it or to dissect it, without authority of law, or written permission of the person or persons having the right to control the remains under Section 7100, or with malice or wantonness. This document recognizes the potential for inadvertent discovery of human remains and proposes mitigation for the treatment of human remains discovered during any soil-disturbing activity.

3.4.1.3 Tribal

The following regulations pertain to tribal considerations:

American Indian Religious Freedom Act

The American Indian Religious Freedom Act affirms the rights of American Indians, Alaskan Natives, and Native Hawaiian peoples to practice their traditional religions, including access to any sacred sites, ceremonial use of sacred objects, and the freedom to worship. Federal agencies must avoid actions that restrict these rights and would affect Tribal religious or cultural practices.

EO 13175, Consultation and Coordination with Indian Tribal Governments

EO 13175 requires regular meaningful consultation and collaboration with tribal officials in the development of tribal policies that have tribal implications, to strengthen the United States's government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

EO 13007, Indian Sacred Sites

EO 13007 requires federal agencies to accommodate access to and ceremonial use of Indian sacred sites by religious practitioners and to avoid adversely affecting the physical integrity of such sites.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (33 U.S.C. § 3001 *et. seq*.) applies on federal and tribal lands. It provides a process for museums and federal agencies to return certain Native American cultural items to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations.

National Historic Preservation Act

Section 106 of the NHPA (16 U.S.C. § 470) requires federal agencies to consult with Indian tribes regarding historic properties that may be culturally or religiously significant to the tribe. Consultation should occur early in the planning process and continue throughout the compliance process.

3.4.2 Environmental Setting

This section provides a general historic context for the region and a detailed description of the cultural resources currently identified in each of the Area of Potential Effects (APE) locations. The APE is defined by USACE as all locations considered in the RDMMP, including future placement sites and all federal navigation channels. While the APE encompasses individual current and future placement sites, these will be permitted and subject to individual Section 106 reviews when and if they are selected for future use. Accordingly, this EA/EIR provides environmental setting descriptions for the existing placement sites within the APE. The 2015 EA/EIR provides a detailed description of the historic context for the region

(USACE and Regional Water Board 2015), and the discussed analysis will provide the basis for USACE complying with Section 106 of the NHPA for all federal dredging-related activities.

The SF Bay region has experienced considerable landscape and environmental change over the last 20,000 years. As the vast ice sheets that covered the northern part of what is now North American began to melt 20,000 years ago, sea levels rose and began transforming the Bay Area. The broad inland grassland with riparian habitats that stretched near to the modern day Farallon Islands had transformed into a smaller version of the SF Bay by 8,000 years ago (Atwater et al. 1977). Inundation by SLR continued at a slower pace until about 5,000 years ago, creating extensive tidal marsh deposits and the Estuary that are defining features of the region today. This transformation impacts archaeological visibility as some of the earliest evidence for human occupation in the region may have been inundated during the terminal Pleistocene/Early Holocene boundary (circa 11,000 to 8,000 years ago). Nonetheless, there is evidence for human occupation of the region as early as 11,700 years ago to the present, where the Ohlone, Coast Miwok, Bay Miwok, Plains Miwok, Patwin, and other Native American communities continue to live today. The extensive maritime history in the region began with these communities and continues to define the region today. Alongside this rich Native American history is evidence of the Euroamerican colonialism that reshaped the region during the Historic Era. The remains of a colonial ocean-based commerce, with watercraft, lighthouses, wharfs, and other evidence of the historic and modern maritime economy lie alongside or, in some cases, obscure the indigenous foundations of this enduring maritime economy.

This extensive history of human use of the region has left a historic record rich in cultural resources both on the land and on the continental shelf. As such, the cultural resources that are of interest for the current project include not only archaeological sites both on the shorelines or submerged beneath the Bay and open ocean, but also evidence from the region's rich historic maritime history and its associated watercraft and onshore and nearshore infrastructure.

In consideration of the unique history of the Bay Area and nature of the current federal dredging program, the background cultural resources investigation focused on identifying previously recorded cultural sites in and around the navigation channels and placement locations, as well as specific consideration of known shipwrecks and marine hazards. This included review of environmental documents from previous dredging projects, archaeological literature and survey reports, and information on shipwrecks. An updated records search received from the Northwest Information Center on May 24, 2024, was considered along with additional documentation including the Office of Historic Preservation Archaeological Determinations of Eligibility, Built Environment Resources Directory, California Inventory of Historic Resources 1976, CALTRANS Bridge Survey (August 2013), General Land Office and Rancho Plat maps, historic maps, NOAA Office of Coastal Survey Wrecks and Obstructions Database (CSWO), and the CSLC Shipwreck Database.

Per the CSLC, the coordinates provided from their Shipwreck Database may be general and do not account for shipwrecks that have been moved or salvaged. Locational data are based on information gathered from books, newspapers, and other sources and are estimated locations (unless noted) that should be considered with additional information. Using the CSLC Shipwreck Database in concert with the CSWO can be a useful combination as the CSWO does provide exact coordinates of reported shipwrecks and other obstructions. The CSWO, however, combines two different data sets, 1) NOAA's

Automated Wreck and Obstruction Information System (AWOIS) Database and 2) NOAA's electronic navigational charts (ENC). The AWOIS provides locational and historical records data, but is not a comprehensive record. The ENC is more comprehensive than AWOIS, but does not provide historic data and records. Rather, the ENC is focused on providing locational data for marine hazards, which may or may not be of historic age.

The background research resulted in identification of previously recorded archaeological resources and shipwrecks within 0.5 mile of the APEs and built environment resources within 650 feet of the APEs (see Figure 1-2). There are 363 previously recorded cultural resources and 65 historic-age shipwrecks (per the CSLC) noted within the designated search areas. Within the APEs, there are 33 previously recorded cultural resources, including 13 historic properties, 17 cultural resources not eligible for national, state, or local historical registers, and 3 cultural resources that have not yet been evaluated or need to be reevaluated. Per the CSLC, there are 15 historic-age shipwrecks with coordinates within the APEs; the CSWO reports 10 shipwrecks and four obstructions within the APEs. There is likely overlap between the reported shipwrecks. This will be discussed below in the breakdown of each dredge and placement location.

3.4.2.1 Navigation Channels

Oakland Harbor

Within the Oakland Harbor APE, there are nine previously recorded cultural resources. Seven of these are historic properties, one has been determined not eligible for the National Register of Historic Places (NRHP), and one needs to be reevaluated (Table 3-16). There are 30 archaeological resources within 0.5 mile of the APE and 80 built environment resources within 200 meters of the APE. The CSLC indicates seven historic-aged shipwrecks within Oakland Harbor: *Golden Gate* (sunk 1929), *Alven Besse* (sunk 1929), *Star of Vancouver* (sunk 1938), *James Rolph Jr* (Schooner, sunk 1929), *Edwin May* (bark, sunk 1929), *Simla* (bark, sunk 1930), *Ruth* (sunk 1924), and *Herald* (sidewheel steamboat, sunk 1912). The CSWO indicates 18 shipwrecks (8 co-located in ENC and AWOIS) and three obstructions within the APE.

Additionally, the CSLC lists seven historic-aged shipwrecks within 0.5 mile of the Oakland Harbor APE: *San Jose* (steam screw, sunk 1919), *Friedeberg* (sunk 1881), *Helen P Drew* (fish reduction ship, sunk 1950), *Great Western* (sunk 1882), *Whitesboro* (steam schooner, date of sinking unavailable), *Trilby* (sternwheel steamboat, sunk 1911), and *Ranger* (steamship, sunk 1854).

Table 3-16. Previously Recorded Cultural Resources within the Oakland Harbor APE

P-Number	Resource Name	Location	Eligibility Status (criteria)	Resource Type	Age
P-01-003116	Fruitvale Avenue Railroad Bridge	Oakland Harbor	2S2 (C)	Structure	Historic
P-01-003158	High Street Bridge (#33C-0027)	Oakland Harbor	2S2 (C)	Structure	Historic
P-01-003190	Park Street Bridge (#33C-0027)	Oakland Harbor	2S2 (C)	Structure	Historic

P-Number	Resource Name	Location	Eligibility Status (criteria)	Resource Type	Age
P-01-003218	Todd Shipyard, Alameda	Oakland Harbor	7N	Building, Structure, District	Historic
P-01-003708	Posey Tube, Bridge No. 33-106R	Oakland Harbor	3S	Building, Structure, Element of district	Historic
P-01-010809	BART Transbay Tube	Oakland Harbor	3S	Structure	Historic
P-01-011463	Cryer & Sons Boatyard	Oakland Harbor	5S3	Building, Structure	Historic
P-01-012023	Bridge 33C0147	Oakland Harbor	3S	Structure	Historic
P-01-012346	Tunnel 33-0106L	Oakland Harbor	6Z	Structure	Historic

Key: BART = Bay Area Rapid Transit

There have been 52 cultural resources investigations that have intersected the Oakland Harbor APE. None of these have covered the entire APE. Two investigations have covered significant portions of the APE:

- S-002152 (2023) Cultural Resources Investigation of Operating Projects, Oakland Inner Harbor
- S-025526 (1999) Historic Property Survey Report/Finding of Effect, 50-Foot Channel Navigation Improvements Project, Oakland Harbor, Alameda County

Redwood City Harbor

Within the Redwood City Harbor APE there are no previously recorded cultural resources. There is one recorded object adjacent to the APE, the R/V *Polaris*. This science vessel was listed on the NRHP, but was retired and sold in 2016. The CSLC and CSWO indicate three shipwrecks within 0.5 mile of the APE: *City of Glendale* (fishing schooner, sunk 1921), *Morgan Shell*, and *Manana*.

There have been 17 cultural resources investigations that have intersected the Redwood City Harbor APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations. Many of the investigations address regional cultural history considerations that are academic in nature and are not in response to regulatory requirements.

Richmond Harbor

Richmond Outer Harbor

There are no previously recorded cultural resources within the Richmond Outer Harbor APE. There is one recorded shipwreck just outside of the 0.5-mile buffer. A side-scan sonar survey recorded the buried hull of a ship, estimated to date to the late 19th or early 20th century based on building techniques. The CSLC indicates five shipwrecks within 0.5 mile of the APE: *Alton* (oil screw, sunk 1904), *Centennial* (steamship, sunk 1886), *Anna R Forbes* (schooner, sunk 1867), *W Whipple* (sloop, sunk 1880), and *Buenos Dias* (lumber schooner, sunk 1867). The CSWO indicates one shipwreck and one obstruction within 0.5-mile of the APE.

There have been 12 cultural resources investigations that have intersected the Richmond Outer Harbor APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations. Many of the investigations address regional cultural history considerations that are academic in nature and are not in response to regulatory requirements. One survey that does intersect the APE is a marine archaeology survey, but it covers only a small portion of the APE: S-018902 (Sullivan and Allan 1996) Report on a Marine Archaeological Survey of the Proposed Southampton Shoal Ship Channel Extension Terminal and Dredge Area.

Richmond Inner Harbor

There are no previously recorded cultural resources within the Richmond Inner Harbor APE. There are 12 archaeological sites within 0.5 mile of the APE and 17 built environment resources within 200 meters of the APE. The CSLC indicates four shipwrecks within 0.5 mile of the APE: *Adele Hobson* (motor vessel, sunk 1934), *Associated Oil #8* (barge, sunk 1952), *Alpha* (schooner, sunk 1869), and *Ellen Burke* (scow schooner, sunk 1860). The CSWO indicates one shipwreck within 0.5-mile of the APE.

There have been 17 cultural resources investigations that have intersected the Richmond Inner Harbor APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations. Many of the investigations address regional cultural history considerations that are academic in nature and are not in response to regulatory requirements.

San Francisco Mainship Channel Bar

Within the San Francisco Mainship Channel Bar APE there are no previously recorded cultural resources. There are no archaeological sites within 0.5 mile of the APE or built environment resources within 200 meters of the APE. The CSLC indicates one shipwreck within 0.5 mile of the APE: USS *Benevolence* (hospital ship, sunk 1950). The CSWO indicates two shipwrecks, one of which is the USS *Benevolence*, within 0.5 mile of the APE.

There is one investigation that covers the entire San Francisco Mainship Channel Bar APE: S-044172 (2013) Gulf of the Farallones/Monterey Bay National Marine Sanctuaries San Francisco-Pacifica Exclusionary Area (Donut Hole) Expansion (Schwemmer 2013). This undertaking was focused on expanding the northern boundary of the Monterey Bay National Marine Sanctuary. The resulting letter report focused only on maritime history and a marine survey was not conducted. The APE has not been surveyed.

San Pablo (Pinole Shoal Channel)

There are no previously recorded cultural resources within the Pinole Shoal Channel APE. There is one recorded shipwreck located approximately 330 feet beyond the western extent of the APE. The debris field forming the wreckage of the schooner *Sagamore*, which sunk in 1864, was identified in a side-scan sonar and magnetometer survey. The CSLC indicates three shipwrecks within 0.5 mile of the APE: *Victor*

H Kelly (tanker, sunk 1952), *Harry* (sunk 1904), and *Monarch* (tug, sunk 1915). CSWO indicates four shipwrecks and five obstructions within 0.5 mile of the APE.

There has been one cultural resources investigation that intersects the Pinole Shoal Channel APE. The majority of the APE has not been subject to a cultural resources investigation. The one survey that does intersect the APE is a marine archaeology survey but covers only a small portion of the APE: S-018901 (no date) Nautical Archaeological Survey (Sullivan and Allen 1996).

Suisun Bay Channel

There is one previously recorded cultural resource within the Suisun Bay Channel APE; it is split into two records (Table 3-17). The Union Pacific Railroad's Martinez-Benicia Bridge crosses into Solano and Contra Costa counties. Each segment is recorded in its respective county. Both segments were found not eligible for the NRHP per the 2013 CalTrans Bridge inventory. There are five archaeological resources within 0.5 mile of the APE and two built environment resources within 200 meters of the APE. The CSLC indicates six historic-aged shipwrecks within Suisun Bay Channel APE: *Camanche* (steamboat, sunk 1853), *Quinault Victory* (victory ship, sunk 1944), *E A Bryan* (victory ship, sunk 1944), *Sophie McLean* (sternwheel steamboat, sunk 1864), *Lizzie Theresa* (steamship, sunk 1920), and *Swastika* (oil screw, sunk 1933). The *Sophie McLean* location is recorded 40 meters north of the APE. The CSWO indicates 16 shipwrecks (9 co-located in ENC and AWOIS) and 8 obstructions within 0.5 mile of the APE.

Table 3-17. Previously Recorded Cultural Resources within the Suisun Bay Channel APE

P-Number	Resource Name	Location	Eligibility Status	Resource Type	Age
P-07-000859	SP RR Bridge, Martinez-Benicia Bridge	Suisun Bay Channel	6Z	Structure	Historic
P-48-000445	Southern Pacific Railroad Bridge Martinez-Benicia	Suisun Bay Channel	6Z	Structure	Historic

There have been six cultural resources investigations that have intersected the Suisun Bay Channel APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations.

There has been one marine archaeology cultural resources investigation that intersects the APE, though it only covers a small portion of it: S-018901 (no date) Nautical Archaeological Survey.

Napa River Channel

There are three previously recorded cultural resources within the Napa River Channel APE. All three resources have been determined not eligible for the NRHP (

Table 3-18). There are 30 archaeological resources within 0.5 mile of the APE and 20 built environment resources within 200 meters of the APE. The CSLC indicates two historic-aged shipwrecks within Napa Channel: *Valiant* (sunk 1911) and *Rough and Ready* (steamship, sunk 1880). The CSWO also indicates two shipwrecks within 0.5 mile of the APE: one wooden-hulled ship and one 1942 destroyer ship.

Table 3-18. Previously Recorded Cultural Resources within the Napa River Channel APE

P-Number	Resource Name	Location	Eligibility Status (Criteria)	Resource Type	Age
P-28-001020	Bridge 21-75/Maxwell Bridge	Napa River Channel	6Y	Structure	Historic
P-28-001869	Vaca-Lakeville #1	Napa River Channel	6Z	Structure	Historic
P-28-001880	Bridge 21C-12	Napa River Channel	6Z	Structure	Historic

There have been 35 cultural resources investigations that have intersected the Napa River Channel APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations.

Petaluma River Channel

There are five previously recorded cultural resources within the Petaluma River Channel APE. Three of these are historic properties and two have been determined not eligible for the NRHP (Table 3-19). There are 38 archaeological sites within 0.5 mile of the APE and 17 built environment resources within 200 meters of the APE. The CSLC indicates two historic-aged shipwrecks within the Petaluma River Channel APE: *Gold* (sidewheel steamboat, sunk 1920) and *Agnes Jones* (Scow schooner, sunk 1889). The CSWO indicates two shipwrecks (co-located in ENC and AWOIS) and six obstructions within the APE.

Table 3-19. Previously Recorded Cultural Resources within the Petaluma River Channel APE

P-Number	Resource Name	Location	Eligibility Status (Criteria)	Resource Type	Age
P-21-002911	Mira Monte Marina	Petaluma River Channel	6Z	Building, Structure, Site	Historic
P-21-002939	Black Point Northwestern Pacific Railroad Bridge	Petaluma River Channel	3S (A&C)	Structure	Historic
P-49-002834	Northwestern Pacific Railroad	Petaluma River Channel	2S2 (A)	Building, Structure, Object, Element of district	Historic
P-49-003288	Bridge 20-0154 (L and R)	Petaluma River Channel	6Z	Structure	Historic
P-49-005165	Haystack Landing Railroad Bridge	Petaluma River Channel	2S2 (A&C)	Structure	Historic

There have been 58 cultural resources investigations that have intersected the Petaluma River Channel APE. None of these have covered the entire APE and the majority of the APE has no recorded cultural resources investigations.

San Rafael Creek

There are no previously recorded cultural resources within the San Rafael Creek APE. There are 19 archaeological sites within 0.5 mile of the APE and three built environment resources within 200 meters of the APE. The CSLC indicates three shipwrecks within 0.5 mile of the APE: *Novato* (hay scow, sunk 1884), *Annie* (sunk 1920), and *Maryland* (steamship, sunk 1913). CSWO indicates one shipwreck within 0.5 mile of the APE.

There have been 24 cultural resources investigations that have intersected the San Rafael Creek APE. None of these have covered the entire APE. Many of the investigations address regional cultural history considerations that are academic in nature and are not in response to regulatory requirements. One investigation covers the onshore creek portion of the APE: S-009125 (Bramlette 1987) Preliminary Cultural Resources Assessment for Planned Modification and Maintenance of San Rafael Creek in the Town of San Rafael, Marin County, California.

One additional report appears to include a marine survey that crosses the offshore portion of the APE: S-028138 (no date). A Cultural Resources Evaluation of the Loch Lomond Yacht Harbor, San Rafael, Marin County, California (Pesnichak no date).

3.4.2.2 Placement Areas

The following sections describe cultural resource records for placement areas that have been previously permitted.

Existing Beneficial Use Sites

Non-Aquatic Direct Placement Sites

<u>Cullinan Ranch Restoration Project</u>

There are no previously recorded cultural resources within the Cullinan Ranch APE. A ranch complex and a levee associated with ranch activities were identified and evaluated as not eligible for listing on the NRHP (Ducks Unlimited 2008).

Several archaeological surveys have been conducted near the APE: two along the Highway 37 corridor and three following the powerline corridor located to the north of the site. No recorded archaeological sites were identified near Cullinan Ranch as a result of these previous studies (Ducks Unlimited 2008).

<u>Montezuma Wetlands Restoration Project</u>

Based on research conducted in 1998, two known cultural resources are located within the APE: a prehistoric archaeological site (CA-SOL-34) and the Molea Railroad Station (CA-SOL-209H). A field survey conducted in 1992 detected 13 historic sites consisting of a variety of artifacts such as pump houses, the rail depot and tracks, machinery, water pipe, glass, ceramics, cans, bottles and remnants of a structure with a hay baler and thrasher (USACE 1998).

Nearshore Strategic Placement Site, SF-17 (Ocean Beach Nearshore Placement Site)

There are no previously recorded cultural resources within the SF-17 APE. There is one recorded shipwreck (SS *Neptune*, schooner, sunk 1900) within 0.5 mile of the APE, the remains of which are located onshore at the base of a cliff at Fort Funston. There are no previously recorded built environment resources within 200 meters of the APE. The CSLC indicates five shipwrecks within the APE: *King Philip* (clipper, sunk 1878), *Maggie* (steamship, sunk 1904), *Reporter* (three-masted schooner, sunk 1902), *James A Garfield* (three-masted schooner, sunk 1904), and *Trifolicum* (sunk 1914). The CSLC indicates an additional three shipwrecks within 0.5 mile of the APE: *William Frederick* (two-masted schooner, sunk 1887), *Republic* (fishing smack, sunk 1879), and *Sunlight* (oil screw, sunk 1937). There are no built environment resources within 200 meters of the APE. The CSWO indicates no shipwrecks and one obstruction within 0.5 mile of the APE.

There are no cultural resources investigations that intersect the SF-17 APE. The APE has not been surveyed for cultural resources. There is one geological master's thesis focused on the infilling of SF Bay that discusses the general region where the SF-17 APE is located (Dow 1973).

Transitional Placement Sites

SF-8, San Francisco Bar Channel Placement Site

There are no previously recorded cultural resources within the SF-8 APE. There are no archaeological sites within 0.5 mile of the APE and no built environment resources within 200 meters of the APE. The CSLC indicates five shipwrecks within 0.5 mile of the APE: *Laura May* (schooner, sunk 1873), *Lina Simpson* (sloop, sunk 1972), *Albert Harris* (pilot schooner, sunk 1850), *Minnie G Atkins* (schooner, sunk 1873), *Relief* (pilot boat, sunk 1863). The CSWO indicates no shipwrecks or obstructions within 0.5 mile of the APE.

There are no cultural resources investigations that intersect the SF-8 APE. The APE has not been surveyed for cultural resources.

In-Bay Placement Sites

SF-9, Carquinez Strait Placement Site

There are no archaeological sites or built environment resources within the SF-9 APE. There are no archaeological sites within 0.5 mile of the APE and no built environment resources within 200 meters of the APE. The CSLC and CSWO indicate no shipwrecks or obstructions within 0.5 mile of the APE.

There have been 10 cultural resources investigations that have intersected the SF-9 APE. These all of address regional cultural history considerations and are academic in nature and are not in response to regulatory requirements. The APE has not been surveyed.

SF-10, San Pablo Bay Placement Site

There are no previously recorded cultural resources within SF-10 APE. There is one recorded shipwreck within 0.5 mile of the APE. The debris field forming the wreckage of the schooner *Sagamore*, which sank in 1864, was identified in a side-scan sonar and magnetometer survey. The CSLC and CSWO indicate no shipwrecks or obstructions within 0.5 mile of the APE.

There have been 15 cultural resources investigations that have intersected the SF-10 APE. These are all broad investigations; many of the investigations address regional cultural history considerations that are academic in nature and are not in response to regulatory requirements. The APE has not been surveyed.

SF-11, Alcatraz Placement Site

There are no previously recorded cultural resources within the SF-11 APE. There is one historic district within 0.5 mile of the APE (Alcatraz Island) and no built environment resources within 200 meters of the APE. The CSLC indicates three shipwrecks within 0.5 mile of the APE: *McPherson* (steam screw, sunk 1869), *Thomas Burnett* (sunk 1850), and *Bialchi* (tugboat, sunk 1947). The CSWO indicates no shipwrecks or obstructions within 0.5 mile of the APE.

There have been 12 cultural resources investigations that have intersected the SF-11 APE. These all address regional cultural history considerations and are academic in nature and not in response to regulatory requirements. The APE has not been surveyed.

SF-16, Suisun Bay Placement Site

There are no previously recorded cultural resources within the SF-16 APE. There are no archaeological sites within 0.5 mile of the APE and no built environment resources within 200 meters of the APE. The CSLC and CSWO indicate one shipwreck, *Camanche* (steamboat, sunk 1853) and no obstructions within 0.5 mile of the APE.

There has been one marine archaeology cultural resources investigation that intersects the SF-16 APE, but it covers only a small portion of the APE: S-018901 (no date) Nautical Archaeological Survey (Sullivan and Allen 1996). The majority of the APE has not been surveyed.

Upland (Sponsor-Provided) Sites

For the two existing upland (sponsor-provided) sites, Shollenberger Park and Imola Avenue:

- The Imola Avenue Upland Placement site is located within the Napa River Channel APE. Refer to Section 3.4.2.1, Napa River Channel, for a description of the cultural resources present within the APE.
- The Shollenberger Park (Petaluma River) Upland Placement site is located within the Petaluma River Channel APE. Refer to Section 3.4.2.1, Petaluma River Channel, for a description of the cultural resources present within the APE.

Deep Ocean Disposal, SF-DODS

There are no previously recorded cultural resources within the SF-DODs APE. There are no archaeological sites within 0.5 mile of the APE and no built environment resources within 200 meters of the APE. The CSLC and CSWO indicate no shipwrecks or obstructions within 0.5 mile of the APE.

There are no cultural resources investigations that intersect the SF-DODS APE. The APE has not been surveyed.

Possible Future Beneficial Use Placement Sites

All future beneficial use placement sites would require analysis by USACE under NEPA and an appropriate state entity under CEQA before they would be permitted for use as restoration sites. Environmental review of these sites is not included as part of this document.

3.4.2.3 Tribal Coordination

In compliance with USACE Tribal Consultation Policy and AB 52, in March 2024, USACE and the Regional Water Board reached out to the tribes listed in Appendix E (via email and for AB52 USPS Certified Mail) and requested their comments on the project. To date, the Regional Water Board has had one meeting with the Federated Indians of Graton Rancheria. No other tribal interest has been expressed to date. The Confederated Villages of Lisjan and the Amah Mutsun Tribal Band also provided comments. Tribal consultation is ongoing.

USACE coordinated with the NAHC in March 2024 for this large-scale undertaking, and received a list of tribal contacts in Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties. The Sacred Lands File was completed, and the results were positive. The list of tribes consulted, a summary of tribal consultation, and a copy of correspondence is provided in Appendix E.

3.4.3 Methodology and Thresholds of Significance

The NHPA and its implementing regulations for Section 106 (36 C.F.R. Part 800) require USACE to make a reasonable and good-faith effort to identify historic properties that may be affected by the proposed maintenance dredging and the disposal of the dredged sediment. Historic properties are a subset of cultural resources that are listed on or determined eligible for the NRHP. To be eligible for the NRHP, properties must be 50 years old (unless they have special significance) and have national, state, or local significance in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet at least one of four criteria for evaluation (36 C.F.R. § 60.4):

- Criterion A: be associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B: be associated with the lives of persons significant in our past.
- Criterion C: have distinctive characteristics of type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D: have yielded, or may be likely to yield, information important in prehistory or history.

These criteria are used to determine what properties should be considered for protection from destruction or impairment resulting from project-related activities (36 C.F.R. § 60.2).

On a state level, CEQA evaluation criteria are similar to Section 106 and require agencies to consider impacts on historical resources, a subset of cultural resources that meet the criteria for eligibility to the

California Register of Historical Resources (CRHR). To be eligible for the CRHR, a historic property must meet at least one of these criteria; they are set forth in CEQA Section 15064.5:

- Criterion 1: Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
- Criterion 2: Is associated with lives of persons important in our past.
- Criterion 3: Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
- Criterion 4: Has yielded, or may be likely to yield, information important in prehistory or history.

CEQA also considers if a cultural resource is an "unique archaeological resource," defined as an artifact, object, or site that meets one of these requirements:

- Contains information needed to answer important scientific questions, and there is a demonstrable public interest in that information.
- Has a special and particular quality, such as being the oldest of its type or the best available example of its type.
- Is directly associated with a scientifically recognized important prehistoric or historic event or person (PRC 21083.2).

Eligibility requirements for the NRHP and the CRHR are similar, and historic properties–cultural resources listed on or eligible for the NRHP–are also eligible for listing on the CRHR.

Impact analysis for cultural resources focuses on assessing whether the implementation of an alternative would have the potential to affect cultural resources that are eligible for listing in the NRHP or CRHR or have traditional significance for tribes.

Impact analysis for historic properties focuses on, but is not limited to, guidelines and standards set forth in the implementing regulations (36 C.F.R. 800) of NHPA Section 106. Under Section 106, the proponent of the action is responsible for determining whether any historic properties are located in the area, assessing whether the proposed undertaking would adversely affect the resources, and notifying the State Historic Preservation Officer (SHPO) of any adverse effects. An adverse effect is any action that may directly or indirectly change the characteristics that make the historic property eligible for listing in the NRHP.

Impact analysis for historical resources under CEQA are similar and assess a project's impacts on the historic integrity of a historical resource, and whether the project impacts would materially impair the historical significance of the resource such that it would cause a substantial adverse change in the significance of a historical resource (Cal. Code Regs 15064.5[b]).

Impacts on cultural resources consider both direct and indirect impacts. Impacts could occur through the following:

- Physically altering, damaging, or destroying all or part of a resource.

- Altering characteristics of the surrounding environment that contribute to the resource's significance.
- Introducing visual or audible elements that are out of character with the property or alter its setting.
- Neglecting the resource to the extent that it deteriorates or is destroyed.

Section 15064.5 of CEQA also assigns special importance to human remains and specifies procedures to be used when Native American remains are discovered. These procedures are detailed under California PRC Section 5097.98.

Therefore, an analysis of impacts on cultural resources considers whether the project would:

- Result in a substantial adverse change in the significance of a historical resource (NRHP- and/or CRHR-listed, or eligible to be listed), or a unique archaeological resource as defined under PRC Section 21083.2; or
- Result in disturbance of any human remains, including those interred outside of formal cemeteries as considered under PRC Section 5097.9; or
- Result in impacts on Native American Sacred Sites or Religious Ceremonies pursuant to 61 FR 26771-26772 (1996) and 42 U.S.C. Chapter 21 Subchapter 1 § (1996); or
- Result in cumulative impacts on cultural resources.

3.4.4 Impacts and Mitigation Measures

The SF Bay Area represents a key location for local, national, and international marine shipping commerce, national security needs, and recreation. To support these activities and needs, a key congressional mandate of USACE is maintenance of federal navigation channels to authorized depths. These federal channels in and around the Bay Area are located in inland waterways (rivers, creeks), inner and outer harbor locations, and offshore shipping channels. The dredging process includes removing the sediment from these channels and transporting said sediment to an authorized placement site, located in upland, bay, and ocean settings. Consideration of potential effects is limited to the federal navigation channels and placement sites.

Water surface levels have increased in the SF Bay region since the Last Glacial Maximum by approximately 130 meters. The coastline for this region was near to the edge of the continental shelf, just offshore of the Farallon Islands. Approximately 11,700 years ago, what is now SF Bay and its related waterways were dry land characterized by steppe biota and river valleys. Archaeological evidence shows the first human presence on this landscape at this time. Human habitation has persisted in this region ever since, including thousands of years of Native American settlement as well as evidence of Euroamerican historic-era maritime commerce with associated coastal infrastructure and drowned watercraft. Some of the cultural sites created by the people living in this region at the end of the Pleistocene and into the Holocene would be on landscapes that are now submerged or incorporated into coastal or wetland habitats. Remnants of historic ocean-based exploration and economies, including shipwrecks, may be found on submerged landscapes. While the character and preservation of these landscapes have been altered, intact remnants of formerly terrestrial landscapes that can contain preserved cultural resources are present under the marine sediment that was transported to the region with increased water levels and/or historic anthropogenic infilling. Constant shifting of the submerged landscape though natural (oceanographic or tectonic movement) or anthropogenic activities may expose previously buried cultural resources and/or human remains, exposing them to impacts from project activities. Additionally, archaeological sites and built environment remnants of maritime infrastructure located near to the shorelines of inland waterways, harbors, and open ocean may erode into the water and be transported into navigation channels and placement sites. While this material is no longer considered in primary context, individual cultural items and/or human remains may be subject to the Native American Grave Protection and Repatriation Act and its 2024 updated regulations (43 C.F.R. Part 10). They may also be considered a unique archaeological resource or tribal cultural resource under CEQA.

The placement locations for the dredged material are located throughout the SF Bay Area. As the placement of dredged material does not disturb native soil, placement activities would not result in impacts on historical resources, unique archaeological resources, or human remains. Only placement sites that have undergone appropriate environmental review will be used. Future placement sites would not be used until environmental review is completed, including evaluation and mitigation of impacts on cultural resources.

All previously recorded historic properties identified in the navigation channels are built environment resources that will not be impacted by project activities.

3.4.4.1 Impact CT-1: Substantial Adverse Change to a Historical Resource or Disturb Unique Archaeological Resources

No Action Alternative/No Project Alternative, Alternatives 1 through 4

The dredging proposed with the No Action Alternative/No Project Alternative and Alternatives 1 through 4 will occur in previously dredged and maintained federal navigation channels. The maintenance operation removes sediment that has infilled each channel since the last dredging episode. The Dredging Guidance Letter (DGL), published by USACE in March 1989, established the approach to identify submerged cultural resources in previously dredged federal channels. This DGL indicates that remote sensing surveys (e.g., magnetometer, side-scan sonar, subbottom profiler) are not required within the boundaries of previously dredged channels unless there is “reason to believe” cultural resources may exist in previously dredged channels.

Although historical dredging has occurred in the navigation channels, there is the potential that cultural resources could be inadvertently uncovered by project activities. Such inadvertently discovered resources could represent historical resources or unique archaeological resources, and their disturbance could adversely change their condition. Potential inadvertent impacts will be minimized and/or avoided by implementation of cultural resources monitoring program and inadvertent archaeological discovery protocol, as described below.

Cultural Resources Monitoring Program

Projects that occur on submerged landscapes present unique challenges to recognition of potential inadvertent discoveries. The landscape where sediments are removed is not available for immediate inspection and, depending on the dredging method, sediment removed from the submerged landscape is not available for inspection of potential cultural resources. Considering these challenges, a monitoring program that focuses on opportunistic monitoring of identified sensitive locations can reduce potential impacts on historical and tribal resources and shall be implemented. The details of the opportunistic monitoring program that complies with the requirements herein shall be developed by an archaeologist meeting the minimum professional qualifications standards set forth by the Secretary of the Interior (codified in 36 C.F.R Part 61; 48 FR 44739), including a background in maritime (underwater) archaeology. USACE is currently consulting with tribes per 36 C.F.R. Part 800. Two tribes – the Tamien Nation and Amah Mutsun Tribal Band- have identified culturally sensitive areas and have requested to be invited to monitor all dredging and placement activities in certain locations. Additional information is provided in Appendix E.

The Water Board engaged in Tribal consultation with USACE as described above. As of June 20, 2025, the Water Board concluded tribal consultations per AB 52 and 2108.

Identification of sensitive locations may differ for various regions, but shall be based on an archaeological sensitivity analysis that includes all of the following:

- Mapped geologic formations and soils.
- Density of surrounding buried archaeological deposits.
- Potential for remnant Native American fish capture technologies (fish weirs and platforms).
- Density of identified shipwrecks in the APE and vicinity.
- Native American consultation.

Opportunistic monitoring shall include monitoring of the sediment as it is dredged from the submerged landscape and/or when it is placed at the placement locations. The archaeological monitor shall inspect the material dredged for the presence or absence of cultural material. If cultural material is discovered during monitoring or other project activities, all work shall be halted in the vicinity of the discovery until a qualified archaeologist can assess the significance of the discovery. Archaeological monitors shall have a Bachelor of Science or Bachelor of Arts degree in anthropology, archaeology, or a related field, and at least one year’s experience monitoring in California. The monitor must have a background in maritime archaeology and demonstrated experience with historic shipwreck sites, including familiarity with related artifact classes necessary to identify historic submerged materials.

Inadvertent Archaeological Discovery

If any cultural material, or an unusual amount of bone, shell, or non-native stone, is encountered during dredging, work would be immediately stopped in the area of the find until a qualified archaeologist can be retained to evaluate the find (36 C.F.R. 800.11.1 and 14 California Code of Regulations [CCR] 15064.5[f]). The archaeologist will determine the potential scientific/historical/cultural significance and will make a recommendation to USACE as to what action or additional measures, if any, are warranted. Examples of such cultural materials might include ground stone tools such as mortars, bowls, pestles, and manos; chipped stone tools such as projectile points or choppers; historical artifacts such as bottles or ceramics; artifacts related to the Euroamerican maritime economy such as watercraft pieces, anchors, and the like, or resource-gathering items such as fish weir stakes.

Additional measures may include additional submerged study, such as geophysical survey or diver investigation, to further evaluate the context of the find and make recommendations to USACE. Typical measures include development and implementation of a detailed archaeological resources management plan to recover the scientifically consequential information from archaeological resources. Treatment for most archaeological resources consists of (but is not necessarily limited to) sample excavation, artifact collection, site documentation, and historical research, with the aim to target the recovery of important scientific data.

- **NEPA Determination:** Under all alternatives, the inadvertent discovery of cultural resources during project activities represents a potential impact; however, implementation of the cultural resources monitoring protocol and inadvertent archaeological discovery protocol would avoid or reduce the potential for impacts on historical resources to a less-than-significant level.
- **CEQA Determination:** Under all alternatives, the inadvertent discovery of cultural resources during project activities represents a potential significant impact; however, implementation of the cultural resources monitoring protocol and inadvertent archaeological discovery protocol as standard practices will reduce the potential for impacts on historical resources to a less-than-significant level.

3.4.4.2 Impact CT-2: Potential to Disturb Human Remains, Including Those Interred Outside of Formal Cemeteries

No Action Alternative/No Project Alternative, Alternatives 1 through 4

There are no known cemeteries, formal or otherwise, or other evidence of human internment in the federal navigation channels or existing placement sites. Furthermore, USACE would not use the future placement sites identified in Section 1.5.2.2 until appropriate environmental review and permitting are completed. Although unlikely, given the repeated dredging and dredged material placement activities that have historically occurred at the federal navigation channels and existing placement sites, there remains the potential that previously unidentified human remains could be inadvertently uncovered with project implementation. Such disturbance of human remains represents a potential project impact, but these would be minimized and avoided by implementation of the cultural resources monitoring program, as described above, and implementation of a treatment of human remains protocol, as described below.

Treatment of Human Remains

If human remains of Native American origin are discovered during ground-disturbing activities, it is necessary to comply with state laws relating to the disposition of Native American burials that fall within the jurisdiction of the California NAHC (PRC Section 5097). In the event the discovery is composed entirely of human skeletal remains, or if it includes human skeletal remains, dredging activities shall immediately cease and USACE's project representative shall contact the local coroner (county in which discovery is made) to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.5 (e)(1) of the CEQA Guidelines.

If the coroner determines that the remains are Native American, USACE will contact the NAHC, who will appoint a most likely descendant (MLD), in accordance with Health and Safety Code Section 7050.5, subdivision (c), and PRC 5097.98 (as amended by AB 2641). In accordance with PRC 5097.98, USACE shall ensure that, according to generally accepted cultural or archaeological standards or practices, the immediate vicinity of the Native American human remains is not damaged or disturbed by further development activity until USACE has discussed and conferred, as prescribed in this section (PRC 5097.98), with the MLD regarding their recommendations, if applicable, taking into account the possibility of multiple human remains. All human remains will be treated with dignity and respect at all times. USACE and the MLD will make all reasonable efforts to develop an agreement for the treatment of human remains and associated or unassociated funerary objects (CEQA Guidelines Sec. 15064.5[d]). This agreement should take into consideration the appropriate recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. PRC allows 48 hours to reach agreement on these matters. If the MLD and the other parties do not agree on the reburial method, the project will follow Section 5097.98(b) of the PRC, which states, "the landowner or his or her authorized representative will re-inter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."

- **NEPA Determination**: Under all alternatives, the inadvertent disturbance of human remains represents a potential impact; however, implementation of the cultural resources monitoring program and treatment of human remains protocol would avoid or reduce the potential for impacts on human remains to a less-than-significant level.
- **CEQA Determination**: Under all alternatives, the inadvertent disturbance of human remains represents a potential impact; however, implementation of the cultural resources monitoring program and treatment of human remains protocol as standard practices will reduce the potential for impacts on human remains to a less-than-significant level.

3.4.4.3 Impact CT-3: Potential Impacts on Native American Sacred Sites or Religious Ceremonies

Waterways, including rivers and creeks and the wildlife they contain, were and are essential elements to Native American lifeways and continue to be important to contemporary Native American spiritual and ceremonial practices. Dredging may indirectly impact the availability of certain wildlife and cause visual or noise considerations during ceremonies. These considerations are pursuant to EO 13007 (61 FR 26771-26772 (1996) and the American Indian Religious Freedom Act (42 U.S.C. Chapter 21 Subchapter 1 § 1996 (1978). One Native American tribe—the Confederated Villages of Lisjan—has requested notification of annual dredging schedules, and further consultation is warranted if there are concerns about impacts to traditional ceremonies that could be disrupted by dredging and placement activities during certain times of the year.

- **NEPA Determination:** Under all alternatives, impacts on sacred sites and/or religious ceremonies would be identified during tribal consultation and USACE would implement recommended best practices. Impacts would be avoided or reduced to a less-than-significant level.
- **CEQA Determination:** Under all alternatives, impacts on sacred sites and/or religious ceremonies would be identified during tribal consultation and USACE will implement recommended best practices. Impacts would be reduced to a less-than-significant level.

3.4.4.4 Impact CT-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Historical Resources

Under all alternatives, with the implementation of minimization measures CT1-1, CT1-2, and CT2-1, project activities would not result in impacts on known historical resources or Native American sacred sites and/or ceremonies and therefore would not contribute to any cumulative impact on these resources.

If previously undiscovered cultural resources are inadvertently exposed during construction activities, an adverse effect to cultural resources could occur. However, with proper evaluation and management of these resources according to minimization measures, no adverse cumulative impact on historical resources, human remains, or Native American sacred sites and ceremonies would occur under NEPA.

Impacts to historical resources tend to be site specific because they occur on a project level as a result of a project's ground-disturbing activities and, as such, are assessed on a project-by-project basis. The reasonably foreseeable actions in Table 3-2 include several projects that would involve dredging and dredged material placement that could result in impacts on historical resources. These projects could impact undiscovered cultural resources inadvertently exposed during dredging activities and effects to cultural resources may occur. However, the related projects represent ongoing efforts that are subject to federal, state, and local regulations designed to address cultural resource impacts potentially arising from dredging, transport, and/or placement activities. The exception to this type of project is the Brooklyn Basin Marina Expansion Project, which requires, among other activities, in-water work for a marina expansion in the Port of Oakland. The in-water area has been previously disturbed with various dredging and other construction activities, and the potential to encounter historical resources is low. Nonetheless, the 2005 EIR and the 2022 Final Supplemental EIR has mitigation measures that would address impacts to unanticipated discoveries for the in-water portion of the project to less-than-significant (Port of Oakland 2022). The current and related projects have mitigation measures for work stoppage if cultural resources are encountered. At a minimum, any ground disturbance associated with the projects listed in Table 3-2 that include dredging would also proceed in adherence with federal, state, and local regulations designed to address cultural resource impacts. In the unlikely event that impacts were to occur with all of these projects, they could combine to form a significant cumulative impact to cultural resources. However, minimization measures CT1-1, CT1-2, and CT2-1, or similar measures, would avoid or reduce cumulative impacts to less than significant.

- **NEPA Determination**: Project alternatives, considering reasonably foreseeable actions, would not contribute to impacts on historical resources.
- **CEQA Determination**: Project alternatives would not contribute to cumulatively considerable impacts on historical resources.

3.5 Geology, Soils, and Sediment Quality

This section evaluates the project alternatives' potential effects related to erosion and sediment quality. Sediment-related impacts on water quality (e.g., turbidity, contaminant suspension) from dredging and placement activities are discussed in Section 3.7, Hydrology and Water Quality. Potential impacts associated with sediment quality on fisheries and other aquatic species are addressed in Section 3.3 Biological Resources.

3.5.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential geology, soils, and sediment quality impacts from the alternatives.

3.5.1.1 Federal

Federal regulations applicable to potential geology, soils, and sediment quality impacts from project alternatives are discussed below.

Clean Water Act

See Sections 1.2.1.1 and 1.6.1.3 for discussion of the CWA, including previous and planned project permitting. Specific to geology, soils, and sediment quality, current guidance for implementing inland aquatic dredged material placement pursuant to CWA Section 404 is provided in Evaluation of Dredged Material Proposed for Disposal in Waters of the US–Testing Manual for Discharge in Inland and Near Coastal Water–Testing Manual (USACE and USEPA 1998), referred to as the ITM (see Section 1.2.2.2 for more discussion of sediment testing requirements) and Section 3.5.2.2 for characterization of sediments in the study area.

Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged or Fill Material into Waters of the US or Ocean Waters, 33 C.F.R. pt. 335-338

Section 1.6.1.1 describes the Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged or Fill Material into Waters of the US or Ocean Waters, 33 C.F.R. pt. 335-338. This regulation is relevant to geology, soils, and sediment quality, because it addresses requirements to manage the discharge of dredging materials into waters of the United States in accordance with other regulations, including CWA Section 404 and the CZMA.

Coastal Zone Management Act

The federal CZMA (16 U.S.C. § 1456), established in 1972, provides for management of the nation's coastal resources through a state and federal partnership. Under the federal consistency provisions of the CZMA, federal projects need to be consistent with the state's coastal zone management program and policies to the maximum extent practicable. This determination is made by the lead federal agency, and concurrence is requested from the state or local agency responsible for implementing the CZMA. For SF Bay, BCDC is the state's coastal zone management agency responsible for issuing concurrence with consistency determinations under the CZMA. The SF Bay Plan and Suisun Marsh Protection Plan are BCDC's policy document specifying goals, objectives, and policies for BCDC jurisdictional areas. For portions of the study area outside of SF Bay, concurrence with consistency determinations is issued by the California Coastal Commission (CCC). USACE requests consistency determination concurrence from BCDC and/or CCC prior to commencing dredging activities. In June 2019, USACE completed a consistency determination for the federal navigation maintenance dredging program in SF Bay for coverage under the CZMA from 2020 to 2024. Following public review of the EA/EIR, USACE will submit a CZMA federal consistency determinations to BCDC and CCC.

Marine Protection, Resources, and Sanctuaries Act

The MPRSA (33 U.S.C. §§ 1401 *et. seq.*), also known as the Ocean Dumping Act, was signed into law in 1972. This law regulates transportation of material from the United States, by federal agencies or US-flagged vessels for ocean disposal. The purpose of the act is to prevent degradation or endangerment of "human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." Section 102 of the MPRSA authorizes USEPA to establish criteria for evaluating all dredged material proposed for ocean dumping. USACE is identified under Section 103 of MPRSA as the federal agency that determines whether to issue a permit authorizing ocean disposal of dredged materials based on USEPA's ocean-dumping criteria. Although USACE does not issue permits to itself, USACE and USEPA apply these standards to USACE projects.

3.5.1.2 State

State regulations applicable to potential geology, soils, and sediment quality impacts from project alternatives are discussed below.

California Environmental Quality Act

CEQA and the CEQA Guidelines (PRC § 21000 *et. seq*.) require an analysis of the project's potential impacts on geology and soils, including fault rupture, ground shaking, ground failure (e.g., liquefaction), expansive soils, soil stability, unique paleontological resources, or unique geological features.

McAteer-Petris Act

See Sections 1.2.1.1 and 1.6.2.2. for discussion of the McAteer-Petris Act and Bay Plan. These regulatory requirements guide dredging and sediment placement in SF Bay.

3.5.1.3 Dredged Material Management Office

As discussed in Section 1.2.2.1, the DMMO cooperatively reviews sediment quality sampling plans, analyzes the results of sediment quality sampling, and makes suitability determinations for material proposed for placement in SF Bay, ocean placement, and beneficial use. The DMMO promotes use of beneficial use sites in support of the LTMS goals of beneficial reuse of at least 40 percent of material dredged in the SF Bay region, no more than 40 percent placement at the SF-DODS, and no more than 20 percent placement at in-Bay sites.

Section 1.2.2.2 describes the DMMO testing requirements, which apply the most current version of the Guidelines for Implementing the Inland Testing Manual (ITM) in the SF Bay Region (USACE 2001) when determining the dredged material testing that will be required for dredging projects proposing placement and/or disposal at designated sites in waters of the United States in SF Bay. These local guidelines supplement the more detailed information in the ITM and are not intended to be used on their own.

Although the DMMO provides initial review of permit applications and suitability recommendations, applicants must obtain separate approval from the appropriate DMMO member agencies (such as a CWA Act Section 401 WQC from the Regional Water Board); each agency issues permit conditions and specific requirements associated with how the project is to be performed. In February 2004, the DMMO adopted a Master Sampling and Analysis Plan (Master SAP) to streamline the process for composing and reviewing sampling and analysis plans for individual USACE maintenance dredging projects. The Master SAP describes the way material should be collected, shipped, stored, handled, and tested for certain physical, chemical, and biological analyses. An updated Master SAP was approved by the DMMO in 2022.

3.5.2 Environmental Setting

3.5.2.1 Regional Geologic Setting

The topography of the SF Bay Area is shaped by geological structures, featuring north- to northwest-trending mountain ranges and valleys typical of the Coast Ranges geomorphic province. These ranges consist mainly of late Mesozoic (200 to 70 million years old) and Cenozoic (less than 70 million years old) sedimentary layers, with the northern Coast Ranges dominated by the Franciscan assemblage. SF Bay itself is a topographic depression created through faulting and warping, underlain by a down-dropped block known as the Bay block (Olson and Zoback 1998). This depression enables the San Joaquin and Sacramento rivers to flow into the ocean. The Bay stretches about 55 miles in length and is three to five miles wide, segmented into Suisun, San Pablo, Central, and South San Francisco bays.

Geologically, the Bay Area includes three main provinces: the Salinian block, the Franciscan complex, and the Great Valley sequence. The Salinian block, located west of the San Andreas Fault, is composed of granitic plutonic rocks similar to those of the Sierra Nevada, thought to be displaced sections of the Sierra Nevada Batholith. East of the San Andreas Fault, between it and the Hayward Fault, lies the Mesozoic Franciscan complex, consisting of oceanic crust fragments that accreted to North America through subduction and collision. This complex includes deep marine sandstone and shale, as well as chert and limestone. East of the Hayward Fault is the Great Valley sequence, composed mainly of Cretaceous and Tertiary marine sedimentary rocks.

The depression that forms SF Bay has been filled with sediments, sourced from erosion of surrounding hills and later marine deposits. For instance, "Bay Mud" - a marine clay-silt deposit - is widespread, lying several feet beneath newer mud layers. An ancient sand deposit, known as Merritt Sand, is found near the surface in areas like Oakland and Alameda. Natural peat deposits also underlie more recent sediments in parts of San Pablo Bay, Suisun Bay, and the Delta. The thickness of these historic sediment layers varies but can reach several hundred feet. The upper few feet typically consist of newer marine and riverine sediments. Sediments in the Estuary fall into three categories: sandy bottoms in channels, shell debris from oyster beds in the South Bay, and widespread Bay Mud in shallow waters. Coarser sediments, such as fine sand or gravel, dominate areas with strong currents, like the deeper channels of SF Bay and the Delta’s main rivers. In contrast, Bay Mud accumulates in areas with slower currents, such as the shallow edges of the subembayments (USACE et al. 1998).

The Estuary formed less than 10,000 years ago as global temperatures rose and sea levels increased. About 10,000 years ago, marine water returned to SF Bay, and by around 4,000 years ago, sea levels had reached their current elevation. This transition to estuarine conditions shifted sedimentation in the Bay from alluvial sands and silts to darker estuarine clays and silts, commonly known as Bay Mud, with sandier sediments becoming restricted to the channels.

Since around 1850, human activities have significantly altered SF Bay, affecting circulation and sedimentation patterns. From 1856 to 1900, hydraulic mining in the Sierra Nevada foothills deposited several feet of sediment across the Bay. In the 1800s, levee and dike construction modified drainage and seasonal flooding patterns in the Delta. Additionally, the placement of fill along the Bay's edges has significantly changed the shoreline profile over time.

Most of the surficial sediments in SF Bay have been deposited since the onset of industrialization in California, and may have been exposed to pollutants from human activity. These industrial age sediments are sometimes encountered during maintenance dredging. Recent sand deposits - whether from rivers in San Pablo and Suisun bays and the lower Sacramento River, or from sandbars formed by strong currents in Central SF Bay and the San Francisco Bar - may also be exposed to pollutants but generally do not accumulate high levels of contamination. Monitoring programs in the Bay have shown that industrialized areas around its edges tend to have higher average contaminant levels than the central basins (USACE et al. 1998).

Older deposits, formed before European settlement, whether of terrestrial or marine origin, tend to be hard-packed, low in moisture, low in organic carbon (except for peat deposits), and contain low levels of chemicals like heavy metals and organic compounds. These natural concentrations reflect the sediment type and are typically not disturbed during maintenance dredging (USACE et al. 1998).

Based on a query conducted by the California Department of Conservation at the request of the Regional Water Board, records indicate there are 36 known oil or gas wells located within the study area. Of the 36 wells, 20 are classified as "Not Abandoned to Current Division Requirements as Prescribed by Law and Not Projected to Be Built Over or Have Future Access Impeded by this project." Sixteen wells are classified as "Abandoned to Current Division Requirements as Prescribed by Law and Not Projected to Be Built Over or Have Future Access Impeded by this project" (see Scoping Comments, Appendix F). These oil or gas wells have not been encountered during dredging and/or dredged material placement activities to date, and therefore are not further discussed or evaluated in this EA/EIR.

3.5.2.2 Sediments in the Federal Navigation Channels

Sediment dredged from most of the federal navigation channels is typically characterized as Bay Mud, the exceptions being the San Francisco Harbor MSC, Suisun Bay Channel and New York Slough, and portions of Pinole Shoal Channel, which have historically been greater than 80 percent sand; the Southampton Shoal segment of the Richmond Outer Harbor is all sand. Sediments in all remaining channels (Richmond Harbor, San Rafael Creek, Oakland Harbor, Napa River, Petaluma River, Redwood City Harbor, and remaining portions of Pinole Shoal) contain less than 80 percent sand.

Contaminant concentrations in SF Bay are monitored by the SFEI via the RMP, which includes dischargers and dredgers. Contaminants may be introduced into the water column via adherence to suspended sediments, including smaller sediments such as silt, clay, and organic matter, although they are not often water soluble (USACE et al. 1998). As of 2022, the RMP sampling schedule includes the following (SFEI 2022, 2023):

- Continuous: Suspended sediment monitoring, and nutrient monitoring at 13 sites
- Monthly: Nutrients monitoring, including nitrogen, phosphorus, dissolved oxygen, and chlorophyll

- Every two years: Water quality monitoring
- Every five years: Sediment monitoring

The RMP is a coordinated and comprehensive long-term monitoring program with the goal of monitoring water and sediment quality to provide the scientific foundation for managing and improving the health of the SF Bay aquatic ecosystem. USACE is a participant in the RMP and contributes to the program by funding USGS in order to comply with a requirement in the Regional Water Board WDR/WQC (Regional Water Board 2020). The purpose of the monitoring is to measure suspended sediments at an array of locations in the Bay.

DMMO requirements for sediment testing conducted prior to each maintenance dredging episode are based on a tiered structure; they depend on the placement sites being considered and on past testing results. The DMMO tiered testing process is described in Section 1.2.2.2.

Table 3-20 presents the DMMO-approved five-year sediment testing schedule through 2028 for the federal navigation channels in and around SF Bay. The schedule only includes channels that are dredged annually, not those dredged at less-frequent intervals. Assuming future sediment testing results are consistent with historic results, it is expected that the schedule represented in able 3-20 would continue through the 2034 planning horizon for this project.

Recent sampling results are summarized for each of the federal navigation projects below. Results are reported with respect to whether they were determined to be suitable for deposition at the placement site(s) being considered that year.

The summary for each federal navigation project below only presents the most recent results for the baseline evaluation period (2015 through 2024) based on analysis conducted for placement sites USACE was considering for the year reported. Table 1-1 in Chapter 1 provides a review of the type of dredge equipment commonly used, the dredging cycle (i.e., frequency of dredging), the last fiscal year the project was dredged, and the historic dredged material placement site for each navigation project, which includes additional sites for which dredged material from each navigation project has been found suitable for placement.

Oakland Harbor

The Tier I evaluation for the Oakland Inner and Outer Harbors channels in 2024 indicated that dredged material from these channels was suitable for placement at in-Bay placement sites, SF-DODS, and for placement at beneficial use sites as cover material, including Cullinan Ranch. Based on the 2022 sediment testing, dredged material from Oakland Harbor ranges from 70 to 90 percent sand with some areas containing as low as 15 percent sands content. The remainder of the sediment is composed of silts and clays.

Table 3-20. 2025–2030 Annual Sampling and Testing Schedule for Federal Navigation Channels Maintained by USACE

Channel	2025	2026	2027	2028	2029	2030
Oakland: Inner and Outer Harbor[1]	Tier I (No testing)	Tier I (No testing)	Tier III, MET (5-year cycle)	Tier I (No testing)	Tier I (No testing)	Tier I (No testing)
Redwood City[1]	Tier I (No testing)	Tier III, MET (3-year cycle, depending on dredging cycle)	Tier I (No testing)	Tier I (No testing)	Tier III, MET (3-year cycle, depending on dredging cycle)	Tier I (No testing)
Richmond Inner Harbor[1]	Tier III, MET (3-year cycle)	Tier I (No testing)	Tier I (No testing)	Tier III, MET (3-year cycle)	Tier I (No testing)	Tier I (No testing)
Richmond Outer Harbor[1]	Tier I (No testing, if planned to be dredged)	Tier I (No testing, if planned to be dredged)	Tier III, MET	Tier I (No testing, if planned to be dredged)	Tier I (No testing, if planned to be dredged)	Tier I (No testing, if planned to be dredged)
San Francisco Harbor: Main Ship Channel	Tier I (No testing)	Confirmatory Grain-Size Analysis (8-year cycle)	Tier I (No testing)	Tier I (No testing)	Tier I (No testing)	Tier I (No testing)
San Pablo Bay (Pinole Shoal) and Mare Island Strait*	Grain-Size Verification/ Tier III, MET (3-year cycle)	Tier I (No testing, if planned to be dredged)	Tier I (No testing, if planned to be dredged)	Tier I (No testing, if planned to be dredged)	Grain-Size Verification/ Tier III, MET (3-year cycle)	Tier I (No testing)
Suisun Bay Channel[1] (Suisun, NY Slough, Bulls Head)	Tier I (No testing)	Tier I (No testing)	Tier I (No testing)	Confirmatory Grain-Size Analysis (5-year cycle)	Tier I (No testing)	Tier I (No testing)
Napa River	TBD	TBD	TBD	TBD	TBD	TBD
San Rafael	TBD	TBD	TBD	TBD	TBD	TBD

[1] These projects have potential placement at upland wetland restoration projects. If placement at a wetland restoration project is being proposed, then the sediments shall be analyzed for the constituents required by those projects' permits.
Notes: Tier III = Physical/Chemical Analysis, Benthic and Water Column Toxicity Tests and Bioaccumulation when necessary ITM or OTM requirements will be determined based on placement locations.
Confirmatory Grain-Size Analysis = Physical Analysis (grain size, total organic carbon, and total solids)
Key: MET = Modified Elutriate Test
TBD = to be determined

Redwood City Harbor: Channels

The Tier I evaluation for Redwood City Harbor channels in 2024 indicated that all dredged material from these channels was suitable for disposal at SF-DODS. In addition, sediment proposed for dredging from Sample Areas 1 and 2 is suitable for placement at MWRP as cover material and for use in the Section 1122 Strategic Placement Project. Sediment proposed for dredging from Sample Areas 3 through 9 is suitable for placement at MWRP as foundation material and sediment from Sample Areas 1 through 5 is suitable for placement at Cullinan Ranch and for placement at an in-Bay placement site.

The above suitability determination was based on Tier III analysis efforts conducted in 2023. This analysis also showed that the sediment in Redwood City Harbor channels is composed of 86 to 99 percent fines and less than 15 percent sand (USACE 2024d).

Redwood City Harbor: San Bruno Shoal

Testing of San Bruno Shoal took place in 2016 and showed that the sediment was suitable for unconfined aquatic placement at SF-10 and SF-11.

Richmond Harbor

The Tier I evaluation for Richmond Inner Harbor in 2024 indicated that dredged material from these channels was suitable for placement at SF-DODS and all in-Bay sites (USACE 2024b). In addition to the above site, material from Sampling Areas 1 through 4 was determined to be suitable for placement as cover material at MWRP and Cullinan Ranch, and material from Sampling Areas 5 and 6 was determined to be suitable for placement as foundation material at MWRP. Based on the 2021 sediment testing, dredged material from Richmond Inner Harbor ranges from 65 to 95 percent fines with the remainder being sand.

The Tier III evaluation for Richmond Outer Harbor in 2021 indicated that dredged material from these channels was suitable for unconfined aquatic placement at in-Bay sites, SF-DODS, and for placement as cover material at MWRP. Based on 2024 sediment testing, dredged material from Richmond Outer Harbor is varied; its sand composition ranges from 8 to 93, with the remainder being fines.

San Francisco Harbor

Sediment from San Francisco Harbor MSC has historically been granted a Tier I exemption because it is predominantly composed of sand, gravel, or rock. Based on 2010 and 2018 grain-size analysis, the sediment at the San Francisco Harbor MSC is composed of 96 to 97 percent sand. The total organic carbon levels in composite samples (a total of two composites) ranged from 1.0 percent to 1.3 percent for samples collected in 2018, which is considered low and in the highly suitable range for BUDM. Throughout the years that San Francisco Harbor MSC has been tested for maintenance dredging purposes, the sediment has been determined to be suitable for unconfined aquatic placement at SF-17 and SF-8.

Sediment sampling by USGS in 2010 indicated that the mean grain size in most of the San Francisco Bight (i.e., coastal and offshore area) falls in the fine-sand range (0.125 to 0.250 mm) with fine to medium sand (0.250 to 0.500 mm) occurring along Ocean Beach and on the inner part of the bar. Coarse sand (0.500 to 1.000 mm) was restricted to areas closest to the Golden Gate, where strong tidal currents effectively wash away finer sand. The physical characteristics of material dredged from the San Francisco Harbor MSC are generally compatible with the sand in the Ocean Beach nearshore environment (USACE et al. 2013).

San Pablo/Mare Island Strait

Tier 1 evaluation in 2023 of the Pinole Shoal determined that its sediments were suitable for unconfined aquatic placement at SF-9, SF-10, and SF-8. Tier III testing last occurred in 2021 and showed that sediment at Pinole Shoal is composed of 85 to 99 percent sands and gravel, with the remainder being fines.

Suisun Bay Channel and New York Slough

Tier I evaluation for Suisun Bay and New York Slough in 2024 showed that the sediment is suitable for unconfined aquatic placement at an in-Bay placement site such as SF-16 and SF-9, and for placement as cover material at upland/beneficial use sites. Grain-size testing in 2023 showed sediment ranges between 90 and 98 percent sand.

Napa River

Testing of the Napa River took place in 2022; all sediments were determined to be suitable for placement at permitted upland sites such as the Imola Avenue, South Coombs, and South Jefferson sites. In addition, sediment proposed for dredging from Sample Areas 1, 2, and 4 is suitable for placement at MWRP as foundation material and sediment from Sample Area 3 is suitable for placement at SF-9. Grain-size testing in 2022 shows that sands and gravel make up 98 percent of the sediment composition.

Petaluma River

Testing of the Petaluma River took place in June 2024. Sediments at the Upper Channel and Across the Flats were deemed suitable for unconfined aquatic placement at in-Bay site and for upland placement at Cullinan Ranch. A new determination of suitability for 2025 is expected to be released by the end of October 2024. Based on the 2024 testing, the sediment is composed of near 100 percent fines expect for sample areas 4 and 6 where the percent fines is 32–37.

San Rafael Creek

In 2021, sampling and testing sediment at San Rafael creek showed that sediment downstream of Station 168+00 is suitable for placement at in-Bay placement site SF-DODS, and for placement as cover material at MWRP. Sediment upstream of Station 168+00 is suitable for placement at SF-DODS due to potential contamination resulting from upstream construction activities. Based on 2022, sediment is composed of 73 to 93 percent fines.

3.5.3 Methodology and Thresholds of Significance

The project alternatives neither propose construction of new structures nor introduce elements that would increase potential risks related to rupture of a known earthquake fault; seismic shaking; or seismic-related ground failure, including liquefaction; or landsides. Similarly, because channels would be dredged to previously maintained depths, the project alternatives would not involve activities that would cause geologic units or soils to become unstable and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse. This excludes minor erosion of the channel sides from sloughing that may occur after the channels are dredged. Placement of dredged material at existing permitted placement sites would not be expected to result in onsite or offsite landslides, lateral spreading, subsidence, liquefaction, or collapse because the placement of dredged material at these sites is managed and monitored to avoid such impacts. Because the project alternatives would have no potential impacts related to seismic risks or unstable geologic resources, these topics are not further addressed in this section. Additionally, as described in Section 3.1.1, because the Proposed Project would not result in adverse impact on minerals, this resource is not evaluated further in this EA/EIR.

Therefore, the analysis considers whether the Proposed Project would result in any of the following:

- Substantial soil erosion.
- Substantial degradation of sediment quality (i.e., substantially increase sediment contaminant concentrations above ambient conditions).
- Substantial sediment mounding determined through exceedances of monthly and annual site capacities in Table 3-23.

The alternatives present a range of dredged and placed sediment volumes for each alternative. In any given year, the average volume of dredge sediment could range from 2.13 million CY to 2.815 million CY. For all alternatives except the No Project Alternative the maximum amount of dredged sediment that could occur in one year is 2.73 million CY. In the No Project Alternative, the maximum amount of dredged sediment that could occur in one year is 2.815 million CY due to increased volume at Richmond Outer Harbor. This represents a scenario where all channels are dredged within the same year and will be used to conduct the impact analysis.

3.5.4 Impacts and Mitigation Measures

3.5.4.1 Impact GE-1: Potential for Dredging, Transport, and Placement Activities to Result in Substantial Soil Erosion

No Action Alternative/No Project Alternative

The act of dredging removes sediment in the channels that has accumulated since the prior dredging event. The design dimensions of the channels are intended to preclude sloughing of the channel sides. Although the alternatives may result in minimal erosion of the channel sides from sloughing after they are dredged due to the disturbance of sediments, historic patterns of erosion and sediment accumulation would not be expected to change due to the act of the dredging under the No Action Alternative/No Project Alternative. Transport of dredged material would not disturb sediments, and therefore would not result in any erosion impacts.

The potential for erosion impacts at and adjacent to the placement sites due to placement activities would be minimal. With the exception of SF-DODS, all of the other open-water placement sites, both inside and outside SF Bay, are considered dispersive (USACE et al. 1998). Therefore, although sediments placed at in-Bay locations may disperse, they would not be expected to erode beyond their original bed elevation. The disposition of dredged material at beneficial use and upland placement sites is managed by site operators so that substantial erosion impacts do not occur. Furthermore, at beneficial use sites, placement of dredged material would have beneficial impacts on soil resources by providing sediments needed to implement the site-specific intended beneficial use (e.g., habitat restoration, flood protection).

Additional potential beneficial impacts would result from the placement of dredged material at Ocean Beach Nearshore Placement Site (SF-17), which includes the Ocean Beach demonstration site and Ocean Beach itself. Sand placed in SF-17 is expected to stay in the nearshore, slowly moving shoreward while dispersing, and creating shallower depths. This scenario could lead to a slowing of bluff erosion as more wave energy is dissipated further offshore. Also, having a larger volume of sand at or inside the breaker zone (i.e., where wave and tidal currents can drive shore-normal and shore-parallel sand transport) is expected to extend the length of time sand remains on the beach. This is because each storm has the potential to erode a given volume of sand from the nearshore, beach, and bluffs; therefore, having more sand in the nearshore would likely result in a smaller cross-shore transport potential for beach erosion and bluff failure (USACE et al. 2013).

Newly placed sand at both SF-17 and the Ocean Beach nourishment site would immediately start dispersing. Post-placement surveys show that the elevation of the mound above the pre-placement bottom decreases by one to two feet in the year between placements. Consequently, placement of additional sand in the littoral zone would temporarily change existing erosion and accretion patterns offshore and along the beaches of Ocean Beach. However, those changes are not expected to be significant given the small placement footprint. Overall, the purpose of placement at SF-17 and Ocean Beach is to alleviate the beach erosion occurring along Ocean Beach by having more sand in the littoral system off the stretch of Ocean Beach south of Sloat Boulevard. The changes to erosion and accretion patterns from both options are considered to be temporary and not significant (USACE et al. 2013), and would be outweighed by the beneficial effects on shoreline stabilization.

Potential impacts and benefits of placing sediment at the alternative beneficial use sites listed in Section 01.5.2.2 would be similar to the current beneficial use sites and SF-17.

Under the No Action Alternative/No Project Alternative, a majority of the dredged sediment, approximately 83 percent, is placed at in-Bay sites and SF (SF-DODS), and 12 percent of the sediment is for BUDM. Wetland restoration and nature-based SLR adaption adaptation solutions, which are critical to ensure future resiliency for SF Bay, often require large amounts of suitable sediment. By maintaining the BUDM to 12 percent of total dredge sediment volume under these alternatives, the progress of restoration projects requiring suitable sediment may be delayed or limited. Furthermore, 48 percent of the dredged sediment is placed at SF-DODS, and therefore removed from the SF Bay sediment system. Based on a recent study conducted by SFEI, sediment/sand budgets in SF Bay for 2001 to 2021 showed net outflows of total sediment (4.0 million tons per year) exceeded net inflows (2.0 million tons per year) resulting in a net bed loss of 2.0 million tons per year (Battalio et al. 2024; McKee et al. 2023). Sediment placement at (SF-DODS) contributes to the overall net loss of sediment from SF Bay and may lead to erosion of the Bay floor and shoreline, reduced availability of sediment for restoration projects, and overall reduction in the long-term resiliency of the SF Bay ecosystem.

- **NEPA Determination:** Under the No Action Alternative/No Project Alternative, erosion impacts would be minimal. While the removal of dredged sediment from the system may contribute to a net sediment loss in SF Bay, the impact this has on overall erosion in SF Bay is minimal. The placement of dredged material at beneficial use sites would have beneficial impacts on soil resources. The overall potential impact for dredging, transport, and placement activities to result in substantial soil erosion is less than significant.

- **CEQA Determination:** Under the No Action Alternative/No Project Alternative, erosion impacts would be minimal. While the removal of dredged sediment from the system may contribute to a net sediment loss in SF Bay, the impact this has on overall erosion in SF Bay is minimal. The placement of dredged material at beneficial use sites would have beneficial impacts on soil resources. The overall potential impact for dredging, transport, and placement activities to result in substantial soil erosion is less than significant.

Alternatives 1 through 4

Alternatives 1 through 4 experience the same degree of erosion impacts in and adjacent to the channels and placement sites as the No Action Alternative/No Project Alternative. Likewise, these alternatives experience the same beneficial impacts of placing sediment at SF-17 and the Ocean Beach nourishment site as the No Action Alternative/No Project Alternative.

Under Alternatives 1 through 4, the amount of dredged sediment placed at SF-DODS is greatly reduced and accounts for 0 to 35 percent of total dredged sediment, which reduces the overall net loss of sediment from SF Bay. These alternatives also increase the amount of sediment placed at non-aquatic direct placement sites and thus facilitate the creation and/or restoration wetland habitats along and around SF Bay by providing suitable soil material.

- **NEPA Determination:** Under Alternatives 1 through 4, erosion impacts would minimal. The increased placement of dredged material at beneficial use sites would have beneficial impacts on soil resources. The overall potential impact for dredging, transport, and placement activities to result in substantial soil erosion is less than significant.
- **CEQA Determination:** Under Alternatives 1 through 4, erosion impacts would minimal. The increased placement of dredged material at beneficial use sites would have beneficial impacts on soil resources. The overall potential impact for dredging, transport, and placement activities to result in substantial soil erosion is less than significant.

3.5.4.2 Impact GE-2: Potential for Dredging, Transport, and Placement Activities to Substantially Degrade Sediment Quality

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Generally, based on historic sediment testing data, dredged material from the federal navigation channels has been determined suitable for placement at the existing and proposed potential alternate placement sites identified for each channel in Chapter 2. Over time, some isolated areas in or adjacent to the channels have been identified as containing sediment that is NUAD. USACE would continue to avoid dredging the areas (e.g., portions of the Richmond Harbor federal channel adjacent to the United Heckathorn Superfund Site) that it has been able to avoid dredging in the past. Under all the alternatives, USACE would continue to conduct testing following guidelines in the Master Sampling and Analysis Plan, Ocean Testing Manual (OTM), ITM, Upland Testing Manual (UTM), and the Guidelines for Implementing the ITM in the SF Bay Region; obtain suitability determinations from the DMMO for the placement of dredged material; and conduct placement in accordance with the LTMS goals to ensure BUDM, as appropriate and feasible. If future testing identifies NUAD material that must be dredged, all NUAD dredged material would be placed at upland sites, and in some cases MWRP, as determined during DMMO review. Conformance with the above processes would ensure that dredged material placement activities would not substantially degrade sediment quality at the placement sites.

USACE would also implement sediment bioaccumulation testing as detailed in the Agreement on Programmatic EFH Conservation Measures for Maintenance Dredging Conducted Under the LTMS Program (USACE and USEPA 2011). Per this agreement, if residual layer contamination that would be exposed after maintenance dredging is greater than that in the overlying sediment and exceeds the bioaccumulation trigger values established in the agreement, the need for potential management actions to address the residual contamination would be addressed on a case-by-case basis. Because the LTMS program does not include a remediation component, if substantially elevated concentrations of contaminants in sediment are found during testing conducted prior to dredging, the area of contamination would not be dredged and LTMS agencies would typically refer the project to toxic cleanup programs for further investigation.

Potential impacts and benefits of placing sediment at the alternative beneficial use sites listed in Section 2.3 would be similar to those at the current beneficial use sites.

- **NEPA Determination:** Under all alternatives, impacts on sediment quality would be less than significant.
- **CEQA Determination:** Under all alternatives, impacts on sediment quality would be less than significant.

3.5.4.3 Impact GE-3: Potential for Dredging, Transport, and Placement Activities to Result in Substantial In-Bay Sediment Mounding

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Based on the maximum amount of dredged sediment within one year, which assumes that all channels are dredged in one year, the cumulative sediment volumes placed at in-Bay sites by USACE dredging activities and all non-federal dredgers under each alternative are shown in

. The maximum and average amount of sediment placed at each in-Bay site per year, over the 10-year dredging cycle, was calculated based on the placement locations and volumes shown in Tables 2-4, 2-6, 2-8, 2-10, 2-14 and 2-14, and is shown in Table 3-22.

Table 3-21. Cumulative Annual Sediment Volume Placed at All In-Bay Sites Under Each Alternative (USACE and Non-Federal Projects)

Alternative	Minimum in-Bay Placement (CY)	Average in-Bay Placement (CY)	Maximum in-Bay Placement (CY)
No Action	934,700	1,040,550	1,146,400
No Project	976,700	1,089,550	1,202,400
Alternative 1	1,089,550	1,247,540	1,540,950

Alternative	Minimum in-Bay Placement (CY)	Average in-Bay Placement (CY)	Maximum in-Bay Placement (CY)
Alternative 2	1,428,100	1,563,520	1,653,800
Alternative 3	1,089,550	1,202,400	1,315,250
Alternative 4	299,600	435,020	525,300

Key: CY = cubic yard

Table 3-22. Annual Sediment Volume Placed at Each In-Bay Site Under Each Alternative

Alternative		SF-9 (CY)	SF-10 (CY)	SF-11 (CY)	SF-16 (CY)
No Action	Maximum	0	190,000	700,000	170,000
	Average	0	112,500	367,000	170,000
No Project	Maximum	0	190,000	700,000	170,000
	Average	0	112,500	367,000	170,000
Alternative 1	Maximum	0	190,000	860,000	170,000
	Average	0	112,500	536,500	170,000
Alternative 2	Maximum	310,000	320,000	840,000	130,000
	Average	118,000	142,500	705,500	130,000
Alternative 3	Maximum	250,000	300,000	500,000	130,000
	Average	104,000	135,000	390,500	130,000
Alternative 4	Maximum	0	70,000	0	130,000
	Average	0	17,500	0	130,000

Key: CY = cubic yard
SF-9 Carquinez Strait placement site
SF-10 San Pablo Bay placement site
SF-11 Alcatraz Island placement site
SF-16 Suisun Bay placement site

As noted in Section 1.2.1.1, the LTMS has a capacity goal of 1.25 million CY per year for placed sediment at all in-Bay sites. This total in-Bay placement capacity goal is measured by the LTMS as a blocked three-year average (DMMO 2022). This capacity includes placed sediment from all projects, including small and medium (non-federal) dredging projects. Small dredgers can account for up to 250,000 CY of sediment per year, though typically are less than 200,000 CY per year. The LTMS requires medium dredgers to conduct an Integrated Alternatives Analysis and dispose of less than 20 percent of their sediment at in-Bay locations. The LTMS also sets limits for each in-Bay site as shown in

Table 3-23. The total in-Bay and site-specific placement goals are set to prevent mounding of sediments, limit impacts on fisheries and reduce potential navigational hazards at each site.

Table 3-23. Placement Limits for In-Bay Site

Placement Sites	Annual Capacity (CY)	Monthly Capacity (CY)
SF-9	2,000,000	1,000,000
SF-10	500,000	500,000
SF-11	4,000,000	300,000 (May–Sept) 400,000 (Oct–April)
SF-16	200,000	-
Total in-Bay	**1,250,000[1,2]**	**-**

1 Calculated as the average of the most recent three years of in-Bay placement volumes
2 This value does not account for a 250,000 CY contingency volume
Key: CY = cubic yard
SF-9 = Carquinez Strait placement site
SF-10 = San Pablo Bay placement site
SF-11 = Alcatraz Island placement site
SF-16 = Suisun Bay placement site

In-Bay monthly and annual site capacities were considered the significant thresholds in the development of the alternatives and none of the alternatives would place more sediment at the in-Bay sites than their current capacities, as shown in Table 3-23.

In-Bay placement of non-federal dredgers between 2015 and 2023 ranged from 143 to 470 thousand CY, with an average of 299,600 CY. During this time total in-Bay placement of all dredged sediment (USACE + non-federal) peaked at 1.285 million CY in 2022 and dropped to a low of 833 thousand CY in 2023. Table 3-21 includes the USACE projected in-Bay placement volumes under each alternative, with the added average annual volume of 299,600 CY from non-federal dredgers. Alternatives 1, 2 and 3 have the potential to exceed the 1.25 million CY in-Bay placement capacity goal under the maximum estimate of USACE dredging. In contrast, when assuming average USACE placement volumes, only Alternative 2 exceeds the in-Bay capacity goal.

Between 1970-1990, large volumes of sediment were placed at SF-11 with the expectation that it would disperse. However, in 1982, a large mound of sediment was discovered at the site, prompting the need for site placement limits. Placement volumes during this time ranged from 1 to 3 million CY per year at SF-11. Since 2010, placement volumes at SF-11 have been significantly lower, ranging from 75,000 CY to 540,000 CY per year. Alternative 1, which has the largest potential annual volume placed at SF-11, at 860,000 CY, is only 220,000 CY more than the maximum amount placed at SF-11 over the last 20 years, and well below the volumes placed between 1970 and 1990 that resulted in mounding at SF-11. It is unlikely that the extra sediment volume for in-Bay placement under alternatives would create mounding impacts because the historic sediment mounding issues at SF-11 were correlated to substantially more in-Bay sediment placement volumes that than the potential volumes under alternatives.

In-Bay placement sites are generally dispersive, and sediment will migrate over time (USACE et al. 1998). When considering mounding impacts, it is important to consider the time scale at which impacts are evaluated. Short-term navigation impacts may occur until the sediment naturally disperses. A recent study conducted by SFEI on SF Bay sediment/sand budgets for 2001 to 2021 (Battalio et al. 2024; McKee et al.

2023) showed that net outflows of total sediment (4.0 million tons per year) exceeded net inflows (2.0 million tons per year) resulting in a net bed loss of 2.0 million tons per year. Therefore, more sediment is leaving SF Bay than is entering, and the Bay is losing sediment every year. This implies that sediment in SF Bay is generally dispersive and will find a means for transport out of SF Bay.

Based on these conditions and continued future constraints on in-Bay placement volume to their current site capacities, there would not be a significant increase in mounding or creation of a new navigation hazard compared to the CEQA and NEPA baseline.

- **NEPA Determination:** Under all alternatives, impacts related to potential for dredging, transport, and placement activities to result in substantial in-Bay sediment mounding would be less than significant.
- **CEQA Determination** Under all alternatives, impacts related to potential for dredging, transport, and placement activities to result in substantial in-Bay sediment mounding would be less than significant.

3.5.4.4 Impact GE-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Soil Erosion, Sediment Quality and Sediment Mounding

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

All alternatives would create less than significant impacts if implemented. When considering the other regional projects in Table 3-2, cumulative impacts on soil erosion, sediment quality, and sediment mounding would be minimal and short-term. Non-federal dredging is small compared to the volumes dredged and disposed for this project, such that their relative impact on soil erosion, sediment quality, and sediment mounding would also be small compared to project alternatives. The LTMS also allocates up to 250,000 CY of sediment per year for small dredgers in its in-Bay sediment placement limit, though generally small dredgers account for less than 200,000 CY per year. Additionally, these other regional projects would be compliant with permitting processes and requirements as required by law and with the necessary measures to mitigate geology soils and sediment quality impacts. The combined cumulative impacts of the alternatives and the other projects on soil erosion, sediment quality, and sediment mounding would not be significant.

- **NEPA** Determination**:** Project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts on soil erosion, sediment quality, and sediment mounding.
- **CEQA Determination:** Project alternatives would not contribute to cumulatively considerable impacts on soil erosion, sediment quality, and sediment mounding.

3.6 Hazards and Hazardous Materials

This section describes the existing conditions for hazards including emergency planning and hazardous materials in the SF Bay region and evaluates the potential hazard and hazardous materials impacts related to human health. Potential hazardous material impacts on sediments are addressed in Section 3.5 Geology, Soils, and Sediment Quality. Potential hazardous material impacts on water quality are addressed in Section 3.7, Hydrology and Water Quality. Hazards related to marine navigation are evaluated in Chapter 3.9 Transportation and Traffic.

3.6.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential hazards and hazardous materials impacts from the alternatives.

3.6.1.1 Federal

Federal regulations applicable to hazards and hazardous materials are discussed in the sections below.

Rivers and Harbors Act

The Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.) was the first federal water pollution act in the United States. This act addressed construction of structures in navigable waters, with a focus on protecting navigation, protecting waters from pollution; this act was a precursor to the CWA of 1972. Section 10 of the Rivers and Harbors Act of 1899 regulates creation of obstructions in navigable waters of the United States. USACE is not required to permit itself for projects sponsored and executed by USACE.

Oil Pollution Act

The Oil Pollution Act (OPA) (Title 33 U.S.C. §§ 2701 et seq.) establishes a liability system for oil spills into navigable waters or adjacent shorelines that injure or are likely to injure natural resources, and/or the services that those resources provide to the ecosystem or humans. Pursuant to the OPA, federal and state agencies and Indian tribes may act as trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries, and implement restoration.

Various Oil or Hazardous Material Pollution Prevention Regulations for Vessels

This section addresses regulations related to oil and hazardous material pollution prevention regulations for vessels, including 3 U.S.C. 301 through 303; 33 U.S.C. 1321(j), 1903(b), 2735; 46 U.S.C. 70011; 46 U.S.C. 70034; EO 12777 (56 FR 54757, 3 C.F.R, 1991 Comp., p. 351); DHS Delegation No. 00170.1, Revision No. 01.3. Section 155.1020 also issued under Section 316 of Pub. L. 114-120. Section 155.480 also issued under Section 4110(b) of Pub. L. 101-380.

To operate in US waters and ports, applicable vessels regulated by USCG are required to provide a Vessel Response Plan to the USCG for review and approval. A Vessel Response Plan serves as an oil spill response plan for vessels and would include, at a minimum, a contact list, including the spill removal contractor and contacts for spill notifications; procedures for spill notifications; shipboard spill mitigation procedures to mitigate or prevent discharge or threat of discharge resulting from operations, accidents, or emergencies; and shore-based response activities, including notification, coordination actions, and organization structure for response. A Vessel Response Plan would be consistent with both the National Oil and Hazardous Substances Pollution Contingency Plan and the California Office of Spill Prevention and Response’s Area Contingency Plan.

Clean Water Act Section 303(d)

Under Section 303(d) of the CWA, Impaired Water Bodies and Total Maximum Daily Loads (TMDL) (33 U.S.C. § 303(d)), each state is required to identify those waters within its boundaries for which effluent limits required by Section 301 are not stringent enough to meet water quality standards. The state must establish priority rankings for these waters and develop TMDLs to maintain beneficial uses and improve water quality. Seasonal variations in loading and a margin of safety are considered when TMDLs are established. In California, the State Water Resources Control Board (State Water Board) and Regional Water Quality Control Boards prepare the CWA Section 303(d) List of Water Quality Limited Segments Requiring TMDLs.

SF Bay is listed as impaired for pesticides (e.g., chlordane, DDT, dieldrin, dioxin, and furan compounds), mercury, invasive species, PCBs, selenium, and trash. In the greater SF Bay Area, Suisun Bay and San Pablo Bay are listed for these same parameters, except for trash. The Napa River is listed as impaired for pathogens and sedimentation/siltation. The tidal portion of the Petaluma River is listed as impaired for diazinon, nutrients, pathogens, and nickel.

Clean Water Act Section 401

See Section 1.6.1.3 for discussion of the CWA Section 401, including previous and planned project permitting. Section 401 of the CWA certifications must include effluent or other limitations to ensure compliance with applicable sections of the CWA and state law, including those related to hazardous material discharges.

Clean Water Act Section 402

The 1972 amendments to the CWA established the National Pollutant Discharge Elimination System (NPDES) permit program to control discharges of pollutants from point sources. The 1987 amendments to the CWA created a new section of the CWA devoted specifically to stormwater permitting (Section 402[p]), NPDES, 33 U.S.C. § 1342). USEPA has delegated administering and enforcing the provisions of CWA and NPDES to the State of California. NPDES is the primary federal program that regulates point-source and non-point-source discharges to waters of the United States. Projects disturbing areas 1 acre or greater in size are effectively prohibited unless the discharge complies with a NPDES permit. State Water Board Order No. 2022-0057, NPDES General Permit No. CAS000002, General Permit for Stormwater Discharges Associated with Construction Activity (Construction General Permit), is the active general stormwater construction activity permit for the State of California and Regional Water Board.

Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act of 1986 (also known as Title III of the Superfund Amendments and Reauthorization Act), 42 U.S.C. §§ 9601 et. seq, imposes requirements to ensure that hazardous materials are properly handled, used, stored, and disposed of, and to prevent or mitigate injury to human health or the environment if such materials are accidentally released.

Resource Conservation and Recovery Act

Under the Resource Conservation and Recovery Act of 1976 (RCRA) (40 C.F.R. §§ 239-282), USEPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste from "cradle to grave." Transportation of hazardous materials and hazardous waste is carried out by individuals or entities that move hazardous materials and waste from one site to another by highway, rail, water, or air (40 C.F.R. § 260.10).

Hazardous and Solid Waste Amendments

The 1984 RCRA Hazardous and Solid Waste Amendments (42 U.S.C. §§ 6901 et seq.) affirmed and extended the "cradle to grave" system of regulating hazardous wastes. The amendments specifically prohibit the use of certain techniques for the disposal of some hazardous wastes.

Hazardous Materials Transportation

Under the Hazardous Materials Transportation Act of 1975 (49 U.S.C. §§ 5101 *et seq.*), the USDOT has the regulatory responsibility for the safe transportation of hazardous materials. The USDOT regulations govern all means of transportation except packages shipped by mail.

Occupational Safety and Health Act

The Occupational Safety and Health Act of 1970 (29 U.S.C. §§ 651 *et seq.*) created the Occupational Safety and Health Administration (OSHA), which sets standards for safe workplaces and work practices, including the reporting of accidents and occupational injuries.

3.6.1.2 State

State regulations applicable to hazards and hazardous materials are discussed in the following sections.

Lempert-Keene-Seastrand Oil Spill Prevention and Response Act

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (California Government Code Title 2, Division 1, Chapter 7, Article 3.5) was passed in 1990 following the 1989 Exxon Valdez oil spill in the waters off Alaska and the 1990 American Trader oil spill offshore Orange County, California. The act sets forth a comprehensive oil spill prevention and response program that requires all marine facilities and vessels to comply with an integrated system of statewide regulations, operation manuals, inspections, training, and drill programs to provide the "best achievable protection" of the state's coastal and marine resources through the use of "best achievable technologies" and practices.

Unified Hazardous Waste and Hazardous Materials Management Regulatory Program

In January 1996, CalEPA adopted regulations that implemented a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program), Certified Unified Program Agency (CUPA), and California Health and Safety Code Sections 25404 *et seq.* at the local level. The agency responsible for implementation of the Unified Program is called CUPA. The Unified Program consists of six environmental and safety programs: the hazardous materials business plan (HMBP) program, the underground storage tank program, the hazardous waste generator program, the tiered permitting program for onsite treatment of hazardous waste and the California accidental release prevention program for highly hazardous materials.

California Hazardous Materials Release Response Plan and Inventory Law

The California Hazardous Materials Release Response Plan and Inventory Law of 1985 (Business Plan Act), California Health and Safety Code, Div. 20, Chapter 6.95, requires that businesses that store hazardous materials onsite prepare an HMBP and submit it to the local CUPA.

California Hazardous Waste Control Act, California Health and Safety Code

The California Hazardous Waste Control Act (Division 20, Chapter 6.5, Article 2, Section 25100 *et seq.*) regulates the generation, transportation, treatment, storage, and disposal of hazardous waste in California. The hazardous waste regulations establish criteria for identifying, packaging, and labeling hazardous wastes; dictate the management of hazardous waste; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills. The Department of Toxic Substances Control is also the administering agency for the California Hazardous Substance Account Act, also known as the State Superfund law, which provides for the investigation and remediation of hazardous substances pursuant to state law.

Hazardous Waste Transportation

The Hazardous Waste Transportation (Titles 13, 22, and 26 of the California Code of Regulations) regulates the transportation of hazardous waste originating in and passing through the state, including requirements for shipping, containers, and labeling.

Hazardous Materials Transportation Emergency Response

Caltrans and the California Highway Patrol have primary responsibility for enforcing federal and state regulations on California’s roadways and responding to hazardous materials transportation emergencies.

Occupational Safety and Health Administration, California Code of Regulations Title 8

Under California Code of Regulations Title 8, the California Division of Occupational Safety and Health (Cal/OSHA) has primary responsibility for developing and enforcing workplace safety regulations in California. Because California has a federally approved OSHA program, it is required to adopt regulations that are at least as stringent as those found in Title 29 of the C.F.R. Cal/OSHA standards are generally more stringent than federal regulations. The use of hazardous materials in the workplace requires employee safety training, safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation.

3.6.2 Environmental Setting

3.6.2.1 Study Area

Three hazard sites in the study area were identified and discussed in the 2015 EA/EIR (USACE and Regional Water Board 2015). Two hazard sites remain, and no additional hazard sites were identified in the study area during this assessment. The hazard sites are:

- *Cosco Busan*, CA: In 2007, the container ship *Cosco Busan* struck the San Francisco-Oakland Bay Bridge, causing the release of 53,000 gallons of fuel into the water which spread throughout SF Bay. Restoration projects for *Cosco Busan* are still under way (CDFW 2024).
- United Heckathorn Superfund Site: This site contains elevated levels of DDT and dieldrin in the waters and sediments of the Parr Canal and Lauritzen Channel. It is located north of the Richmond Inner Harbor Santa Fe dredging channel. Since the 2015 EA/EIR (USACE and Regional Water Board 2015) was released, the EPA has determined that remediation goals have not been met in the channel, and they will select a new remedy for the channel (USEPA 2021).

The third hazard identified in the 2015 EA/EIR (USACE and Regional Water Board 2015) is the Suisun Bay Reserve Fleet. At this location, in the Suisun Bay Channel, military vessels stored for emergency use have slowly decayed, leaking fuel, rusting, collecting invasive species, and shedding metals and toxic paint into the surrounding area. As of 2017 the ships in worst condition have been removed from the fleet and additional cleanup operations have been completed so that the fleet is no longer considered a hazard (San Francisco Baykeeper 2017).

3.6.3 Methodology and Thresholds of Significance

This analysis assesses the anticipated impacts of the project alternatives concerning hazards and hazardous materials on human health and the environment. The project alternatives would involve maintenance dredging of federal navigation channels, transport of dredged material, and placement of dredged material at permitted placement sites.

As discussed in Section 3.5, Geology, Soils, and Sediment Quality, sediment testing results for previous USACE maintenance dredging episodes indicate that, in general, dredged material from the subject federal navigation channels has been suitable for unconfined aquatic placement. Contaminated dredged sediments that are not suitable for unconfined aquatic placement and do not meet the criteria for placement at upland sites or permitted beneficial use or sites would be disposed at a permitted facility approved by the DMMO (e.g., a landfill). Therefore, the potential impacts related to release of hazardous materials to land are anticipated to not be adverse and are not further evaluated. The 2015 Federal Navigation Channels EA/EIR sections 3.3 and 3.4 describes the potential effects from hazardous materials on human health and the environment and sediment impacts on hydrology and water quality. There has been no change in how NEPA and CEQA effects are analyzed since 2015 and therefore the methodology and significance criteria are incorporated by reference.

Because dredging, transport, and placement operations are conducted over open water, any releases of hazardous materials have the potential to negatively impact water quality within the study area.
These potential effects are discussed in Section 3.7, Hydrology and Water Quality. Impact analysis in this

section analyzes potential adverse effects to human health associated with hazards and hazardous materials.

3.6.4 Impacts and Mitigation Measures

3.6.4.1 Impact HM-1: Potential Public or Environmental Exposure from the Transport, Use, and Disposal of Hazardous Materials

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Under all alternatives, the DMMO would require approval of sediment analysis, which would include development of a sampling plan, sediment characterization, and a sediment removal plan. Handling and disposal of sediments would be in accordance with applicable permit conditions. Human health and safety impacts would be avoided through adherence with all federal, state, and local regulations regarding the use, transport, and disposal of hazardous materials during project activities.

Cleanup activities for *Cosco Busan* have been completed, although restoration efforts are still underway. The proposed dredge and placement operations would not interfere with restoration efforts.

The United Heckathorn Superfund Site is still under active surveillance with some exceedances of established remediation thresholds for DDT and dieldrin, specifically in the Lauritzen Channel, but these areas do not appear to be close enough to the Santa Fe Channel to impact the sediments there as recently as 2021 (USEPA 2021). As discussed in Section 3.5.2.2, sediment testing conducted in 2021 at Richmond Inner Harbor, the closest dredging location to the Heckathorn hazard site, determined dredged material was suitable for unconfined aquatic disposal. Sediment testing conducted by USACE in 2018 upstream of the dredging location adjacent to the United Heckathorn site also showed that sediment upstream of the dredging site also met the criteria for unconfined aquatic disposal and non-aquatic beneficial use (see Pacific EcoRisk and D.R. Reed and Associates Inc. 2021, Table 8-1). Therefore, it is not anticipated that dredging operations would encounter contaminated material from these or other sites.

Transport of dredged material by truck or train would be rare; it would only occur in circumstances where dredged material that is not suitable for unconfined aquatic disposal requires secondary placement at a land-based facility, such as a permitted landfill, after the material has dried. The transport of dried sediment is easily contained and is not anticipated to create hazardous emissions, therefore, human health impacts from land transport would be negligible. Additionally, the project alternatives would not pose a risk to human health due to waterborne recreation or fishing operations since the alternatives do not involve these activities in contaminated areas.

Dredging operations in SF Bay pose the risk of accidental minor oil spills, hydraulic fluid leaks and/or hazardous materials releases into receiving water from vessels involved in dredging work. The risk is mitigated by the ongoing implementation of a vessel emergency spill response plan which would limit the potential of these materials to enter the receiving water. The *Essayons* and the *Yaquina* both operate under the spill response plan for the Portland District of USACE, which is the home port for these vessels. The spill response plan applies to all activities and operations of these vessels while they are operating in any waters of the United States, including SF Bay. It covers USACE responsibilities for accidental releases including discovery and notification procedures, incidental spill response, emergency spill response and containment, safety and health, pollutant disposal, spill response contracting, reporting, public information, training and exercise requirements, and the distribution of the document. Any assisting tugboats are required to operate under their own vessel emergency spill response plan.

The project boundary is not located within 0.25 mile of any existing or proposed school, and therefore would not emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school.

No proposed dredging operations are located on or near a site that is included on a list of hazardous material sites compiled pursuant to Government Code Section 65962.5; and as a result, create a significant hazard to the public or the environment.

Proposed dredging operations are not located near any existing airports, and therefore would not present a safety hazard for people residing and working in the vicinity of a public-use airport.

Proposed dredging operations will not be conducted near any private airstrip and would not present a safety hazard for people residing and working in the vicinity of a private airstrip. The Proposed Project will take place entirely within the aquatic environment and some placement sites adjacent to SF Bay that are primarily marsh lands subject to tidal action. Therefore, the project does not expose people or structures to a significant risk of loss, injury, or death involving wildland fires.

- **NEPA Determination**: Under all alternatives, impacts on public or environmental exposure from the transport, use, and disposal of hazardous materials would be less than significant.
- **CEQA Determination**: Under all alternatives, impacts on public or environmental exposure from the transport, use, and disposal of hazardous materials would be less than significant.

3.6.4.2 Impact HM-2: Potential Impacts on Implementation of an Adopted Emergency Response Plan

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Under all alternatives, it is anticipated that there would be no interference with emergency operation or evacuation plans in the study area. In the event of an emergency, dredge equipment would be repositioned or removed from the federal navigation channel(s) to allow for the navigation of emergency response or evacuation vessels. Under all alternatives, dredging would result in long-term beneficial impacts on emergency response by eliminating shallow sediment and upholding the navigability of federal waterways, which in turn would facilitate the movement of vessels during emergency response operations.

- **NEPA Determination**: Under all alternatives, impacts on emergency response operations would be beneficial.
- **CEQA Determination**: Under all alternatives, there would be no impacts on emergency response operations.

3.6.4.3 Impact HM-3 Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hazards and Hazardous Materials

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

The Proposed Project and alternatives would either have no impact or not cause adverse impacts related to hazards and hazardous materials. Project alternatives would not result in cumulative hazards and hazardous materials use impacts when considered with other past, present, and reasonably foreseeable projects in Table 3-2. Specifically, in consideration of non-federal maintenance dredging in SF Bay, the DMMO would require approval of sediment analysis, which would include development of a sampling plan, sediment characterization, and a sediment removal plan, same as described for all alternatives.

- **NEPA Determination**: The project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts from hazards and hazardous materials.
- **CEQA Determination**: The project alternatives would not contribute to cumulatively considerable impacts from hazards and hazardous materials.

3.7 Hydrology and Water Quality

This section summarizes the existing hydrologic and water quality environmental setting of SF Bay and the offshore ocean environment and analyzes the potential impacts of the project alternatives on water resources. Existing conditions and potential impacts associated with plans and water quality policies pursuant to compliance with the CZMA are addressed in Section 3.8 Land Use and Planning. Existing conditions and potential impacts associated with water quality impacts on fisheries and other aquatic species are addressed in Section 3.3 Biological Resources.

3.7.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential hydrology and water quality impacts from the alternatives.

3.7.1.1 Federal

Federal regulations applicable to hydrology and water quality are discussed in the sections below.

Clean Water Act

See Section 1.6.1.3 of this document for discussion of Sections 401 and 404 of the CWA, and Section 3.6.1.1 for discussion of Section 303(d) of the CWA.

The impaired water bodies list was most recently updated by the California State Water Resources Control Board and approved by USEPA in 2022. This list is updated every two years (Regional Water Board 2024). In addition to these listings, the greater SF Bay is also impaired for PAHs (State Water Board 2021).

Marine Protection, Resources, and Sanctuaries Act

See Section 3.5.1.1 for discussion of MPRSA. This regulation is relevant to Hydrology and Water Quality resources because of its mandate to protect against degradation of the marine environment and ecosystems by projects that place sediment in ocean waters.

Rivers and Harbors Act

See Section 3.6.1.1 for discussion of the Rivers and Harbors Act. This regulation is relevant to Hydrology and Water Quality resources because of its focus on protecting navigation and preventing pollution in navigable waters.

International Convention for Prevention of Pollution from Ships

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the primary international convention covering the prevention of pollution in the marine environment by ships from operational or accidental causes. The MARPOL Convention (implemented by the Act to Prevent Pollution from Ships, 33 U.S.C. §§ 1901-1911) was adopted in 1973 and modified by the Protocol of 1978 (referred to as MARPOL 73/78). The provisions cover the prevention of pollution by oil, noxious liquids, harmful substances, and garbage from operational measures, as well as from accidental discharges. The USCG is the responsible enforcement agency for MARPOL.

Coastal Zone Management Act, 16 U.S.C. § 1456

See Section 3.5.1.1 for discussion of the CZMA. This regulation is relevant to hydrology and water quality resources because of the requirement for the regulatory agency to ensure consistency with policies in the Coastal Zone, including those related to water quality.

Executive Order 11988: Floodplain Management

EO 11988: Floodplain Management (42 Federal Register 26951, 3 C.F.R., 1977 Comp., p.Part 117) requires federal agencies to avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative. This EO relates primarily to the placement of dredged material and the appropriate management of lands that received dredged material for beneficial use.

3.7.1.2 State and Regional

State and regional regulations applicable to hydrology and water quality are discussed in the sections below.

McAteer-Petris Act

See Section 1.6.2.2 for discussion of the McAteer-Petris Act. This regulation is relevant to hydrology and water quality resources because of its mandate to protect SF Bay and its shoreline.

Porter-Cologne Water Quality Control Act of 1969, California Statutes 1942, Chapter 368

See Section 1.6.2.3 for discussion of the Porter-Cologne Act. This regulation is relevant to hydrology and water quality resources because of its focus on water quality and beneficial uses.

Dredged Material Management Office

The DMMO is a joint program of USACE, the Regional Water Board, BCDC, USEPA, and the CSLC. Participating agencies also include CDFW, NMFS, and the USFWS (See Section 1.2.1.1). The purpose of the DMMO is to cooperatively review sediment quality sampling plans, analyze the results of sediment quality sampling, and make suitability determinations for material proposed for placement in SF Bay. The 2021 DMMO Annual Report (DMMO 2022) lists DMMO responsibilities as follows:

- Review and approve sediment quality sampling and analysis plans.
- Analyze the results of sediment quality tests.
- Make suitability determinations for placement at in-Bay, ocean, and beneficial use sites.
- Receive, review, and coordinate dredging project permit applications in the SF Bay Area.
- Develop guidance documents as needed.
- Coordinate implementation of programmatic requirements such as species consultations, alternative disposal site analyses and recordkeeping.

The DMMO agencies apply the most current version of the Guidelines for Implementing the ITM in the SF Bay Region (USACE 2001) when determining the dredged material testing that will be required for dredging projects proposing placement and/or disposal at designated sites in waters of the United States in SF Bay. These local guidelines supplement the more detailed information in the ITM and are not intended to be used on their own.

Additional background on the DMMO, including requirements for separate permit conditions and/or approvals by DMMO member agencies, is described in Section 3.5.1.3.

3.7.2 Environmental Setting

The hydrologic and water quality settings within the study area were described in the 2015 EA/EIR (USACE and Regional Water Board 2015) and are still applicable for this EA/EIR. General descriptions of the hydrologic setting and water quality conditions of SF Bay are provided in sections below, along with updated water quality monitoring and SLR information.

3.7.2.1 Hydrology

The SF Bay Estuary is the largest estuary on the west coast of the United States. Flows from rivers and streams draining California's Central Valley through the Delta, along with flows from rivers and streams draining directly into SF Bay are conveyed to the Pacific Ocean at the Golden Gate, the only outlet for these waters to the ocean. Because of its highly dynamic and complex environmental conditions, SF Bay's deepwater channels, tidelands, marshlands, freshwater streams, and rivers support an extraordinarily diverse and productive ecosystem (Regional Water Board 2024).

Tides propagate through SF Bay from the Golden Gate to the Delta. These tides, in combination with sea level height, the extent and duration of river/stream flows into SF Bay, and meteorological (e.g., wind) conditions, affect hydrodynamics in SF Bay. This includes sediment deposition and transport, and salinity intrusion from the Pacific Ocean into SF Bay (Cloern et al. 2011). SF Bay's bathymetry is an important factor affecting sediment dynamics. The broad, shallow areas incised by narrow channels of San Pablo Bay and Suisun Bay, are more prone to wind-generated currents and sediment resuspension than deeper areas such as the Central Bay (USACE et al. 1998).

Outside of the Golden Gate and into the Pacific Ocean, the California Current is a broad offshore flow that transports cold, low-salinity, subarctic waters toward the equator. However, two northerly flows - the Coastal Countercurrent and the California Undercurrent - dominate the flow regime in the vicinity of the Farallon Islands throughout most of the year. The Coastal Countercurrent generally moves nutrient-poor surface water over the continental shelf northward, while the California Undercurrent's strong northerly flow over the slope dominates in depths ranging from 100 to 1,000 meters. Currents in the vicinity of SF-DODS are generally slow, which aids in minimizing the spread of water column plumes during and immediately following placement events. Studies by USEPA indicate that the ocean bottom in the vicinity of SF-DODS (and generally across the region at depths greater than 600 to 800 meters) is depositional. Wave heights are variable and usually greater during the late fall, winter, and spring because of the presence of storms and generally stronger sustained winds (USACE et al. 1998).

3.7.2.2 Water Quality

Water quality conditions in SF Bay are affected by various factors, including tidal movements, freshwater inflows from rivers and streams, and human activities. The water quality of many water bodies in SF Bay continues to be degraded from pollutants discharged from nonpoint sources, and from the cumulative effects of multiple point sources, including urban runoff. This degradation persists despite successful pollutant reduction efforts in the regulation of municipal and industrial wastewater point-source discharges through the NPDES program. Ongoing watershed management actions in the region represent a shift to a regional approach that acknowledges environmental impacts from all activities and prioritizes regulation of these activities with input from local stakeholders rather than regulation of point sources (Regional Water Board 2024).

Water quality is managed and monitored by several agencies in SF Bay. The Regional Water Board plays a key role through development and implementation of the Water Quality Control Plan for the SF Bay Basin (Basin Plan). The Basin Plan is a water quality control planning document that designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes implementation programs to achieve water quality objectives (Regional Water Board 2024).

Monitoring Schedule and Trends

Contaminant concentrations in SF Bay are monitored by the SFEI via the RMP. See Section 3.5.2.2 for a description of the sampling schedule.

The SFEI RMP is currently piloting new monitoring plans for contaminants of emerging concern (CEC), which include chemicals not previously regulated or monitored such as per- and polyfluoroalkyl substances (added to monitoring in 2023), organophosphate esters (added in 2021), and bisphenols (added in 2021). The SFEI is also studying tire and vehicle contaminants as CECs. In addition to CECs, the SFEI has been studying microplastic pollution, releasing a large report in 2019 on this new pollutant of concern, namely plastics less than 5 mm in size (SFEI 2023). Microplastic levels are currently unregulated (State Water Board 2024). Recent water quality trends observed by SFEI through collection of the above data include the following (SFEI 2023):

- Algal blooms in 2022 and 2023 led to chlorophyll concentrations above 200 micrograms per liter.
- Detectable levels of tire and vehicle contaminants have been identified near discharge locations and in the SF Bay.
- There is a lack of declining PCB levels in SF Bay fish, despite approval of a total maximum daily load in 2009.
- Microplastics have been detected in the SF Bay water, sediment, prey fish, bivalves, and adjacent ocean.
- Sediment has declined on the SF Bay floor from the 1980s to the 2010s (total loss of around 1.2 billion cubic feet).

The Regional Water Board has adopted water quality attainment plans, referred to as TMDL, to address impairment of water quality in SF Bay by mercury and PCB concentrations. These plans include waste-load allocations for mercury and PCB sources to restore water quality in SF Bay. Dredging is recognized by the Regional Water Board to remove these contaminants, and therefore does not have a waste-load allocation. Contaminant levels are instead regulated by current levels in SF Bay sediment (USACE et al. 2013).

Offshore Ocean Environment

Trace amounts of PAHs, PCBs, pesticides, and metals have been documented in the offshore region over the continental shelf and shelf edge (USACE et al. 1998). Offshore regions typically contain lower contaminant concentrations.

Sea Level Rise

The rate of SLR in California from 1993 to present has been less than the global average primarily due to the natural variability in water level temporarily obscuring the background, climate-driven rate (Bromirski et al. 2011). Observed SLR was minimal from 1993 to 2008 and significant from 2008 to 2023. This pattern will likely persist in the future and longer tide gauge records together with recent observations suggest that SLR along the California coast should resemble the global average (Hamlington et al. 2021). From 1993 to 2023, the rate of SLR for California, on average, is 0.9 inch/decade (California Ocean Protection Council et al. 2024).

In January 2024, the California Ocean Protection Council released updated draft SLR projections and guidance which state that SLR will likely range from 0.6 to 0.8 feet in 2050 and 1.6 to 3.1 feet in 2100. These projections are based on the intermediate-low and intermediate scenarios for the San Francisco tide gauge.

Past placement of beneficial use sediment at wetland restoration sites helps provide resiliency against SLR. Wetland restoration provides protection against high and rising water levels in SF Bay by absorbing wave impacts and facilitating sediment deposition and natural tidal marsh creation.

3.7.3 Methodology and Thresholds of Significance

This section includes an analysis and determination of the impacts of the project alternatives on hydrology and water quality. Hydrology and water quality impacts from dredging would primarily be attributed to sediment disturbance. The effects analysis determined the Proposed Project/Project Alternatives would not result in significant impacts to the following:

- Substantially degrade water quality through alteration of water temperature, salinity, pH, and dissolved oxygen.
- Substantially degrade water quality because of increased turbidity.
- Substantially degrade water quality because of mobilization of contaminated sediments or release of hazardous materials.
- Result in significant cumulative impacts on hydrology or water quality.

3.7.4 Impacts and Mitigation Measures

3.7.4.1 Impact HY-1: Potential to Substantially Degrade Water Quality through Alteration of Water Temperature, Salinity, pH, and Dissolved Oxygen

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Based on studies by USACE, hopper, cutterhead, and clamshell dredging activities and placement of dredged material do not cause substantial changes to salinity, temperature, or pH (USACE 1976a, 1976b, 1977, 1990), and any associated minor changes are localized and short-lived. Minor decreases in dissolved oxygen concentrations, which may be reduced by 1 to 2 milligrams per liter during dredging and placement operations, were also found to be short-term, typically returning to ambient levels within 4 to 8 minutes (USACE 1976a, 1977, 1990). Significant changes in temperature, salinity, pH, and dissolved oxygen are not expected from vessel movement.

There would be increased potential for BUDM placement (e.g., non-aquatic direct placement, nearshore strategic placement, elevation augmentation/marsh spraying, and/or water column seeding) under Alternative 4. In general, sediment placed from scows settles rapidly, and any temporary decreases in dissolved oxygen concentrations would be dispersed from the placement area by the broader open water in SF Bay (USACE and Regional Water Board 2023). BUDM placement under this alternative could directly result in beneficial effects to water quality by augmenting the local supply of sediment available to support accretion in mudflats and tidal wetlands, which in turn may provide water quality benefits.

- **NEPA Determination**: Under all alternatives, the potential to substantially degrade water quality through alteration of water temperature, salinity, pH, and dissolved oxygen would be less than significant.
- **CEQA Determination**: Under all alternatives, impacts on water quality through alteration of water temperature, salinity, pH, and dissolved oxygen would be less than significant. Minor localized

impacts on water temperature, salinity, pH, and/or dissolved oxygen during dredging activities and placement of dredged material may occur, but the effects would be short-lived.

3.7.4.2 Impact HY-2: Potential to Substantially Degrade Water Quality Because of Increased Turbidity

No Action Alternative/No Project Alternative

As described in Impact BI-2, Section 3.3.4.2, the No Action Alternative and No Project Alternative include dredging activities with clamshell, hopper, and cutterhead-pipeline techniques, which are known to cause temporary and local resuspension of sediment, decrease in water clarity, and turbidity increases. Higher turbidity is expected for dredging of finer grain sediments compared to courser sediments, such as sand because finer sediments remain suspended in the water column longer than coarser sediments. The No Action Alternative and No Project Alternative impacts related to turbidity are anticipated to be minor, localized, and temporary (see also the detailed discussion in Impact BI-2).

Of the three techniques, clamshell (mechanical) dredging leads to the highest resuspension and turbidity increases due to the impact of the equipment on the ocean floor, and spillage during transport from the bottom to the water surface (Barnard 1978; NFMS 2015). The use of mechanical dredge equipment often results in more disturbance and sediment resuspension at the dredging site due to the mechanical force applied to the substrate. Sediment may also be introduced into the water column from spillage of materials during barge loading, and from overflow of water from barges (Nightingale and Simenstad 2001; NMFS 2015). However, based on monitoring data collected by USACE from 2015 to 2019 in Oakland Harbor, Richmond Inner Harbor, and Redwood City Harbor, decanting[29] operations during dredging of fine-grain sediment does not generate large plumes of suspended sediment that would adversely impact fish and other aquatic life (Regional Water Board 2019a).

Comparatively, hopper and cutterhead-pipeline dredging lead to less sediment disturbance as they are not as physically impactful to the Estuary bed and transport sediment directly to the vessel via pipework. These effects are generally short-term and occur in the lower portion of the water column, localized to the disturbance. Overflow of excess water in the hold of a hopper dredge poses a potential of increased turbidity as the suspended sediments are released into surrounding waters with overflow water (NMFS 2015). Turbidity increases are not expected from vessel movement.

Minor, temporary turbidity increases are also expected at placement sites. Impacts are anticipated to be lesser at the SF-DODS site compared to in-Bay sites. Resuspension of sediments at identified in-Bay sites will be higher due to placement in shallower estuarine water (USACE et al. 1998).

Under all alternatives, dredged sediment may be placed at one or multiple beneficial use sites, such as MWRP. Sediment additions at these sites may create short-term increases in turbidity during placement for wetland restoration but have the potential to create long-term beneficial increases in sediment

[29] Decanting refers to the release of water entrained with dredged sediment from a barge when the water reaches the top of a stand pipe that typically represents about 80 percent of barge capacity. The stand pipe acts as a weir, allowing the discharge of supernatant water to increase the barge's effective load.

retention and stabilization and pollutant filtration. Habitat benefits from placement at beneficial use sites are discussed in detail in Impact BI-5.

Under the No Action Alternative and No Project Alternative, activities include approximately 1.7 million CY average dredged material using mechanical techniques, assuming all sites are dredged in one year. Under the No Action Alternative, approximately 2.7 million CY of sediment will be dredged, and under the No Project Alternative, approximately 2.8 million CY will be dredged. Dredging mechanisms include both mechanical and hydraulic techniques, with a 62 percent to 38 percent use ratio, respectively. Dredged material will be placed at in-Bay, in-ocean, upland, and SF-DODS sites for both the No Action Alternative and No Project Alternative. The same ratio of sediment would be placed at each site for each of the alternatives.

- **NEPA Determination**: Under the No Action Alternative, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.
- **CEQA Determination**: Under the No Project Alternative, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.

Alternative 1

Under Alternative 1, project activities involve dredging a total of 1.7 million CY average volume dredged, assuming all sites are dredged in one year - the same total as expected in the No Action Alternative and No Project Alternative. Alternative 1 also includes a 15 percent increase in sediment to be placed at in-Bay sites as compared to the No Action Alternative and No Project Alternative. Both mechanical dredging and in-Bay placement are associated with higher turbidity increases compared to hydraulic and SF-DODS or upland placement, respectively, and actions under Alternative 1 would result in a short-term and localized net increase in turbidity at dredging and placement sites. Through the increased potential for BUDM placement under this alternative compared to the No Action Alternative/No Project Alternative, beneficial effects to water quality could occur through augmentation of the local supply of sediment available to support accretion in mudflats and tidal wetlands along with sediment retention and stabilization, which may reduce long-term local/site-specific turbidity conditions.

- **NEPA Determination:** Under Alternative 1, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.
- **CEQA Determination:** Under Alternative 1, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.

Alternative 2

Alternative 2, with a total of 1.2 million CY average volume dredged, assuming all sites are dredged in one year, will result in an 18 percent reduction in mechanical dredging compared to the No Action Alternative and No Project Alternative. Alternative 2 instead uses more hydraulic dredging techniques, which are associated with lower turbidity levels than their mechanical counterparts. Actions under Alternatives 2 would result in short-term and localized net decreases in turbidity at dredging sites.

Under Alternative 2, a 20 percent increase in dredged material is to be placed at in-Bay sites compared to the No Action Alternative and No Project Alternative. Actions under Alternatives 2 would result in short-term and localized net increases in turbidity at placement sites. However, the increased potential for BUDM placement under this alternative compared to the No Action Alternative/No Project Alternative could result in beneficial effects to water quality through augmenting the local supply of sediment available to support accretion in mudflats and tidal wetlands along with sediment retention and stabilization, which in turn may reduce long-term local/site-specific turbidity conditions.

- **NEPA Determination:** Under Alternative 2, impacts related to the potential to substantially degrade water quality because of increased turbidity under Alternative 2 would be less than significant.
- **CEQA Determination:** Under Alternative 2, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.

Alternative 3

Alternative 3, with an average total of 1.5 million CY average volume dredged, assuming all sites are dredged in one year, will result in an 8 percent reduction in mechanical dredging compared to the No Action Alternative and No Project Alternative. Alternative 3 instead uses more hydraulic dredging techniques, which are associated with lower turbidity levels than their mechanical counterparts. Actions under Alternative 3 would result in short-term and localized net decreases in turbidity at dredging sites.

Under Alternative 3, a 15 percent increase in dredged material is to be placed at in-Bay sites compared to the No Action Alternative and No Project Alternative. Actions under Alternative 3 would result in short-term and localized net increases in turbidity at placement sites. Through the increased potential for BUDM placement under Alternative 3 compared to the No Action Alternative/No Project Alternative, beneficial effects to water quality could occur through augmentation of the local supply of sediment available to support accretion in mudflats and tidal wetlands along with sediment retention and stabilization, which may reduce long-term local/site-specific turbidity conditions at beneficial use placement sites.

- **NEPA Determination:** Under Alternative 3, impacts related to potential to substantially degrade water quality because of increased turbidity would be less than significant.
- **CEQA Determination:** Under Alternative 3, impacts related to potential to substantially degrade water quality because of increased turbidity would be less than significant.

Alternative 4

Under Alternative 4, project activities will cause a 14 percent increase in mechanical dredging by volume compared to the No Action Alternative and No Project Alternative, with a total of 2.1 million CY dredged, assuming all sites are dredged in one year. Due to increases in mechanical dredging, actions under Alternative 4 would result in a short-term and localized net increase in turbidity at dredging sites.

Alternative 4 will have a 30 percent reduction in maximum sediment placed at in-Bay sites compared to the No Action Alternative and No Project Alternative. Deposition placement under Alternative 4 would be concentrated around non-aquatic beneficial use, with at least 65 percent more sediment placed at non-aquatic beneficial use sites than the No Action Alternative and No Project Alternative. Actions under Alternative 4 would result in short-term and localized net decreases in turbidity at placement sites.

Alternative 4 includes increased potential for BUDM placement (e.g., non-aquatic direct placement, nearshore strategic placement, elevation augmentation/marsh spraying, and/or water column seeding). In general, sediment placed from scows settles rapidly, and any temporary increases in turbidity would be dispersed from the placement area by the broader open water in the Bay (USACE and Regional Water Board 2023). BUDM placement under this alternative could directly result in beneficial effects to water quality by augmenting the local supply of sediment available to support accretion in mudflats and tidal wetlands along with sediment retention and stabilization, which in turn may provide long-term, localized water quality benefits such as filtration functions and an associated decrease in turbidity.

- **NEPA** Determination**:** Under Alternative 4, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.
- **CEQA Determination:** Under Alternative 4, impacts related to the potential to substantially degrade water quality because of increased turbidity would be less than significant.

3.7.4.3 Impact HY-3: Potential to Substantially Degrade Water Quality from Mobilization of Contaminated Sediments or Release of Hazardous Materials

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Contaminants associated with dredged soils and sediments can be reintroduced to the water environment during dredging process as sediments are disturbed. To prevent mobilization of contaminants and hazardous materials, sediment from proposed sites will be tested prior to dredging. Sites which test positive for higher contamination levels will be avoided by USACE for future dredging, including in all the alternatives. If dredging of contaminated sites is unavoidable, collected sediment will be placed further from water bodies, i.e., upland.

Contaminants are not often easily separated from sediments, even during dredging activities, and are not anticipated to cause related impacts. Preventative measures and planning will be coordinated between USACE and DMMO for all dredging activities, and USACE will implement best management practices and comply with the Regional Water Board water quality protection measures. Vessels engaged in project work will be operated within relevant regulations to prevent contamination, and dredged material will be secured during transport. Through proactive measures, minimal release of contaminants and hazardous materials is expected from dredging activities.

- **NEPA Determination:** Under all alternatives, impacts related to the potential to substantially degrade water quality from mobilization of contaminated sediments or release of hazardous materials would be less than significant.
- **CEQA Determination:** Under all alternatives, impacts related to the potential to substantially degrade water quality from mobilization of contaminated sediments or release of hazardous materials would be less than significant.

3.7.4.4 Impact HY-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hydrology or Water Quality

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

All alternatives would create negligible, short-term impacts if implemented, and have the potential to incur cumulative hydrology or water quality impacts with the other regional projects in Table 3-2. Potential cumulative impacts could include short-term changes to water quality such as temperature, dissolved oxygen, and turbidity differences, as well as contaminant mobilization or introduction. All projects are subject to permitting from the Regional Water Board and must comply with applicable water quality standards. In addition, the projects' effects are anticipated to be short-term and localized. Under these conditions, no ongoing cumulative impacts are expected.

- **NEPA** Determination**:** Project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts on hydrology or water quality.
- **CEQA Determination:** Project alternatives would not contribute to cumulatively considerable impacts on hydrology or water quality.

3.8 Land Use and Planning

This section provides an overview of the land use planning context and examines the potential impacts on land use resulting from the implementation of the proposed alternatives.

3.8.1 Regulatory Setting

The following sections describe the regulatory framework applicable to potential land use and planning impacts from the alternatives.

3.8.1.1 Federal

Federal regulations applicable to land use and planning are discussed in the following sections.

Executive Order 11988: Floodplain Management

EO 11988: Floodplain Management (42 Federal Register 26951, 3 C.F.R., 1977 Comp., p.117) requires federal agencies to avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative. This EO relates primarily to the placement of dredged material and the appropriate management of lands that received dredged material for beneficial use.

Coastal Zone Management Act

See discussion of the CZMA in Section 3.5.1.1. As stated in that section, an application for an updated CZMA consistency determination will be prepared in 2024 and submitted to BCDC and CCC.

3.8.1.2 State and Regional

State and regional regulations applicable to land use and planning are discussed in the sections below.

California Coastal Act

The California Coast Act (CCA) (CPR, Div. 20) includes specific policies (Division 20 of the California PRC) for planning and regulatory decisions made by CCC and local governments, once those local governments adopt Local Coastal Programs that are approved by the CCC. The CCA covers dredging and placement activities along with many other development activities within the coastal zone.

McAteer-Petris Act, San Francisco Bay Plan, Suisun Marsh Preservation Act, and Suisun Marsh Protection Plan

The Bay Plan, and its relationship to the McAteer-Petris Act, is described in Section 1.2.1.1. The McAteer-Petris Act is further described in Section 1.6.2.2. Bay Plan policies relevant to Land Use and Planning Resources for this EA/EIR are listed below.

Dredging policies (amended October 2019) in the Bay Plan relevant to the Proposed Project are as follows:

1. *Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner. Dredgers should reduce disposal in the Bay and certain waterways over time to achieve the LTMS goal of limiting in-Bay placement volumes to a maximum of one million cubic yards per year. The LTMS agencies should implement a system of disposal allotments to individual dredgers to achieve this goal only if voluntary efforts are not effective in reaching the LTMS goal. In making its decision regarding disposal allocations, the Commission should confer with the LTMS agencies and consider the need for the dredging and the dredging projects, environmental impacts, regional economic impacts, efforts by the dredging community to implement and fund alternatives to in-Bay placement, and other relevant factors. Small dredgers should be exempted from allotments, but all dredgers should comply with policies 2 through 12.*

2. *Dredging should be authorized when the Commission can find: (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety; (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board; (c) important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the USFWS and/or the NMFS, or through other appropriate measures; (d) the siting and design of the project will result in the minimum dredging volume necessary for the project; and (e) the materials would be disposed of in accordance with Policy 3.*

3. *Dredged material should, if feasible, be reused or disposed outside the Bay and certain waterways. Except when reused in an approved fill project, dredged material should not be disposed in the Bay and certain waterways unless disposal outside these areas is infeasible and the Commission finds: (a) the volume to be disposed is consistent with applicable dredger disposal allocations and disposal site limits*

adopted by the Commission by regulation; (b) disposal would be at a site designated by the Commission; (c) the quality of the material disposed of is consistent with the advice of the San Francisco Bay Regional Water Quality Control Board and the inter-agency DMMO; and (d) the period of disposal is consistent with the advice of the California Department of Fish and Game, the USFWS and the NMFS.

4. *If an applicant proposes to dispose dredged material in tidal areas of the Bay and certain waterways that exceeds either disposal site limits or any disposal allocation that the Commission has adopted by regulation, the applicant must demonstrate that the potential for adverse environmental impact is insignificant and that non-tidal and ocean disposal is infeasible because there are no alternative sites available or likely to be available in a reasonable period, or because the cost of disposal at alternate sites is prohibitive. In making its decision whether to authorize such in Bay disposal, the Commission should confer with the LTMS agencies and consider the factors listed in Policy 1.*

5. *To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural resources, acceptable non-tidal disposal sites should be secured and the Deep Ocean Disposal Site should be maintained. Further, dredging projects should maximize use of dredged material as a resource consistent with protecting and enhancing Bay natural resources, such as creating, enhancing, or restoring tidal and managed wetlands, creating, and maintaining levees and dikes, providing cover, and sealing material for sanitary landfills, and filling at approved construction sites.*

6. *Dredged material disposed in the Bay and certain waterways should be carefully managed to ensure that the specific location, volumes, physical nature of the material, and timing of disposal do not create navigational hazards, adversely affect Bay sedimentation, currents, or natural resources, or foreclose the use of the site for projects critical to the economy of the Bay Area.*

7. *All proposed channels, berths, turning basins, and other dredging projects should be carefully designed so as not to undermine the stability of any adjacent dikes, fills or fish and wildlife habitats.*

8. *The Commission should encourage increased efforts by soil conservation districts and public works agencies in the 50,000 square-mile Bay tributary area to continuously reduce soil erosion as much as possible.*

9. *To protect underground freshwater reservoirs (aquifers): (a) all proposals for dredging or construction work that could penetrate the mud "cover" should be reviewed by the San Francisco Bay Regional Water Quality Control Board and the State Department of Water Resources; and (b) dredging or construction work should not be permitted that might reasonably be expected to damage an underground water reservoir. Applicants for permission to dredge should provide additional data on*

groundwater conditions in the area of construction to the extent necessary and reasonable in relation to the Proposed Project.

10. *Interested agencies and parties are encouraged to explore and find funding solutions for the additional costs incurred by transporting dredged material to nontidal and ocean disposal sites, either by general funds contributed by ports and other relevant parties, dredging applicants or otherwise.*

11. *A project that uses dredged sediment to create, restore, or enhance Bay or certain waterway natural resources may be approved if:*

12. *The Commission, based on detailed site-specific studies, appropriate to the size and potential impacts of the project, that include, but are not limited to, site morphology and physical conditions, biological considerations, the potential for fostering invasive species, dredged sediment stability, and engineering aspects of the project, determines all of the following:*

    a. *Project would provide, in relationship to the project size, substantial net improvement in habitat for Bay species;*

    b. *No feasible alternatives to the fill exist to achieve the project purpose with fewer adverse impacts on Bay resources;*

    c. *The amount of dredged sediment to be used would be the minimum amount necessary to achieve the purpose of the project;*

    d. *Beneficial uses and water quality of the Bay would be protected; and*

    e. *There is a high probability that the project would be successful and not result in unmitigated environmental harm;*

1. *The project includes an adequate monitoring and management plan and has been carefully planned, and the Commission has established measurable performance objectives and controls that would help ensure the success and permanence of the project, and an agency or organization with fish and wildlife management expertise has expressed to the Commission its intention to manage and operate the site for habitat enhancement or restoration purposes for the life of the project;*

2. *The project would use only clean sediment suitable for aquatic disposal and the Commission has solicited the advice of the San Francisco Bay Regional Water Quality Control Board, the Dredged Material Management Office and other appropriate agencies on the suitability of the dredged sediment;*

3. *Dredged sediment would not be placed in areas with particularly high or rare existing natural resource values, such as eelgrass beds and tidal marsh and mudflats, unless the material would be needed to protect or enhance the habitat. The habitat project would not, by itself or cumulatively with other projects, significantly decrease the*

overall amount of any particular habitat within the Suisun, North, South, or Central Bays, excluding areas that have been recently dredged;

4. *The Commission has consulted with the California Department of Fish and Wildlife, the NMFS, and the USFWS to ensure that at least one of these agencies supports the Proposed Project; and*

5. *The project's design and goals incorporate the best available science on the use of dredged sediment for habitat projects.*

6. *After a reasonable period of monitoring, if either:*

   a. *The project has not met its goals and measurable objectives, and attempts at remediation have proven unsuccessful, or the dredged sediment is found to have substantial adverse impacts on the natural resources of the Bay, then the dredged sediment would be removed, unless it is demonstrated by competent environmental studies that removing the material would have a greater adverse effect on the Bay than allowing it to remain, and the site would be returned to the conditions existing immediately preceding placement of the dredged sediment.*

   b. *To ensure protection of Bay habitats, the Commission should not authorize placement of more than a minor amount of dredged sediment for projects that are similar to the Oakland Middle Harbor Enhancement Area project in characteristics including, but not limited to, scale, bathymetric modification, and type of habitat creation, until The Oakland Middle Harbor Enhancement Area project is completed successfully.*

   c. *The Commission should encourage research and well-designed pilot projects to evaluate:*

      1. *The appropriate amounts of all habitat types within the Bay, especially for support and recovery of endangered species;*

      2. *The appropriate biological, hydrological, and physical characteristics of locations in the Bay for habitat creation, enhancement, and restoration projects that use dredged sediment;*

      3. *The potential for direct, indirect, and cumulative impacts of such projects;*

      4. *The effectiveness of different dredged sediment placement strategies for habitat restoration, enhancement, and creation; and*

      5. *The feasibility of the beneficial reuse of dredged sediment in the Bay and certain waterways for habitat creation, enhancement, and restoration.*

   7. *The Commission should continue to participate in the LTMS, the DMMO, and other initiatives conducting research on Bay sediment movement, the effects of*

dredging and disposal on Bay natural resources, alternatives to Bay aquatic disposal, and funding additional costs of transporting dredged material to non-tidal and ocean disposal sites.

Policies in the Bay Plan pertaining to Fish, Other Aquatic Organisms, and Wildlife (amended October 2019) in the Bay Plan that are relevant to the Proposed Project are:

1. *To assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored and increased.*

2. *Native species, including candidate, threatened, and endangered species; species that the California Department of Fish and Wildlife, the National Marine Fisheries Service, and/or the USFWS have listed under the California or Federal Endangered Species Acts; and any species that provides substantial public benefits, as well as specific habitats that are needed to conserve, increase, or prevent the extinction of these species, should be protected, whether in the Bay or behind dikes. Protection of fish, other aquatic organisms, and wildlife and their habitats may entail placement of fill to enhance the Bay's ecological function in the near-term and to ensure that they persist into the future with sea level rise.*

3. *In reviewing or approving habitat restoration projects or programs the Commission should be guided by the best available science, including regional goals, and should, where appropriate, provide for a diversity of habitats for associated native aquatic and terrestrial plant and animal species.*

4. *The Commission should:*

    a. *Consult with the California Department of Fish and Wildlife, and the USFWS or the NMFS, whenever a Proposed Project may adversely affect an endangered or threatened plant, fish, other aquatic organism or wildlife species;*

    b. *Not authorize projects that would result in the "taking" of any plant, fish, other aquatic organism or wildlife species listed as endangered or threatened pursuant to the state or federal Endangered Species Acts, or the federal Marine Mammal Protection Act, or species that are candidates for listing under these acts, unless the project applicant has obtained the appropriate "take" authorization from the USFWS, NMFS or the California Department of Fish and Wildlife; and*

    c. *Give appropriate consideration to the recommendations of the California Department of Fish and Wildlife, the NMFS or the USFWS in order to avoid possible adverse effects of a Proposed Project on fish, other aquatic organisms and wildlife habitat.*

5. *The Commission may permit fill or a minimum amount of dredging in wildlife refuges necessary to enhance or restore fish, other aquatic organisms and wildlife habitat, or to provide appropriately located public facilities for wildlife observation, interpretation and education*

6. *Allowable fill for habitat projects in the Bay should (a) minimize near term adverse impacts on and loss of existing Bay habitat and native species; (b) provide substantial net benefits for Bay habitats and native species; and (c) be scaled appropriately for the project and necessary sea level rise adaptation measures in accordance with the best available science. The timing, frequency, and volume of fill should be determined in accordance with these criteria.*

7. *Sediment placement for habitat adaptation should be prioritized in 1) subsided diked baylands, tidal marshes, and tidal flats, as these areas are particularly vulnerable to loss and degradation due to sea level rise and lack of necessary sediment supply, and/or in 2) intertidal and shallow subtidal areas to support tidal marsh, tidal flat, and eelgrass bed adaptation. In some cases, sediment placement for a habitat project in deep subtidal areas may be authorized if substantial ecological benefits will be provided and the project aligns with current regional sediment availability and needs.*

Water Quality policies (Amended June 2003) in the Bay Plan relevant to the Proposed Project are:

1. *Bay water pollution should be prevented to the greatest extent feasible. The Bay's tidal marshes, tidal flats, and water surface area and volume should be conserved and, whenever possible, restored and increased to protect and improve water quality. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses.*

2. *Water quality in all parts of the Bay should be maintained at a level that will support and promote the beneficial uses of the Bay as identified in the San Francisco Bay Regional Water Quality Control Board's Water Quality Control Plan, San Francisco Bay Basin and should be protected from all harmful or potentially harmful pollutants. The policies, recommendations, decisions, advice and authority of the State Water Resources Control Board and the Regional Board, should be the basis for carrying out the Commission's water quality responsibilities.*

Policies in the Bay Plan pertaining to Tidal Marshes and Tidal Flats (amended 2019) relevant to the Proposed Project are:

1. *Tidal marshes and tidal flats should be conserved to the fullest possible extent. Filling, diking, and dredging projects that would substantially harm tidal marshes or tidal flats should be allowed only for purposes that provide substantial public benefits and only if there is no feasible alternative.*

2. *Any proposed fill, diking, or dredging project should be thoroughly evaluated to determine the effect of the project on tidal marshes and tidal flats, and designed to minimize, and if feasible, avoid any harmful effects.*

3. *Projects should be sited and designed to avoid, or if avoidance is infeasible, minimize adverse impacts on any transition zone present between tidal and upland habitats. Where a transition zone does not exist and it is feasible and ecologically appropriate, shoreline projects should be designed to provide a transition zone between tidal and upland habitats.*

4. *To provide for the restoration of Bay wetlands, state, regional, and local government land use, tax, and funding policies should not lead to the conversion of restorable lands to uses that would preclude or deter potential restoration. The public should make every effort to acquire these lands for the purpose of habitat restoration and wetland migration.*

5. *Where feasible, former tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging and breeding habitat for fish, other aquatic organisms, and wildlife. As recommended in the Baylands Ecosystem Habitat Goals Update report (2015), approximately 65,000 acres of areas diked from the Bay should be restored to tidal action and supported to maintain a healthy Bay ecosystem on a regional scale. Regional ecosystem targets should be updated periodically to incorporate the best available science to guide regionally appropriate conservation, restoration, and climate adaptation. To the greatest extent feasible, habitat projects should be sustained by natural processes; increase habitat connectivity; restore hydrological connections; provide opportunities for endangered species recovery; and provide opportunities for landward migration of Bay habitats. As conditions change, management measures may be needed to maintain habitat and ecological function in some areas.*

6. *Any habitat project should include clear and specific long-term and short-term biological and physical goals, success criteria, a monitoring program, and as appropriate, an adaptive management plan. Design and evaluation of the project should include an analysis of: (a) how the project's adaptive capacity can be enhanced so that it is resilient to sea level rise and climate change; (b) the impact of the project on the Bay's and local embayment's sediment transport and budget; (c) localized sediment erosion and accretion; (d) the role of tidal flows; (e) potential invasive species introduction, spread, and their control; (f) rates of colonization by vegetation; (g) the expected use of the site by fish, other aquatic organisms and wildlife; (h) an appropriate buffer, where feasible, between shoreline development and habitats to protect wildlife and provide space for marsh migration as sea level rises; (i) site characterization; (j) how the project adheres to regional restoration goals; (k) whether the project would be sustained by natural processes; and (l) how*

the project restores, enhances, or creates connectivity across Bay habitats at a local, sub-regional, and/or regional scale.

7. *If a habitat project's success criteria have not been met, benefits and impacts should be analyzed to determine whether appropriate adaptive measures should be implemented. If substantial adverse impacts on the Bay and/or native or commercially important species have occurred, the project should be further modified to reduce its impacts.*

8. *The level of design; amount, duration, and extent of monitoring; and complexity of the adaptive management plan required for a habitat project should be consistent with the purpose, size, impact, level of uncertainty, and/or expected lifespan of the project. Habitat projects should have a funding strategy for monitoring and adaptive management of the project, commensurate with the level of monitoring and adaptive management that is required for the project, to demonstrate that the applicant has considered costs and identified potential funding sources for any necessary monitoring and management.*

9. *The Commission should encourage and support regional efforts to collect, analyze, share, and learn from habitat monitoring data. Where feasible and appropriate, the Commission should encourage monitoring for habitat restoration projects that coordinates with regional efforts and improves the value and usefulness of data.*

10. *Based on scientific ecological analysis, project need, and consultation with the relevant federal and state resource agencies, fill may be authorized for habitat enhancement, restoration, or sea level rise adaptation of habitat.*

11. *The Commission should encourage and authorize pilot and demonstration projects that address sea level rise adaptation of Bay habitats. These projects should include appropriately detailed experimental design and monitoring to inform initial and future work. Project progress and outcomes should be analyzed and reported expeditiously. The size, design, and management of pilot and demonstration projects should be such that it will minimize the project's potential to negatively impact Bay habitats and species.*

12. *The Commission should encourage and support research on:*

    1. *Habitat restoration, enhancement, and creation approaches, including strategies for: increasing resilience to sea level rise, placing fill, evaluating habitat type conversion, enhancing habitat connectivity, and improving transition zone design.*

    2. *The estuary's sediment processes.*

    3. *Detection and monitoring of invasive species and regional efforts for eradication of specific invasive species.*

Policies for Subtidal Areas (Amended 2019) in the Bay Plan that are relevant to the Proposed Project are:

1. *Any proposed filling or dredging project in a subtidal area should be thoroughly evaluated to determine the local and Bay-wide effects of the project on: (a) the possible introduction or spread of invasive species; (b) tidal hydrology and sediment movement; (c) fish, other aquatic organisms and wildlife; (d) aquatic plants; and (e) the Bay's bathymetry. Projects in subtidal areas should be designed to minimize and, if feasible, avoid any harmful effects.*

2. *Subtidal areas that are scarce in the Bay or have an abundance and diversity of fish, other aquatic organisms and wildlife (e.g., eelgrass beds, sandy deep water or underwater pinnacles) should be conserved. Filling, changes in use; and dredging projects in these areas should therefore be allowed only if: (a) there is no feasible alternative; and (b) the project provides substantial public benefits.*

3. *Any subtidal habitat project should include clear and specific long-term and short-term biological and physical goals, success criteria, a monitoring program, and as appropriate, an adaptive management plan. Design and evaluation of the project should include an analysis of: (a) the ecological need for the project; (b) the effects of relative sea level rise; (c) the impact of the project on regional and local sediment budget and transport; (d) localized sediment erosion and accretion; (e) the role of tidal flows; (f) potential invasive species introduction, spread, and control; (g) rates of colonization by vegetation, where applicable; (h) the expected use of the site by fish, other aquatic organisms and wildlife; (i) characterization of and changes to local bathymetric features; (j) how the project will adhere to the best available and regionally appropriate science on subtidal restoration and conservation goals; and (k) whether the project would be sustained by natural processes.*

4. *If a habitat project's success criteria have not been met, benefits and impacts should be analyzed to determine whether appropriate adaptive measures should be implemented. If substantial adverse impacts on the Bay or native or commercially important species have occurred, the project should be further modified to reduce its impacts.*

5. *The level of design; amount, duration, and extent of monitoring; and complexity of the adaptive management plan required for a habitat project should be consistent with the purpose, size, impact, level of uncertainty, and/or expected lifespan of the project. Habitat projects should have a funding strategy for monitoring and adaptive management of the project, commensurate with the level of monitoring and adaptive management that is required for the project., to demonstrate that the applicant has considered costs and identified potential funding sources for any necessary monitoring and management.*

6. *The Commission should encourage and support regional efforts to collect, analyze, share, and learn from habitat monitoring data. Where feasible and appropriate, the*

Commission should encourage monitoring for habitat restoration projects that coordinates with regional efforts and improves the value and usefulness of data.

7. *Subtidal restoration projects should be designed to: (a) promote an abundance and diversity of fish, other aquatic organisms and wildlife; (b) restore rare subtidal areas; (c) establish linkages between deep and shallow water and tidal and subtidal habitat in an effort to maximize habitat values for fish, other aquatic organisms and wildlife; or (d) expand open water areas in an effort to make the Bay larger.*

8. *Based on scientific ecological analysis and consultation with the relevant federal and state resource agencies, fill may be authorized for habitat enhancement, restoration, or sea level rise adaptation of habitat if the Commission finds that no other method of enhancement or restoration except filling is feasible.*

9. *The Commission should encourage and authorize pilot and demonstration projects that address sea level rise adaptation of Bay habitats. These projects should include appropriately detailed experimental design and monitoring to inform initial and future work. Project progress and outcomes should be analyzed and reported expeditiously. The size, design, and management of pilot and demonstration projects should be such that it will minimize the project's potential to negatively impact Bay habitats and species.*

10. *The Commission should continue to support and encourage expansion of scientific information on the Bay's subtidal areas, including: (a) inventory and description of the Bay's subtidal areas; (b) the relationship between the Bay's physical regime and biological populations; (c) sediment dynamics, including sand transport, and wind and wave effects on sediment movement; (d) oyster shell transport; (e) areas of the Bay used for spawning, birthing, nesting, resting, feeding, migration, among others, by fish, other aquatic organisms and wildlife; (f) where and how habitat restoration, enhancement, and creation should occur considering species/habitat needs and suitable project sites; and (g) if, where, and what type of habitat type conversion may be acceptable.*

Navigational Safety and Oil Spill Prevention policies (Amended July 2001) in the Bay Plan relevant to the Proposed Project are:

1. *Physical obstructions to safe navigation, as identified by the US Coast Guard and the Harbor Safety Committee of the San Francisco Bay Region, should be removed to the maximum extent feasible when their removal would contribute to navigational safety and would not create significant adverse environmental impacts. Removal of obstructions should ensure that any detriments arising from a significant alteration of Bay habitats are clearly outweighed by the public and environmental benefits of reducing the risk to human safety or the risk of spills of hazardous materials, such as oil.*

2. *The Commission should ensure that marine facility projects are in compliance with oil spill contingency plan requirements of the Office of Spill Prevention and Response, the US Coast Guard and other appropriate organizations.*

3.8.2 Environmental Setting

The land use and planning study area encompasses the SF Bay and shoreline areas, which occur in the following 11 counties: Marin, Sonoma, Napa, Solano, Sacramento, San Joaquin, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco. BCDC[30] has jurisdiction over much of the study area, with the exception of a small portion of the eastern extent of the study area east of Pittsburg along the Suisun Bay Channel and the San Francisco Harbor MSC.

The Bay Plan, first adopted in 1969 and last updated in October 2019, is BCDC's policy document specifying goals, objectives, and policies for BCDC jurisdictional areas (BCDC 2020). Policies in the Bay Plan applicable to the Proposed Project include those in the following categories: Dredging; Fish, Other Aquatic Organisms, and Wildlife; Water Quality; Tidal Marshes and Tidal Flats; Subtidal Areas; and Navigational Safety and Oil Spill Prevention. Policies relevant to the Proposed Project are listed in Section 3.8.1.

The CCC has jurisdiction over the coastal zone, which extends approximately 3,000 feet into eastern end of the MSC, including SF-8 and the Ocean Beach Nearshore Placement Site (SF-17).

3.8.3 Methodology and Thresholds of Significance

The land use evaluation focuses on consistency with coastal land use policies and plans. The analysis considered whether the project would conflict with applicable land use plans, policies, or regulations that an agency with jurisdiction over the project has adopted to avoid or mitigate environmental effects. Under CEQA thresholds of significance evaluate impacts under state and local policy plans to determine if mitigation is required. Under NEPA the proposed action is evaluated for significant impacts to the environment under federal agency policies and consistency with coastal land use policies and plans. The analysis considered whether the project would conflict with applicable land use plans, policies, or regulations that an agency with jurisdiction over the project has adopted to avoid or mitigate environmental effects. The proposed dredging, transport, and placement activities would not require any new land-based construction or facilities and would not result in any new residences or infrastructure that could indirectly induce growth or development in the study area. Therefore, this land use evaluation focuses on land use polices that affect shoreline development and the waters in the study area.

3.8.4 Impacts and Mitigation Measures

The project alternatives would involve the maintenance dredging of existing federal navigation channels and placement of dredged material at existing placement sites. These activities would have no potential to divide an existing community or substantially affect existing land uses and land use patterns in the study area, because no new land uses, types of activities, or improvements would be implemented. In addition, the use of any alternative placement sites identified in Section 1.5.2.2 would be unlikely to result

[30] See discussion of BCDC and Bay Plan in Section 1.2.1.1

in such impacts based on their location and existing surrounding land uses; however, USACE would not use the alternative placement sites identified in Section 1.5.2.2 until appropriate environmental review is completed, including evaluation of impacts on land use.

3.8.4.1 Impact LU-1: Potential Conflict with Applicable Plans and Policies

No Action Alternative/No Project Alternative

This land use evaluation focuses on land use policies that affect waters and shoreline development in the study area. Maintenance dredging and sediment placement operations have occurred in the waters of SF Bay for decades; the No Action Alternative and No Project Alternative would be a continuation of USACE's current maintenance dredging program for the federal navigation channels in SF Bay. Under the No Action Alternative and No Project Alternative, dredging and placement activities would be similar to USACE maintenance dredging operations previously concurred with by the CCC and BCDC. Bay Plan updates since the last project approvals (2015 EA/EIR and 2019 Consistency Determination) did not include additions or revisions that substantially change policies relevant to dredging and potential project impacts. In accordance with the CZMA, both the BCDC and the CCC would assess USACE's determination of consistency regarding dredging and placement operations within their respective jurisdictions. It is not expected that continuation of dredging operations would conflict with plans, regulations, or policies considered under the CZMA, including the California Coastal Management Program (CCMP) and the Bay Plan.

The No Action Alternative and No Project Alternative would not require any new land-based facilities or construction. Nor would they result in any new infrastructure or residences that may indirectly stimulate development or growth in the study area. USACE's dredging, transport, and placement activities would continue to be consistent with policies considered under the Bay Plan including Dredging policies; Fish, Other Aquatic Organisms, and Wildlife policies; Water Quality policies; Tidal Marshes and Tidal Flats policies; Subtidal Areas policies, and Navigational Safety and Oil Spill Prevention policies (see policies in Section 3.8.1). The BCDC would review USACE's consistency determination for dredging and placement activities that would occur within BCDC's jurisdiction to verify that the activities would be consistent, to the maximum extent practicable, with the Bay Plan.

USACE's dredging, transport, and placement activities would continue to be consistent with policies considered under the California Coastal Management Plan and Article 4 of the California Coastal Act. The only federal navigation channel within the jurisdiction of the CCC addressed in this EA/EIR is the San Francisco Harbor MSC. Placement sites SF-17 and a portion of SF-8 are within CCC's jurisdiction. For previous dredging operations, USACE submitted a negative determination to the CCC for maintenance dredging at the San Francisco Harbor MSC and placement of dredged material at SF-8, SF-17, and onshore at Ocean Beach. A federal agency may submit negative determination for an activity that "is the same as or is similar to activities for which consistency determinations have been prepared in the past (15 C.F.R. § 930.35(a)(2))." The negative determination demonstrated that the proposed dredging and placement activities for the San Francisco Harbor MSC would be consistent—to the maximum extent practicable—with the CCMP and Article 4 of the California Coastal Act; and that the proposed activities were consistent with the annual maintenance dredging program for the San Francisco Harbor MSC implemented by USACE, and previously concurred with by the CCC. While the CCC has concurred with

USACE's negative determination in the past and for future dredging operations, USACE would be required to request concurrence from the CCC on a negative determination to verify that continuing activities would be consistent to the maximum extent practicable with the CCMP and California Coastal Act.

Since the federal navigation channels discussed in this EA/EIR are designated navigation projects authorized by Congress, dredging and placement activities would not require a lease agreement from the CSLC for use of public trust lands based on the navigational servitude provisions of the Submerged Lands Act. While the Submerged Lands Act confers CSLC ownership over all submerged navigable lands within the state, it explicitly recognizes the federal government's constitutional authority regarding navigation matters, thus exempting such projects.

The No Action Alternative and No Project Alternative would comply with applicable land use plans and policies.

- **NEPA Determination:** Under the No Action Alternative, there would be no impact on land use as related to potential conflict with applicable plans and policies.
- **CEQA Determination:** Under the No Project Alternative, there would be no impact on land use as related to potential conflict with applicable plans and policies.

Alternatives 1 Through 4

Implementation of Alternatives 1 through 4 would be very similar to the No Action Alternative and No Project Alternative. All alternatives would remain compliant with plans, regulations, or policies considered under the CZMA, including the CCMP and the Bay Plan. Alternatives 1 through 4 would increase beneficial use and habitat restoration, as compared to the No Action Alternative and No Project Alternative and would support BCDC's habitat restoration and SLR adaptation.

- **NEPA Determination**: Under Alternatives 1 through 4, there would be adverse effect on land use as related to potential conflict with applicable plans and policies. Project activities would comply with applicable land use plans and policies under all alternatives. With increase in beneficial placement, which supports Bay Plan policies and goals, there would be an overall beneficial impact from the project related to compliance with land use policies.
- **CEQA Determination**: Under Alternatives 1 through 4, there would be no impact on land use. Project activities would comply with applicable land use plans and policies under all alternatives.

3.8.4.2 Impact LU-2: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Land Use

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Because the project would not result in any land use impacts (i.e., the project would not conflict with applicable land use plans and policies), it would not contribute to cumulative land use impacts.

- **NEPA Determination**: Project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts on land use.

- **CEQA Determination**: Project alternatives would not contribute to cumulatively considerable impacts on land use.

3.9 Transportation and Traffic

This section describes the existing transportation systems and infrastructure in the study area and analyzes potential transportation impacts from implementation of the alternatives. As described in Chapter 2, Alternatives, the project alternatives would involve maintenance dredging of the federal navigation channels, and transport and placement of the dredged material, at a combination of in-water and adjacent landward placement sites.

Dredged material is rarely transported by land because this method is more expensive and inefficient compared to water transport. Transport of dredged material by truck or train would only occur in circumstances where dredged material that is not suitable for unconfined aquatic disposal requires secondary placement. In this case, sediments would be transported by dredge or barge to a rehandling site until the sediments are dry, at which point they would be taken to a land-based facility such as a landfill via truck or train. As discussed in Section 3.5.2.2, sediment testing results indicate that dredged material from the subject federal navigation channels would be suitable for unconfined aquatic placement therefore, transport of dredged material on land would be rare. Land-based transport of dredged material from USACE's maintenance dredging projects in SF Bay did not occur during the 2000 to 2012 baseline period or in the last 10 years under permitted maintenance dredging. There is extensive roadway, railway, bicycle, and pedestrian infrastructure within the study area; however, since land-based transport of dredged material would be rare, the project's alternatives would not result in noticeable impacts on vehicle, rail, pedestrian, or bicycle use. Because impacts on land-based transportation and transit would be negligible, these modes of transportation are not further discussed in this section. Therefore, this section evaluates the potential impact of the project alternatives on marine navigation in the study area.

3.9.1 Regulatory Setting

Regulatory authorities relevant to transportation and traffic are discussed in the sections below.

3.9.1.1 Federal

Inland Navigational Rules Act

The Inland Navigational Rules Act of 1980 (Public Law 96-591, 94 Stat. 3415), more commonly known as the Inland Rules, governs many rivers, lakes, harbors, and inland waterways including SF Bay. Rule 27, Vessels Not Under Command or Restricted in Their Ability to Maneuver, specifies lighting and safety requirements for vessels engaged in dredging or underwater operations that are restricted in their ability to maneuver. In addition, Title 33 C.F.R. § 88.15 contains requirements for lighting on floating or supported dredge pipelines.

United States Marine Highway Program, Energy Independence and Security Act

The United States Marine Highway Program, Energy Independence and Security Act of 2007 Pub. L. No. 110-140, 121 Stat. 1492, which is administered by the USDOT Maritime Administration is intended to expand the use of inland, Great Lakes Saint Lawrence Seaway System, intracoastal, and coastal waterways for the transportation of freight and passengers to mitigate landside congestions, reduce greenhouse gas emissions per ton-mile moved and accomplish other objectives. The program, which is loosely based on the European model of inland waterways, saw major updates in 2023.

3.9.1.2 Regional

San Francisco Bay Area Water Emergency Transportation Authority

The San Francisco Bay Water Emergency Transportation Authority (WETA) is a regional public transit agency tasked with operating and expanding ferry service on SF Bay. WETA also coordinates water transit response during regional emergencies.

3.9.2 Environmental Setting

3.9.2.1 Study Area

The Proposed Project involves maintenance dredging of federal navigation channels, and transport and placement of dredged material at in-water and shoreline beneficial use sites. Dredged material is primarily transported via water vessels, which is more cost-effective and efficient than land-based transportation (Section 2.3.1.3). Because land-based transportation and transit would be minimal relative to the total volume of dredged material transport, as well as existing levels of land-based traffic, these modes of transportation are not further discussed in this section. This section focuses on the evaluation of the potential impact of the project alternatives on marine navigation in the study area.

3.9.2.2 Vessel Movement in the Study Area

Vessel activity within SF Bay encompasses both incoming and outgoing ships as well as movements solely within the Bay Area. This vessel traffic includes tugs, government vessels, passenger ferry ships, cruise ships, commercial shipping vessels, recreational boats, commercial and sport fishing boats, board sailors, and personal watercraft.

SF Bay ranks among the four largest Pacific Coast ports for container cargo. The Port of Oakland loads and discharges more than 99 percent of the containerized goods moving through Northern California. Oakland's cargo volume made it the ninth busiest container port in the United States in 2023 (Port of Oakland 2024). The Bay Area includes four additional ports, and the proposed dredging activities would support the continued operation of the Port of Sacramento and the Port of Stockton (USACE and Regional Water Board 2015).

The United States Marine Highway Program aims to relieve landside congestion, reduce air emissions, and generate other public benefits by increasing the efficiency of the surface transportation system by promoting waterways as an alternative to landside shipping and transportation. The Marine Highway M-580 Route includes the Sacramento and San Joaquin Rivers, and connects commercial navigation channels, harbors, and ports in Northern California from Sacramento to Oakland and beyond the SF Bay Area via the M-5 route. If fully implemented, a proposed marine highway service between the Ports of Oakland, Stockton, and West Sacramento in the Bay Area would see improvements in congestion on major roadways. It would significantly reduce the amount of truck emissions associated with the current distribution system (USDOT 2024b). Proposed dredging activities would support sections of both marine highways in the Bay Area.

Maneuvering deep-draft ships in narrow channels with minimal underkeel clearance poses high navigational risks, given the complexities of tides, currents, and weather conditions in the Bay. To avoid grounding, deep-draft vessels traveling through SF Bay are usually restricted to the main shipping channels. Instances of vessels running aground have been documented across various areas of the region, primarily attributed to the narrow width of numerous channels. Groundings may result in damage to vessels and property, with the potential for serious environmental consequences. If a vessel becomes stranded within a channel, it can impede the passage of other vessels or contribute to the formation of new shoals, which may cause significant disruptions to maritime commerce (HSC 2020).

Critical Maneuvering Areas (CMA) are areas within the SF Bay and Delta Region where additional standards of care are required due to the restrictive nature of the channel, the prevalence of adverse currents, or the proximity of hazards. Large vessels, tugs with tows of 1,600 gross tons or more, and all tugs with tows in petroleum service should not transit through CMAs when visibility is less than 0.5 nautical mile. Locations in the Bay identified as CMAs are Redwood Creek, San Mateo-Hayward Bridge, Islais Creek Channel, Oakland Harbor Regulated Navigation Area, San Francisco-Oakland Bay Bridge (West of Treasure Island), Richmond Inner Harbor, the east span of the Richmond–San Rafael Bridge, the Union Pacific Bridge, the up-bound New York Slough, and the Rio Vista Lift Bridge (HSC 2020).

Water transit carries only a fraction of the total SF Bay Area travelers, but it plays a meaningful role in reducing congestion and providing mobility in the key trans-Bay bridge corridors throughout the SF Bay Area. The SF Bay Area WETA manages the largest ferry service in the Bay. Since 2017, WETA has introduced seven vessels that accommodate 400 passengers or more and in 2019 the SF Bay Ferry served over three million passengers for the first time. Ferry service throughout the Bay is expected to increase, requiring new ports, port expansions, and more vessels (WETA 2024a). Existing ferry service is summarized in Table 3-24. Services to Oakland and Vallejo use the federal navigation channels.

Table 3-24. Existing Regional Network of Ferry Transit Services and Operators

Corridor/Ferry Route	Operators
Alameda (Main Street): Oakland	WETA (Blue & Gold Fleet)[1]
Angel Island: Tiburon	Angel Island, Tiburon Ferry Company
Pier 41 – Sausalito	Blue and Gold Fleet
San Francisco: Alameda (Seaplane Lagoon)	WETA (Blue & Gold Fleet)[1]
San Francisco: Harbor Bay	WETA (Blue & Gold Fleet)[1]
San Francisco: Oakland—Alameda (Main Street)	WETA (Blue & Gold Fleet)[1]
San Francisco: Richmond	WETA (Blue & Gold Fleet)[1]
San Francisco: Vallejo—Mare Island	WETA (Blue & Gold Fleet)[1]
San Francisco: Pier 41	WETA (Blue & Gold Fleet)[1]
San Francisco: Larkspur	Golden Gate Bridge, Highway and Transportation District
San Francisco: Sausalito	Golden Gate Bridge, Highway and Transportation District

Corridor/Ferry Route	Operators
San Francisco: Tiburon	Golden Gate Bridge, Highway and Transportation District
San Francisco: Angel Island State Park	Golden Gate Bridge, Highway and Transportation District
San Francisco: Treasure Island	Treasure Island, Yerba Buena Island Ferry
South San Francisco: Oakland—Alameda (Main Street)	WETA (Blue & Gold)[1]

Sources: Angel Island Tiburon Ferry 2024; Blue and Gold Fleet 2024; Golden Gate Bridge, Highway and Transportation District 2024; Treasure Island San Francisco 2024; WETA 2024b
[1] Blue & Gold Fleet operates these services under an O&M contract with WETA.
Key: WETA = San Francisco Bay Area Water Emergency Transportation Authority

3.9.3 Methodology and Thresholds of Significance

Because the Proposed Action/Proposed Project and alternatives would be conducted in waterways, this transportation evaluation focuses on marine navigation. Many of the CEQA Appendix G thresholds for transportation/traffic, as written, do not apply to the project alternatives because they are focused on land-based or air transportation. Therefore, the following project-specific thresholds were established considering the topics addressed in the transportation/traffic CEQA thresholds that could be applied to navigation to evaluate the potential for navigation impacts under NEPA and CEQA:

- Would the project alternatives disrupt or substantially impede marine navigation including mass transit? For the purposes of this analysis, a marine traffic disruption would occur if dredging or placement activities substantially interfered with vessel navigation, and/or substantially increased the volume of vessel movement in the study area.
- Would the project alternatives result in inadequate emergency access or create substantial navigational safety risks?

3.9.4 Impacts and Mitigation Measures

3.9.4.1 Impact TR-1: Potential to Disrupt or Impede Marine Navigation

No Action Alternative

Maintenance dredging and sediment placement operations have occurred in the waters of SF Bay for decades; the No Action Alternative would be a continuation of USACE's current maintenance dredging program for the federal navigation channels in SF Bay, as authorized.

Dredging is temporary and its duration depends on factors such as the volume of sediment in each channel, the frequency of dredging, and the equipment used for dredging and transporting sediment. For the federal channels addressed in this EA/EIR, the duration of dredging ranges from five to 65 days; however, vessels and equipment move along the channel as dredging operations occur, limiting the amount of time a dredge would be operating in a specific location. Federal navigation channels are generally wide enough to allow the passage of vessel traffic and accommodate dredge equipment at the same time. Dredges would move out of the way for larger vessels to pass, but dredging activities may occasionally impede or delay some vessels. Under all alternatives, dredging and placement activities would comply with all applicable safety and vessel traffic requirements, including specifications for dredge pipelines.

Hopper dredges generally have less impact on marine navigation because they are self-propelled, move continuously during dredging operations and can store dredged material for transport. Cutterhead-pipeline and clamshell-bucket dredges often take up more space in a channel since operations require the use of a dredge plant, where dredge equipment is located, and four or five support vessels in the immediate dredge area to provide equipment and maneuver the dredge plant. Additionally, cutterhead and clamshell-bucket dredges are stationary during operation and may need to temporarily cease dredging activities to move out of the way of larger passing vessels. Cutterhead-pipeline dredges pump material directly onto placement sites, therefore, it does not involve transport of dredged material by vessel. However, clamshell dredges do require additional vessels to store and transport dredged material to placement sites.

Maintenance dredging and placement operations are anticipated to increase vessel activity within the study area, particularly during transport to placement sites; however, the amount of vessel traffic would be similar to traffic levels during previous maintenance dredging initiatives by USACE. An increase in vessel traffic due to dredging operations would be negligible considering the existing volume of vessel movement in the study area. Therefore, adverse impacts on navigation under the No Action Alternative would be minimal and short-term. Dredging would have a long-term beneficial impact by removing shoaled sediment and maintaining the navigability of the federal channels.

- **NEPA Determination**: Under the No Action Alternative, short-term impacts on marine navigation would be less than significant, and long-term impacts would be beneficial. The overall potential impact for dredging, transport, and placement activities to have the potential to disrupt or impede marine navigation is less than significant.

No Project Alternative

Under the No Project Alternative, existing dredging activities and the current dredging program as implemented by USACE would continue irrespective of current federally authorized dredging frequencies for channels. For Richmond Outer Harbor and Pinole Shoal, dredging would occur every other year rather than annually. The reduced annual maintenance, or entire lack of annual maintenance of dredging for Richmond Outer Harbor and Pinole Shoal channels would potentially increase the risk of a navigational hazard that would result in vessel groundings, allisions, or collisions, as well as oil spills that could result from such incidents. However, under this alternative, similar to other alternatives evaluated in this EA/EIR, emergency dredging would be performed by USACE to address navigation hazards if the depth of a channel becomes a concern for navigation, as reported by the San Francisco Bar Pilots, then subject to issuance of an emergency declaration by the USCG, then review and action by USACE.

- **CEQA Determination**: Under the No Project Alternative, impacts on marine navigation would be less than significant.

Alternatives 1 Through 4

Implementation of Alternatives 1 through 4 would be very similar to the No Action Alternative and No Project Alternative, but Alternatives 1 through 4 have slightly different dredging methods in some locations. The alternatives using cutterhead-pipeline and clamshell-bucket dredges instead of hopper dredges may result in more significant impacts on marine navigation during dredging operations since they are not as mobile and require more equipment, thus taking up more space in the channel.

The following channels have different anticipated dredging methods depending on the alternative: Inner Richmond Harbor, Richmond Outer Harbor, and San Pablo Bay (Pinole Shoal). Dredging in Inner Richmond Harbor would use clamshell dredges for Alternatives 1 and 4, and hopper dredges for Alternatives 2 and 3 compared to clamshell dredges for the No Action Alternative and No Project Alternative. Alternatives 1 through 4 would use a hopper or cutterhead-pipeline dredge as an alternate method if necessary. Dredging in Richmond Outer Harbor and San Pablo Bay (Pinole Shoal) would use a hopper dredge for all Alternatives except Alternative 4 which would use a clamshell dredge. Alternatives 1 through 3 would use a clamshell or cutterhead-pipeline dredge and Alternative 4 would use a hopper or cutterhead-pipeline dredge as an alternate method, as necessary. Alternatives with clamshell and cutterhead-pipeline methods may result in short-term adverse impacts on marine navigation during dredging operations; however, the impacts on marine navigation would be negligible considering the existing volume of vessel movement in the study area in the project area. The following channels have different alternate dredging methods from the No Action Alternative and No Project Alternative: Oakland Inner and Outer, Petaluma Across the Flats, Redwood City Harbor channels, San Bruno Shoal, San Rafael Creek, and Suisun Bay Channel. The alternate dredging methods would only occur in certain circumstances and may result in short-term beneficial or adverse impacts on marine navigation depending on the dredging method.

Delays may occur more frequently in alternatives with cutterhead-pipeline and clamshell-bucket dredges; however, dredging operations are not anticipated to cause significant adverse impacts on marine navigation since most federal channels are wide enough to allow for vessels to pass while dredging equipment is present. In all alternatives, dredging operations would be paused to move equipment to allow for larger vessels to pass if necessary. The USCG is responsible for organizing vessel traffic and maintaining regulated navigation areas to reduce vessel congestion where maneuvering room is limited.

Therefore, adverse impacts on navigation under Alternatives 1 through 4 would be minimal and short-term. Dredging would have a long-term beneficial impact by removing shoaled sediment and maintaining the navigability of the federal channels.

- **NEPA Determination**: Under Alternatives 1 through 4, short-term impacts on marine navigation would be less than significant and long-term impacts would be beneficial. The overall potential impact for dredging, transport, and placement activities to have the potential to disrupt or impede marine navigation is less than significant.
- **CEQA Determination**: Under Alternatives 1 through 4, impacts on marine navigation would be less than significant.

3.9.4.2 Impact TR-2: Potential to Create Navigational Safety Risks

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

Under all alternatives, dredging and placement activities would comply with applicable vessel traffic and safety requirements, including specifications for dredge pipelines. Notes to mariners and navigational warning markers would be used as needed to prevent navigational hazards. Additional in-Bay placement may occur under the Alternatives 1 through 4, as compared to the No Action Alternative and No Project Alternative. However, there would not be a significant increase in mounding or creation of a new navigation hazard (see Section 3.5.4.3).

Therefore, there would be no impacts related to navigational safety risks.

Dredging would have a long-term beneficial impact by removing shoaled sediment that could pose a navigation hazard and thus allowing for safe navigation in the federal channels.

- **NEPA Determination**: Under all alternatives, impacts on navigational safety under all alternatives would be beneficial.
- **CEQA Determination**: Under all alternatives, there would be no impacts on navigational safety.

3.9.4.3 Impact TR-3: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Transportation and Traffic

No Action Alternative/No Project Alternative, Alternatives 1 Through 4

The project alternatives may temporarily delay vessels while dredge equipment is present in channels which would have short-term adverse impacts on navigation in federal channels. Present and reasonably foreseeable projects described in Table 3-2 may require vessel use in federal channels; however, most vessels associated with these projects are mobile and would not be expected to result in cumulative impacts related to transportation. Anticipated projects that require dredging within federal channels would also require dredging equipment that may cause short-term adverse impacts on transportation. However, multiple dredging projects are not anticipated to happen in the same location at the same time; therefore, would not contribute to cumulative impacts. Additionally, the Proposed Project would not cause long-term adverse impacts related to transportation; therefore, it would not contribute to cumulative transportation use impacts.

- **NEPA Determination**: The project alternatives, considering reasonably foreseeable actions, would not contribute to considerable impacts on navigation.
- **CEQA Determination**: The project alternatives would not contribute to cumulatively considerable impacts on navigation.

3.10 Summary of Impacts and Mitigation Measures for Proposed Action/Proposed Project

This section provides a summary of potential impacts and mitigation measures for the Proposed Action/Proposed Project as a whole (Table 3-25). As described in Section 3.1.4, the potential environmental impacts of the Proposed Action/Proposed Project assume that USACE will proceed with a phased implementation of the No Project Alternative, Alternative 1, and Alternative 2. Specifically, this impact analysis approach for the Proposed Action/Proposed Project considers the impacts described within the No Project Alternative for the first year, Alternative 1 for the next 1 to 2 years, approximately, and Alternative 2 for subsequent years to analyze the effect over the entire 10-year period. Accordingly, impacts, minimization, and mitigation from the Proposed Action/Proposed Project during the first year will be equivalent to impacts, minimization, and mitigation described under the No Project Alternative above. Impacts and minimization during the next one to two years will be equivalent to impacts and minimization described under Alternative 1 measures above. Impacts and minimization in subsequent years will be equivalent to impacts and minimization described under Alternative 2 above. Further, considering the Proposed Action/Proposed Project as a whole, there are no additional impacts beyond those described under the alternatives above. As such, impacts from the Proposed Action/Proposed Project will be less than significant and not cumulatively considerable with mitigation and minimization described under each of the alternatives above.

Table 3-25. Summary of Net Impacts and Findings for Proposed Action/Proposed Project

Potential Impact Pathway	Mitigation Measures[1]	Proposed Action/ Proposed Project
Air Quality, Climate Change, and Greenhouse Gas Emissions		
Impact AQ-1: Potential violation of any air quality standard or contribute substantially to an existing or projected air quality violation.	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact AQ-2: Potential conflict with or Obstruction of Implementation of an Applicable Air Quality Plan.	No Mitigation Measures	NEPA: B CEQA: NI[2]
Impact AQ-3: Potential for exposure of Sensitive Receptors to Substantial Pollutant Concentrations.	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact AQ-4: Potential to Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact AQ-5: Result in Cumulative Impacts on Regional Air Quality	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Biological Resources		
Impact BI-1: Potential Effects on Fish and Benthic Invertebrate Survival Caused by Entrainment	BI1-1: Compensatory Mitigation – *No Project*	NEPA: LTS CEQA: Significant when implementing the No Project Alternative; reduced to LTS with BI1-1 Mitigation Measure
Impact BI-2: Potential Adverse Effects of Increased Turbidity Caused by Dredging and Material Placement on Special-Status Species, Critical Habitat and Commercially Valuable Marine Species	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-3: Potential Effects on Fish and Marine Mammals Caused by Noise from Dredging Activities	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-4: Potential Effects of Maintenance Dredging and Material Placement on Benthic Habitat	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-5: Potential Effects Caused by Non-aquatic beneficial use of Dredged Material Placement	No Mitigation Measures	NEPA: B CEQA: LTS

Potential Impact Pathway	Mitigation Measures[1]	Proposed Action/ Proposed Project
Impact BI-6: Potential Effects Caused by the Resuspension of Contaminated Sediments	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact B7: Potential Interference of Migratory Passage for fish and marine mammals	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-8: Potential Effects of Dredging Activities on Roosting, Nesting, and Foraging Avian Species	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-9: Potential Disturbance of EFH and “Special Aquatic Sites” Including Eelgrass Beds and Mudflats	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact BI-10: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Biological Resources	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Cultural and Tribal Resources		
Impact CT-1: Substantial Adverse Change to a Historical Resource or Disturb Unique Archaeological Resources	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact CT-2: Potential to Disturb Human Remains, including those Interred Outside of Formal Cemeteries	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact CT-3: Potential Impacts to Native American Sacred Sites or Religious Ceremonies	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact CT-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Historical Resources	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Geology, Soils, and Sediment Quality		
Impact GE-1: Potential for Dredging, Transport, and Placement Activities to Result in Substantial Soil Erosion	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact GE-2: Potential for Dredging, Transport, and Placement Activities to Substantially Degrade Sediment Quality	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact GE-3: Potential for Dredging, Transport, and Placement Activities to Result in Substantial in-Bay Sediment Mounding	No Mitigation Measures	NEPA: LTS CEQA: LTS
Hazards and Hazardous Materials		
Impact HM-1: Potential Public or Environmental Exposure from the Transport, Use, and Disposal of Hazardous Materials	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact HM-2: Potential Impacts to Implementation of an Adopted Emergency Response Plan	No Mitigation Measures	NEPA: B CEQA: LTS
Impact HM-3 Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hazards and Hazardous Materials	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Hydrology and Water Quality		
Impact HY-1: Potential to Substantially Degrade Water Quality through Alteration of Water Temperature, Salinity, pH, and Dissolved Oxygen	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact HY-2: Potential to Substantially Degrade Water Quality Because of Increased Turbidity	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact HY-3: Potential to Substantially Degrade Water Quality from Mobilization of Contaminated Sediments or Release of Hazardous Materials	No Mitigation Measures	NEPA: LTS CEQA: LTS

Potential Impact Pathway	Mitigation Measures[1]	Proposed Action/ Proposed Project
Impact HY-4: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Hydrology or Water Quality	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Land Use and Planning		
Impact LU-1: Potential Conflict with Applicable Plans and Policies	No Mitigation Measures	NEPA: No Impact CEQA: No impact
Impact LU-2: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Land Use	No Mitigation Measures	NEPA: NRFI CEQA: NSCI
Transportation and Traffic		
Impact TR-1: Potential to Disrupt or Impede Marine Navigation	No Mitigation Measures	NEPA: LTS CEQA: LTS
Impact TR-2: Potential to Create Navigational Safety Risks	No Mitigation Measures	NEPA: B CEQA: NI[2]
Impact TR-3: Potential for Dredging, Transport, and Placement Activities to Result in Cumulative Impacts on Transportation and Traffic	No Mitigation Measures	NEPA: NRFI CEQA: NSCI

1 Standard Practices and avoidance and minimization measures, as identified in LTMS BiOps (NMFS 1998, 2015; USFWS 1999, 2004a, 2004b, 2024, 2025) and EFH Consultation (USACE and USEPA 2011) would be employed under all alternative to reduce impacts to species and habitat. See Section 2.3.1.5 for more information.

2 Impacts would be similar under NEPA and CEQA; however, CEQA does not permit beneficial impact determinations.

Key:
B = beneficial
CEQA = California Environmental Quality Act
EFH = essential fish habitat
LTS = less than significant
NEPA = National Environmental Policy Act
NI = no impact
NSCI = no significant cumulative impacts
NRFI = No reasonably foreseeable impacts, for NEPA purposes, only analysis of how reasonably foreseeable projects would result in reasonably foreseeable considerable impacts need to be considered.

4.0 Public, Agency, and Tribal Involvement

This chapter summarizes the outreach efforts conducted to the public, agencies, and tribes as part of this project to request their involvement. Public and agency participation has occurred as a part of the environmental review process, pursuant to the requirements of NEPA and CEQA. Tribal outreach has also occurred in accordance with federal and state requirements. Stakeholders and public agencies, including those with permitting authority for the project, have been engaged and involved as described below. This section will be updated throughout the NEPA/CEQA process as additional involvement occurs.

4.1 Notice of Preparation and Public Scoping

Consistent with CEQA guidance for preparation of an EIR, the Regional Water Board submitted an NOP to the California State Clearinghouse on February 13, 2024, to alert potentially interested parties of the project and to invite participation in the environmental review process. The NOP was also posted to the USACE and Regional Water Board websites and distributed through the LTMS, RDMMP, and Regional Water Board's CEQA email listservs. The NOP included the project description and a figure of the study area. It also announced the scoping period and public scoping meeting information.

The scoping period ran from February 13, 2024, through March 14, 2024. A scoping meeting with option for in-person or virtual participation was held at the Regional Water Board's office in Oakland, California, on Tuesday, March 5, from 4:00 to 6:00 p.m. The purpose of the scoping meeting was to solicit public comments on the scope of the EA/EIR and provide a brief overview of the proposed alternatives to the public. The scoping meeting presentation explained the public comment process, the environmental review process and schedule, and the procedure for submitting oral and written comments. All participants were virtual; there were no in-person attendees.

4.2 Review of the Public Draft EA/EIR

A Draft EA/EIR notice of availability was distributed through the same avenues as those used for scoping, with updates made to reflect any feedback received via the scoping process. During the public review period, originally set for October 31, 2024, to December 16, 2024, but then extended to December 30, 2024 written comments were directed to be sent to USACE at SF-Bay-Dredging@usace.army.mil and the Regional Water Board, c/o Jazzy Graham-Davis (Jazzy.Graham-Davis@Waterboards.ca.gov).

The Draft EA/EIR was also available at:

- San Francisco Regional Water Quality Control Board
  1515 Clay Street, Suite 1400
  Oakland, CA 94612

An electronic copy of the Draft EA/EIR was available at: https://spn.usace.afpims.mil/Missions/Projects-and-Programs/Regional-Dredge-Material-Management-Plan/

Public, Agency, and Tribal Involvement

During the review period, a public meeting was held on-line, via Zoom, on November 19, 2024 from 4:00-6:00 pm. The public meeting explained the proposed project, answered clarifying questions on the Draft EA/EIR, and provided instructions to submit written comments on the Draft EIR. USACE and the Water Board considered all relevant comments during preparation of this Final EA/EIR. Written comments were accepted throughout the public comment period. At the end of the public comment period for the Draft EA/EIR, a total of 11 comment letters and emails were received. There were 15 participants at the public meeting consisting of State and Local agencies and 3 individuals. Comment letters were received from the EPA, CDFW, BCDC, County of Solano, Bay Planning Coalition, Citizens for East Shore Parks, CMANC, Richmond Southeast Shoreline Area Community Advisory Group, San Francisco Baykeeper, State Water Contractors and San Luis & Delta-Mendota Water Authority, and one individual.

Appendix H contains the comments received during the public comment period and responses to comments.

4.3 Agencies and Organizations Contacted

Table 4-1 lists the federal, state, and local agencies and other organizations that were contacted during the preparation of this EA/EIR (this list will be updated as the NEPA/CEQA process advances).

Table 4-1. Agencies and Organizations Contacted

Agencies and Organization Contacted	
Federal Agencies	
NMFS USFWS US Coast Guard US Coast Guard Civil Engineering Unit Oakland USEPA (LTMS Executive Committee member) USFWS LTMS Management Committee member	Federal Emergency Management Agency National Park Service NOAA Office of Coastal Management San Francisco Veterans Affairs Medical Center USDOT US Department of Agriculture
State and Local Agencies	
Alameda County Flood Control Zone 7 Alameda County Flood Control District BART BCDC (LTMS Executive Committee member) California Department of Transportation California Department of Water Resources California State Coastal Conservancy CSLC CDFW (LTMS Executive Committee member) CSLC (LTMS Management Committee member for DMMO issues) California Ocean Protection Council City of Alameda City of Pacifica City of Petaluma City of San Francisco City of San Rafael City of Sausalito	Contra Costa County Flood Control and Water Conservation District East Bay Regional Park District Marin County Napa County Flood Control and Water Conservation District San Francisco Airport San Francisco Regional Water Quality Control Board Region 2 San Francisco Public Utilities Commission Solano County Sonoma County Sonoma County Regional Parks Sonoma Water South Bay Salt Ponds Restoration Project State Coastal Conservancy (LTMS Management Committee member for beneficial reuse issues) Suisun Resource Conservation District Valley Water

Agencies and Organization Contacted	
Organizations	
Bay Planning Coalition Bay.org British Petroleum (BP) California Marine Affairs Navigation Conference California State University East Bay Chevron Curtin Maritime Delta Stewardship Council Dixon Marine Services Ducks Unlimited Dutra Group Ellen Johnck Consulting Environmental Resources Management Environmental Science Associates Manson Construction Marathon Petroleum Mare Island Dry Dock Moran Shipping Natural Resources Defense Council One Shoreline Point Blue Conservation Science	Port of Oakland Port of Redwood City Port of Richmond Port of San Francisco Port of Stockton Port of West Sacramento RI Dredge San Francisco Bay Joint Venture San Francisco Bay Restoration Authority San Francisco Baykeeper SFEI San Francisco Estuary Partnership San Francisco Marine Exchange San Mateo Harbor Save San Francisco Bay Schoonmaker Marina Shell Stevedoring Services of America TSO Corp Valero Wild Oyster Project

4.4 Tribal Notification

Per USACE Tribal Consultation Policy (USACE 2012c), USACE must “provide affected Tribes an opportunity to participate in the decision-making process that will ensure these tribal interests are given due consideration in a manner consistent with tribal sovereign authority; Consulting, consistent with government-to-government relations and consistent with protocols mutually agreed to by the particular tribe and the US Department of Defense, including necessary dispute resolution processes.” USACE acknowledges all federally recognized tribes are sovereign governments. Tribes located in the study area are considered rightsholders, as they possess inherent rights and a political relationship with governments, including the right to self-determination and the preservation of their culture and resources. USACE has a fundamental tribal trust responsibility and will maintain government-to-government relationships with tribes.

AB 52 amended CEQA and created a separate resource category called “tribal cultural resources” (PRC Section 21074). AB 52 requires lead agencies to provide notification and the opportunity to request consultation to California Native American tribes that are traditionally and culturally affiliated with the geographic area of a Proposed Project.

In December 2023, USACE and Regional Water Board initiated Tribal consultation regarding the development of the RDMMP to engage with Tribal communities and ensure their perspectives and concerns are integrated into the environmental and cultural review process.

On February 6, 2024, a consultation meeting was held with representatives from the Federated Indians of Graton Rancheria. The primary focus of this meeting was to identify and address potential inadvertent impacts on Tribal Cultural Resources associated with the RDMMP. The Confederated Villages of Lisjan and the Amah Mutsun Tribal Band also provided comments. Ongoing consultation with the Federated Indians of Graton Rancheria and the Confederated Villages of Lisjan Nation continues, with a focus on the findings of effect related to our environmental assessments. This engagement is essential for identifying any additional Tribal resources, sacred sites, or areas of traditional cultural or religious significance that require further consideration within the RDMMP. In response to the feedback received during this meeting, the USACE has since developed a suite of mitigation measures aimed at avoiding or minimizing impacts to cultural and tribal resources.

In compliance with USACE Tribal Consultation Policy and AB 52, USACE coordinated with the NAHC in March 2024 for this large-scale undertaking and received a list of tribal contacts in Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties. A Sacred Lands File search was conducted in March 2024 with the Native American Heritage Commission (NAHC). The results of this search were positive, indicating the presence of potential cultural resources that necessitate additional consultation. As a result, over 60 California Tribes were contacted to identify any concerns to sacred sites and tribal resources. USACE and the Regional Water Board reached out to tribes (via email) and requested their comments on the project. The list of tribes consulted, a summary of tribal consultation, and a copy of correspondence are provided in Appendix E. To date, the Regional Water Board has had one meeting with the Federated Indians of Graton Rancheria. Tribal outreach with non-AB52 tribes is also included in the outreach program.

4.5 Environmental Justice

Section 4.5 and its subparts are only relevant to the EIR and are not part of the EA. The State of California defines environmental justice as “the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.”[31] In California PRC § 30107.3, California’s legislature defined environmental justice as follows:

> *(a) Environmental justice” means the fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins, with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.*
>
> *(b) “Environmental justice” includes, but is not limited to, all the following:*
>
> > *(1) The availability of a healthy environment for all people.*
> >
> > *(2) The deterrence, reduction, and elimination of pollution burdens for populations and communities experiencing the adverse effects of that pollution, so that the effects of the pollution are not disproportionately borne by those populations and communities.*
> >
> > *(3) Governmental entities engaging and providing technical assistance to populations and communities most impacted by pollution to promote their*

[31] California Government Code §65040.12(e)

meaningful participation in all phases of the environmental and land use decision making process.

(4) At a minimum, the meaningful consideration of recommendations from populations and communities most impacted by pollution into environmental and land use decisions.

CEQA does not have specific environmental justice guidelines; however, several California regulatory agencies, including the State Water Board, the Regional Water Board, and the BCDC have developed environmental justice practices specifically designed to ensure that environmental justice issues affecting minority populations, low-income populations, and/or Indian tribes and Indigenous communities are adequately considered in agency decision making.

Assembly Bill (AB) 2108[32] requires the State Water Board and Regional Water Board to engage in equitable, culturally relevant community outreach to promote meaningful civic engagement from potentially impacted communities of proposed discharges of waste that may have disproportionate impacts of water quality in disadvantaged communities. This includes community and tribal outreach to tribes that have not requested notification under AB 52. In furtherance of AB 2108's mandate, the Regional Water Board consults with tribes and environmental justice community representatives consistent with AB 2108 on issuance of WDRs that have potential tribal and environmental justice impacts. Additionally, the Regional Water Board uses the San Francisco Bay Restoration Regulatory Integration Team (BRRIT) as an agency coordinating tool on shoreline restoration projects in environmental justice communities (such as Heron's Head Park in San Francisco). The Regional Water Board considers BRRIT/Policy Management Committee coordination and outreach to tribes on cultural resources being exposed by shoreline changes relating to SLR.

4.5.1 Environmental Justice Approach

To inform the assessment of the environmental justice impacts associated with each action, this analysis used the Environmental Justice and Social Equity policies adopted by the San Francisco BCDC, the regulatory body responsible for guiding development in and around SF Bay. The key Environmental Justice and Social Equity policies that apply to this analysis are as follows:[33]

3. *Equitable, culturally-relevant community outreach and engagement should be conducted by local governments and project applicants to meaningfully involve potentially impacted communities for major projects and appropriate minor projects in underrepresented and/or identified vulnerable and/or disadvantaged communities, and such outreach and engagement should continue throughout the Commission review and permitting processes. Evidence of how community concerns were addressed should be provided. If such previous outreach and engagement did not*

[32] AB 2108, Water policy: environmental justice: disadvantaged and tribal communities, was approved and filed with the California Secretary of State on September 16, 2022.

[33] San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan Part IV – Development of the Bay and Shoreline: Findings and Policies. Available at: [San Francisco Bay Plan | SF Bay Conservation & Development (ca.gov)]

occur, further outreach and engagement should be conducted prior to Commission action.

4. *If a project is proposed within an underrepresented and/or identified vulnerable and/or disadvantaged community, potential disproportionate impacts should be identified in collaboration with the potentially impacted communities. Local governments and the Commission should take measures through environmental review and permitting processes, within the scope of their respective authorities, to require mitigation for disproportionate adverse project impacts on the identified vulnerable or disadvantaged communities in which the project is proposed.*

The analysis' adherence to the Environmental Justice and Social Equity policies adopted by BCDC satisfies the environmental justice requirements of AB2108 Waste Discharge (State of California). AB2108 is triggered by a discharge of waste that has a disproportionate impact on a disadvantaged community.

4.5.2 Anticipated Environmental Justice Impacts

Preliminary environmental justice concerns include air quality impacts, water contact recreation, and fishing issues. Environmental justice concerns will be informed and verified by engaging with residents and community stakeholders. USACE and the Regional Water Board have developed a communications plan for this project for outreach and engagement to project stakeholders, including communities with environmental justice concerns. In addition, the lead agencies sent an advance notice of the availability of the EA/EIR and an invitation for comments to community organizations identified as part of the database search described below. The results of these outreach and engagement efforts are summarized in Appendix G of this EA/EIR.

The Proposed Project and its alternatives are not expected to have significant cumulative environmental effects on any of the resource areas studied. Additionally, it is not expected that the Proposed Project will have cumulative effects that would disproportionately impact any populations with environmental justice concerns identified through existing database research and outreach.

The project's direct impacts on air quality and greenhouse gases were not found to be significant or cumulatively considerable. The project would facilitate the continued use of federal navigation channels by petroleum-related shipping and operations in San Francisco Bay, which would therefore result in an indirect impact to air quality and greenhouse gas emissions. The project's impacts on water quality are temporary and not expected to be significant due to strict adherence to sediment testing guidelines and the regulation of materials that will be placed at various placement and beneficial use sites. While resource agency and public concerns have been raised about the potential impact of maintenance dredging operations on fish species, these concerns will be addressed through the implementation of avoidance and minimization measures including adherence to work windows and limitations on the use of hopper dredging that will reduce these impacts to less than significant levels (Section 3.3.4.1). There are not expected to be cumulatively considerable impacts on fisheries that might impact identified environmental justice communities.

Maintenance dredging operations could, however, result in short-term increased turbidity that could temporarily impact water contact recreation and fishing activities in proximity to populations with environmental justice concerns. Areas that may be affected by short-term impacts are shown in Figure 4-1. While these effects are not considered significant or cumulatively considerable, the project sponsor recognizes that these short-term impacts could affect communities with environmental justice concerns for brief periods during certain dredging operations. The project sponsor has engaged in outreach and discussion with these communities to identify key locations that may fall within areas of vulnerability. Ongoing outreach will take place to identify opportunities to provide relevant information to affected communities and discuss appropriate actions.

4.5.3 Identification of Populations with Environmental Justice Concerns

The analysis used a mixture of spatial and demographic data to delineate which socially vulnerable communities[34] were within the impact area of the Proposed Action/Proposed Project. For this analysis, socially vulnerable communities were defined as US Census block groups with high concentrations of one or a combination of individuals meeting the following socioeconomic indicators:

- Disabled
- Minority
- Over 65 and alone
- No high school degree
- Limited English proficiency
- Not a US citizen
- Severe housing cost burden
- Very low income
- No vehicle
- Renter
- Single parent
- Under the age of five

The data for these socioeconomic indicators came from the American Community Survey 2021 five-year estimates. The demographic analysis area was defined as a 1.5-mile buffer area around each dredged material placement site and USACE-maintained federal navigation channel area. To determine which Census block groups fell within the impact areas, the geospatial location of each placement site and channel area with their respective 1.5-mile buffers were overlaid with BCDC's Community Vulnerability Tool (BCDC 2023) data set. A search of churches and faith-based groups in the 1.5-mile buffer was also conducted using the BCDC Community Vulnerability Tool.

[34] Vulnerable populations include low-income and minority populations, as defined in EO 12898, as well as additional populations with environmental concerns, as expanded under EO 14096 and new NEPA rules, including age and disability.

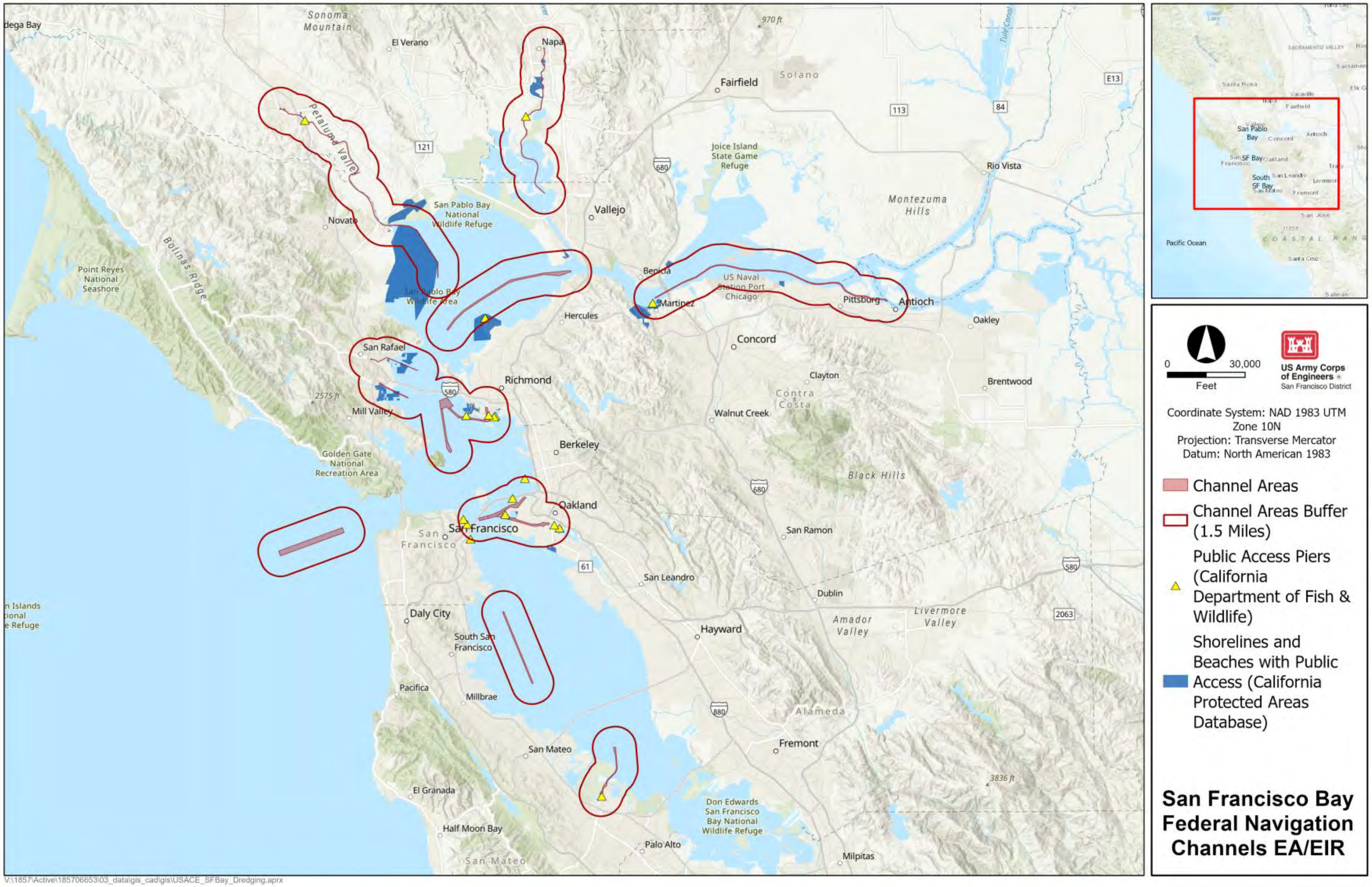


Figure 4-1. Public Access Areas and Piers that Could be Affected by Short-Term Turbidity

The BCDC Community Vulnerability data set includes the socioeconomic data for Bay Area Census block groups in determining the five categories of social vulnerability rankings (see Table 4-2). The social vulnerability criteria analyzed included:

- Renters
- Very low income
- Under five years of age
- Not a US citizen
- Without vehicle
- With disability
- Single parent family
- Communities of color
- 65 or older living alone
- Limited English proficiency
- Without high school diploma
- Severely housing cost burdened

Table 4-2. San Francisco Bay Conservation and Development Commission Categories of Social Vulnerability

Social Vulnerability Class	Class Criteria
Highest social vulnerability	Block group had: 8 or more social vulnerability indicators with rates in the 70th percentile, relative to the 9-county Bay Area; and/or 6 or more social vulnerability indicators with rates in the 90th percentile, relative to the 9-county Bay Area
High social vulnerability	Block group did not meet criteria in “Highest” category, and had: 6 to 7 indicators in the 70th percentile; and/or 4 to 5 indicators in the 90th percentile
Moderate social vulnerability	Block group did not meet criteria in “Highest” and “High” categories, and had: 4 to 5 indicators in 70th percentile; and/or 3 indicators in the 90th percentile
Low social vulnerability	Block group did not meet any of the criteria above
Not calculated	Contained characteristics that were not estimated in the American Community Survey, due to low population and other factors leading to low survey response.

Source: BCDC 2023

4.5.4 Results of Desktop Demographic Analysis

The process documented in Section 4.5.3 resulted in the identification of approximately 473 Census block groups that met moderate to highest social vulnerability scores and fell within the buffer areas of the placement sites and channel areas. Figure 4-2 below demonstrates where each socially vulnerable Census block group intersected with the impact areas of a placement site and channel area. According to the map, the largest concentrations of Census block groups meeting the highest social vulnerability thresholds (in red) that fall within the impact area are in West Oakland, southeast Richmond, Pittsburg, and Antioch.

Table 4-3 provides the percentage of the total land area of any block group that intersects with the 1.5-mile buffer depicted in Figure 4-2.

Table 4-3. Total Land Area of Environmental Justice Communities Intersecting 1.5-Mile Buffer

Block Group Social Vulnerability Ranking	Percent of Land Area of Block Groups that Intersect 1.5-Mile Buffer
Highest social vulnerability	2.18
High social vulnerability	6.97
Moderate social vulnerability	18.77
Low social vulnerability	71.23
Not Calculated	0.85

The BCDC data used two indicators (70th percentile and 90th percentile), across 12 categories to score whether a block group was highest, high, or moderate social vulnerability. Social vulnerability indicator percentiles are relative to nine counties in the Bay Area (Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco). Data values were sourced from the 2017–2021 American Community Survey. Table 4-4 and

Table 4-5 provide a count of the number of each social vulnerability category, broken down by indicator, that occurred in the social vulnerability communities within the 1.5-mile buffer. There were 473 highest, high, or moderate social vulnerability block groups that intersected with the 1.5-mile buffer, so the maximum number for any socioeconomic characteristic would be 473. The only two categories that were noticeably different between the two indicator thresholds were “Renters” and “People with disability.”

Table 4-4. Number of Socially Vulnerable Block Groups with Indicator in 70th Percentile

Socioeconomic Characteristic	Number of Socially Vulnerable Block Groups within Buffer with this Indicator in the 70th Percentile
Very low income	400
Without a high school degree	309
Renters	289
Single parent families	285
Without a vehicle	268
Communities of Color	260
Limited English proficiency	244
Not US citizens	241
People with disability	230
Under 5	188
65 and over living alone	182
Severely housing cost burdened	73

Table 4-5. Number of Socially Vulnerable Block Groups with Indicator in 90th Percentile

Socioeconomic Characteristic	Number of Socially Vulnerable Block Groups within Buffer with this Indicator in the 90th Percentile
Very low income	217
Single parent families	145
Without a high school degree	135
People with disability	102
Without a vehicle	101
Limited English proficiency	100
Communities of Color	95
Renters	92
Not US citizens	80
Under 5	73
65 and over living alone	67
Severely housing cost burdened	5

Refer to Appendix C for the full list of impacted socially vulnerable Census blocks.

Data from this analysis will be used to inform initial engagement strategies and aid in the identification of any potential measures to mitigate disproportionate impacts on populations with environmental concerns.

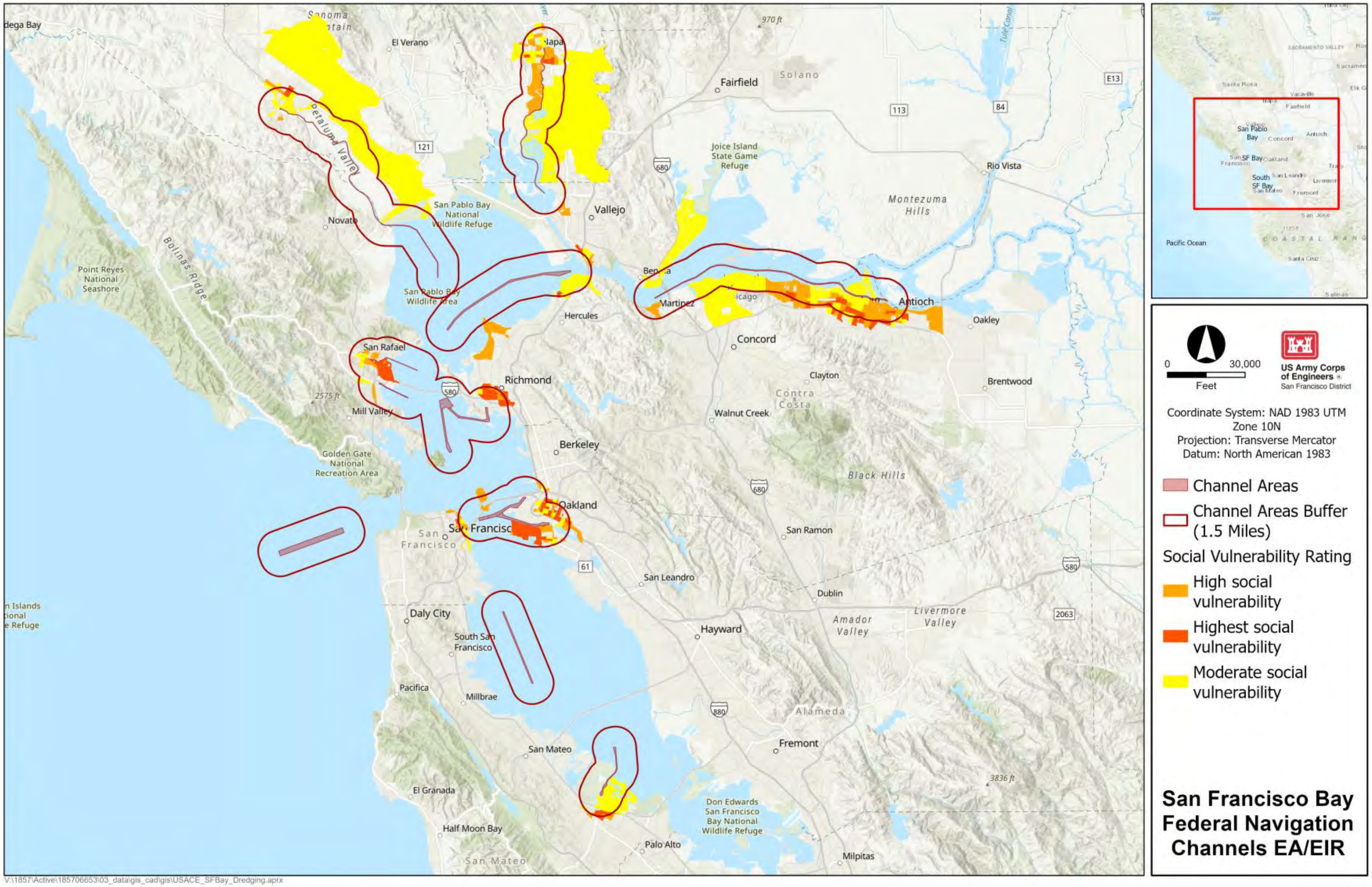


Figure 4-2. Communities with Environmental Justice Concerns in the Project Area

4.5.5 Environmental Justice Community Notification

In accordance with the mandates, codes, and directives presented above in Section 4.5, USACE and the Regional Water Board have developed a communications plan for this project that contains a roadmap for outreach to and engagement with stakeholders with environmental justice concerns. The results of these outreach and engagement efforts to the communities identified using the methods described in Section 4.5.3 are summarized in Appendix G of this EA/EIR.

To ensure this project does not disproportionately impact communities with environmental justice concerns in the SF Bay region, environmental justice community representatives were invited to participate in a virtual public meeting prior to the public review period for this EA/EIR to receive information and for USACE and the Regional Water Board to address any specific concerns or questions. The meeting was held October 15, 2024, at 4:00 p.m. See Appendix G for more information.

5.0 Other Required Analyses

This chapter summarizes impacts and mitigation measures and compares the project alternatives. It also includes additional analysis required under NEPA and CEQA.

5.1 NEPA Preferred Alternative

This EA/EIR considers the No Action Alternative/No Project Alternative and four action alternatives for maintenance dredging of federal navigation channels in SF Bay and the associated placement of dredged material. The Preferred Alternative is the alternative that best fulfills the purpose and need and agency objectives for the project while balancing impacts on the natural and human environment. The Preferred Alternative is the phased implementation of the No Project Alternative, Alternative 1, and Alternative 2. This alternative will be implemented in phases over the next two to three years outlined below.

- 2025, No Project Alternative: Continuing the No Project Alternative allows USACE the time necessary to appropriately plan for and implement the changes required for Alternatives 1 and eventually 2.
- 2026–2027, Alternative 1: The earliest USACE would be able to implement Alternative 1 would be in 2026.
- 2027–2034, Alternative 2: The earliest USACE would be able to implement Alternative 2 would be in 2027. This time is necessary to allow USACE to work to expand the capacity of its hopper dredges, including utilizing the West Coast Hopper Dredging contract.

5.2 CEQA Environmentally Superior Alternative

Per CEQA Guidelines (Section 15126.6[e][2]), if the environmentally superior alternative is the No Project Alternative, then the EIR must also identify an environmentally superior alternative among the other alternatives. For the reasons described in this EA/EIR, the environmentally superior alternative is not the No Project Alternative.

The type and degree of environmental impacts among all the alternatives are similar; differences in impacts are related to the proportion and location of hopper dredge use versus mechanical dredge use under each alternative, along with the extent of BUDM. The action alternatives presented in this document would have lower adverse environmental impacts and more environmentally beneficial effects through increased BUDM for restoration of habitat for listed species. Alternative 4, Beneficial Use–Maximized, proposes placing all suitable material at non-aquatic beneficial use sites. Therefore, it is considered to be the environmentally superior alternative under CEQA.

USACE and the Regional Water Board considered public and agency comments received on this EA/EIR during the public review process to identify the Preferred Alternative.

5.3 Significant Impacts

Under NEPA, if, after preparing an EA, the federal agency determines that an action will not have a significant effect on the human environment (33 C.F.R. § 230.11), a finding of no significant impact (FONSI) will be issued. NEPA also allows for a mitigated FONSI, in cases where an action may pose some significant effects, but where mitigation measures will be adopted to reduce these effects to a level where they are no longer significant.

Under CEQA Guidelines (Section 15382) a significant impact is defined as “a substantial, or potentially substantial, adverse change within the area affected by the project.” CEQA requires the agency to identify each impact it has determined to be significant (CEQA guidelines Section 15126.2, subd. [a]). None of the impacts resulted in a significant impact when applying mitigation measures. Any feasible mitigation measures that can reduce a significant impact must be adopted under CEQA.

Biological impacts would be less then significant under all the alternatives, except for the No Project Alternative, which would be reduced to less than significant with the implementation of the following mitigation measure under CEQA:

Impact BI-1: Potential Effects on Fish and Benthic Invertebrate Survival Caused by Entrainment: Significant impact reduced to LTS with BI-1-1 Mitigation Measure requiring beneficial reuse to support wetland restoration. The Proposed Action/Proposed Project would not have any significant impacts with the implementation of the mitigation measures, therefore a FONSI is included in this final EA/EIR.

5.4 Growth-Inducing Impacts

CEQA guidelines Section 15126.2(e) requires an examination of the direct and indirect impacts of a proposed project, including the potential of the project to induce growth leading to changes in land use patterns, population densities, and related impacts on environmental resources. CEQA guidelines Section 15126.2(e) specifically requires an EIR to include a discussion of the Proposed Project’s potential to foster economic growth, population growth, or the construction of additional housing directly or indirectly in the surrounding environment. This includes projects that would remove obstacles to population growth. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment. NEPA does not offer specific guidance on growth-inducing impacts.

A project may have direct and/or indirect growth-inducement potential. An example of direct growth inducement would be a project that involves the construction of new housing that would result in new residents moving to the area. An example of indirect growth-inducement potential would be a project that provides substantial new permanent employment opportunities (e.g., commercial, industrial, or governmental enterprises) or removes an obstacle to additional growth and development, such as removing a constraint on a required public utility or service.

Growth inducement itself is not an environmental impact, but it may lead to foreseeable environmental impacts including increased demand on public services and infrastructure, increased traffic, increased noise, degradation of air or water quality, degradation or loss of plant or animal habitats, or conversion of agricultural and open space land to urban uses.

The purpose of the Proposed Project is to provide for the continued maintenance of the existing federal navigation channels in SF Bay to historically authorized depths. The Proposed Project does not involve the construction of new housing, nor is it a project that would result in new permanent employment opportunities. Therefore, the Proposed Project would not have any direct growth-inducing impacts.

The Proposed Project and its alternatives would not increase the depth of the existing federal navigation channels, nor does it involve an expansion of the areas previously included in the federal maintenance dredging program. The ongoing maintenance of the federal navigation channels in SF Bay is critical to the survival of several established water-related activities and industries including various ports and associated goods movement, ferry transportation, cruise ships, manufacturing, fuel refining, military uses, and recreational boating. However, these activities and industries have been ongoing for decades in and around SF Bay and are not expected to increase or decrease because of the continued maintenance of existing federal navigation channels. Therefore, the Proposed Project is not expected to have any indirect growth-inducing impacts.

The Proposed Action/Proposed Project would not remove a barrier to growth and development, such as increasing existing cargo throughput or shifting cargo from one port to another within SF Bay. In its 2019–2050 Bay Area Seaport Forecast, BCDC notes that the Port of Oakland, which handles 99 percent of the containerized cargo moving through SF Bay, may grow at a slow, moderate, or strong rate over the next 30 years depending on many factors including the overall economy, trade relations, the rate of adoption of automation, and the buildout of available land. The continued availability of existing federally maintained shipping channels is assumed for each of these growth projections and is not a determining factor in the growth projections (BCDC 2019). The growth of refineries, of which there are five located within SF Bay, is likewise not determined by the continued availability of existing federally maintained shipping channels. While the existing refineries rely on the existing federal channels for the transport of raw and refined products, the current depth and configuration of the navigation channels is adequate to accommodate the minimal growth expected in this industry within SF Bay, which is constrained by space, aging facilities (most over 100 years old), environmental regulations, economics, and a demand for cleaner fuels (Sedgwick et al. 2019). Therefore, the Proposed Project would not remove a barrier to growth and development.

5.5 Areas of Known Controversy

5.5.1 Placement of Dredged Material in San Francisco Bay

Different agencies have different interpretations of their respective policies that add regulatory constraints on the placement of dredged material in SF Bay. For example, BCDC, which administers the Coastal Zone Management Plan for SF Bay under the CZMA, limits in-Bay placement of dredged material in its Bay Plan Dredging Policy 1:

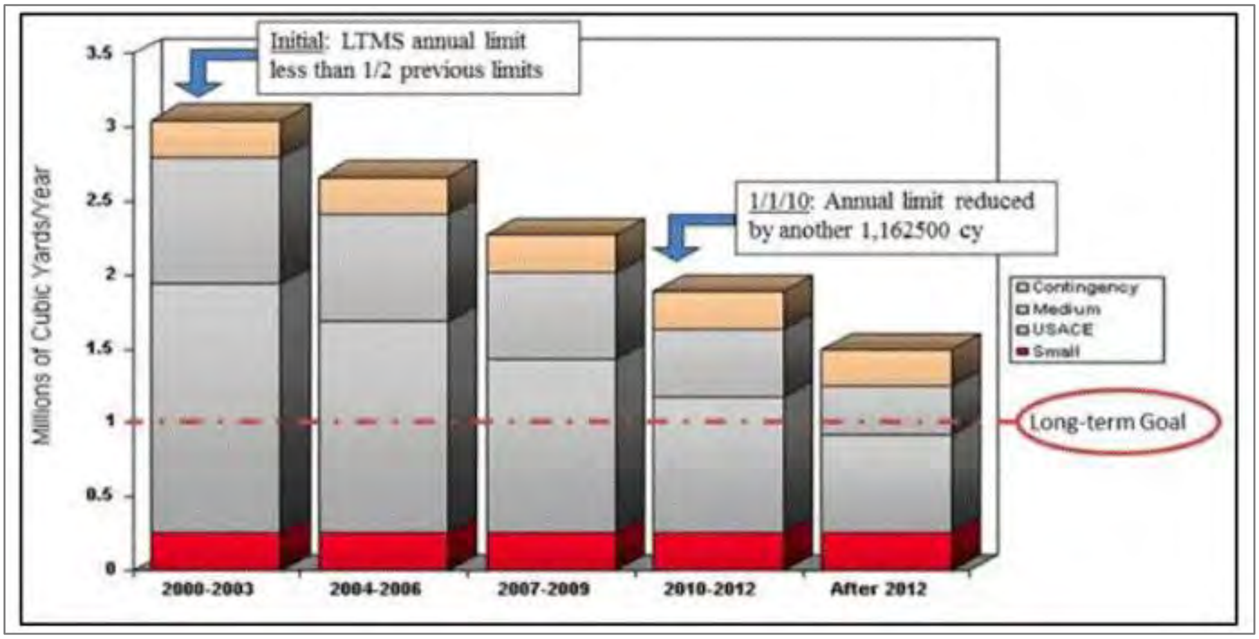
> *Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner. Dredgers should reduce disposal in the Bay and certain waterways over time to achieve the LTMS goal of limiting in-Bay placement volumes to a maximum of one million cubic yards per year. The LTMS agencies should implement a system of disposal allotments to individual dredgers to achieve this goal only if voluntary*

> *efforts are not effective in reaching the L TMS goal. In making its decision regarding disposal allocations, the Commission should confer with the LTMS agencies and consider the need for the dredging and the dredging projects, environmental impacts, regional economic impacts, efforts by the dredging community to implement and fund alternatives to in-Bay placement, and other relevant factors. Small dredgers should be exempted from allotments, but all dredgers should comply with policies 2 through 12.*

While acknowledging that the LTMS in-Bay placement targets are voluntary, BCDC imposes mandatory limits on medium and large dredgers of one million CY combined and on small dredgers placing 250,000 CY of dredged material in-Bay. The agency has expressed apprehension around any changes to these voluntary targets and interprets the LTMS trigger for consideration of mandatory allocations to be 1.25 million CY - that is, 1 million CY for large and medium dredgers and 0.25 million CY for small dredgers. The agency is undergoing a process to analyze the Bay Plan and consider whether any amendments may be necessary, and through a series of workshops, there has been significant input that this policy (among others) may need to be amended.

Similarly, the Regional Water Board, which administers WQCs under Section 401 of the CWA, also outlines in its Basin Plan that 1.25 million CY per year is the in-Bay placement limit for dredged material and that this limit is the trigger for consideration of mandatory allocations. The Regional Water Board has indicated willingness to pursue Basin Plan amendments to permit more in-Bay placement of dredged material, as well as to pursue permitting flexibility to achieve the broader, shared goal of increasing BUDM.

LTMS partner agencies have different interpretations of the LTMS trigger for consideration of mandatory allocations. The LTMS Management Plan outlines this trigger to be the target of 1.25 million CY plus the 250,000 CY contingency volume. As stated in the management plan, “at the triennial LTMS review, if the average in-Bay placement volume from the prior three years exceeds the in-Bay targets plus the 250,000 CY contingency, the LTMS agencies will initiate consideration of allocations” (Figure 5-1).



Notes: San Francisco Bay LTMS step-down from 2000 to the present indicating the 3-year LTMS in-Bay placement of dredged material goal of 1 million CY per year (though there are no mechanisms to achieve said goal), voluntary allocations of 1.25 million CY per year, and trigger mechanism at 1.5 million CY per year.

Figure 5-1. Reductions of In-Bay Dredged Material Placement Since Year 2000 Relative to San Francisco Bay Long-Term Management Strategy for Dredged Material

Implementing Alternative 1 or 2, both of which are aimed at achieving the LTMS BUDM goals, would require revisiting regional policies such as the LTMS as well as encouraging and finding novel flexibility in permitting processes. Several partner agency leaders have expressed support for re-opening the LTMS to consider changing these in-Bay goals, targets, and triggers, given the significant loss of sediment to deep ocean over the course of the implementation of the LTMS step-down and the compounding effects of SLR and sediment loss from a system with critical sediment needs.

As a holistic system interconnected from the subtidal Bay bottom to the upland migration space needed for ecosystem sustainability, it is imperative to keep sediment in the San Francisco Bay system. Placement of material at in-Bay, dispersive sites, while not as desirable as placing sediment in the shallow subtidal environment to re-nourish mudflats or in subsided and leveed baylands to restore high and low marsh plain elevations, is better than losing the sediment to the deep ocean, 55 nautical miles west of the Golden Gate Bridge.

In addition, diffusion of sediment, which occurs on the order of days to years, can help the Bay bottom keep pace with SLR and when coupled with Alternatives 1 and 2's BUDM volumes for wetland restoration, can help the entire Bay system keep pace with SLR. It is also critical to note that the in-Bay placement volume proposed in this EA/EIR and the RDMMP in Alternatives 1 and 2 represents only marginal increases in in-Bay placement and does not rival the volume of material placed in-Bay prior to LTMS creation, nor does it exceed any of the specific in-Bay monthly and annual site specific limits in the

LTMS Management Plan. As such, any changes to the LTMS target and trigger are not expected to induce any significant navigational hazards or substantially increased environmental impacts.

5.5.2 Strategic Expansion of Hydraulic Dredging in San Francisco Bay

The USACE base plan includes hopper dredging of Richmond Outer Harbor and Pinole Shoal (San Pablo Bay) channels every year. However, in 2015, CDFW determined that limiting hopper dredging to one in-Bay channel a year was required to reach a less than significant impact on longfin smelt, which at the time was only a State-listed special status species. SF Bay is home to several endangered species, and most relevant to hopper dredging is delta smelt. The delta smelt exists mostly in Suisun and San Pablo Bays given their proximity to the Delta. It is the view of state and federal resource agencies with jurisdiction over delta smelt that hydraulic hopper dredging entrains individuals and represents a take of the endangered species. Specifically, it is the view of CDFW that the impact can be mitigated to less than significant by hopper dredging only one channel in SF Bay in a given year and limiting dredging to the stated environmental work windows.

While CDFW does not have jurisdiction over USACE, a federal entity, the Regional Water Board included these recommendations in the WQC for 2015 to 2019 and 2020 to 2024, requiring that USACE only use hopper dredging in one of the two channels listed above. It has been USACE's policy, therefore, to dredge the two channels in alternating years, given that the cost to the nation of mechanically dredging these channels in alternating years would be too great and equipment availability and market conditions would constrain USACE's ability to fulfill its navigation mission within the given environmental work windows.

As such, the discussion around potentially expanding hydraulic hopper dredging in SF Bay is potentially controversial, even though the purpose in doing so is to restore more wetland habitat, which would directly benefit delta smelt species by providing refugia and habitat space in the tidal channels. MWRP practitioners have found an abundance of delta smelt in phase I cells of their restored wetlands (pers. comm., Cassie Pinnell, Vollmar Natural Lands Consulting, Senior Ecologist for the MWRP, 2024). USGS released its report by Lewis and colleagues (Lewis et al. 2025) demonstrating endangered fish species use of restored wetlands versus natural wetlands in San Pablo Bay, and longfin smelt were found to utilize these restored habitats.

USACE reinitiated consultation with USFWS on the 1999 LTMS Programmatic Biological Opinion for the listing of longfin smelt on August 14, 2024. The consultation process was completed with the amendment of the LTMS Biological Opinion, issued on February 7, 2025. In that document USFWS accepted compensation for impacts to longfin smelt and their habitat, for both mechanical and hopper dredging, through beneficial placement of dredged material to restore habitat for the species in San Francisco Bay. Therefore, USACE will comply with the requirements of the LTMS Biological Opinion and the minimization and mitigation formulas outlined in this EA/EIR.

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